United States Department of the Interior
Bureau of Land Management

Final

Miles City District

December 1992

OIL and GAS RMP / EIS AMENDMENT

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based on the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include recreation; rangelands; timber; minerals; watershed; fish and wildlife; wilderness; air; and scenic, scientific, and cultural values.

BLM-MT-ES-93-002-4110

Dear Reader:

Enclosed is a copy of the Final Oil and Gas Resource Management Plan/Environmental Impact Statement Amendment for the Billings, Powder River, and South Dakota Resource Areas of the Miles City District. The document presents four alternatives regarding the leasing of Federal oil and gas resources in the three Resource Areas, the planning area. Alternative D is the Preferred Alternative which represents the proposed decision of the State Director.

The document addresses the issues and impacts, including cumulative effects, associated with the leasing of the Federal oil and gas resources in the planning area. Each alternative identifies areas closed to leasing, areas open to leasing with lease terms, and areas open to leasing with stipulations.

The respective RMP/EISs and this amendment will be used as a partial basis for making future site-specific decisions. Additional analysis, such as cultural resource inventories and documentation, will be completed at the time development activities are proposed. Such analysis will evaluate the site-specific impacts associated with wellsites, roads, pipelines, and related facilities, and will assure full compliance with all applicable laws, regulations, and guidelines. Any additional environmental analysis and documentation will be tiered to the respective RMP/EIS and this amendment.

A number of corrections and modifications have been made between the draft and final amendment documents, largely in response to public comments. Corrections and modifications are highlighted in the final using shaded text. In some cases, entire sections have been revised. Readers are urged to refer to both the draft and final when reviewing these actions.

Any person who participated in the plan amendment process and has an interest which is or may be adversely affected may protest approval of the proposed plan amendment. Protests must be in writing and sent to the Director (760), Bureau of Land Management, U.S. Department of the Interior, 18th and C Streets NW, Washington, D.C. 20240. Protests are required to be postmarked within 30 days of the date that the Environmental Protection Agency published the notice of receipt of the final EIS in the Federal Register. Protest statements shall include the following information:

The name, mailing address, telephone number and interest of the person filing the protest.

A statement of the issue or issues being protested.

A statement of the part or parts of the plan being protested.

A copy of all documents addressing the issue or issues that were submitted during the planning process by the protesting party, or an indication of the date the issue or issues were discussed for the record.

A concise statement explaining why the proposed decision is believed to be wrong.

At the end of the 30-day protest period, the proposed plan, excluding any portion under protest, will become final. Approval will be withheld on any portion of the plan under protest until final action has been completed. Any significant changes to the proposed plan made as a result of a protest will be made available for public review and comment prior to final approval and implementation.

The Bureau of Land Management would like to thank everyone who provided suggestions and comments on the draft document. A Record of Decision (ROD) will be prepared after approval of the proposed plan. Copies of the Record of Decision will be provided to everyone on the Final Amendment mailing list.

We appreciate your time and effort regarding this project and we look forward to your continued interest in the management of your public land resources.

FINAL

OIL AND GAS AMENDMENT

Billings — Powder River — South Dakota Resource Management Plans/ Environmental Impact Statements

DECEMBER 1992

Prepared by

United States Department of the Interior
Bureau of Land Management
Montana State Office
Miles City District

Robert N. Lawton
State Director

OIL AND GAS

RESOURCE MANAGEMENT PLAN ENVIRONMENTAL IMPACT STATEMENT AMENDMENT

Draft ( ) Final (X)

LEAD AGENCY: MILES CITY DISTRICT OFFICE
MILES CITY, MONTANA
BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

Type of Action

Administrative (X) Legislative ( )

ABSTRACT

The Final Oil and Gas Resource Management Plan/Environmental Impact Statement Amendment addresses the future management options for oil and gas leasing on approximately 1.7 million surface acres and approximately 4.6 million subsurface acres of public domain and acquired lands administered by the Bureau of Land Management. These lands are managed by the Billings, Powder River and South Dakota Resource Areas within the Miles City District. The amendment focuses on alternative approaches to management and lease stipulations necessary to protect the environment as well as the resources. The final preferred alternative and three other alternatives have been presented to provide options for resolving the issues. Included are Alternative A (No Action), Alternatives B and C, and Alternative D, the Preferred Alternative.

CONTENTS

ILLUSTRATIONS

MAPS

There are 5 maps in the packet which show areas open to oil and gas leasing with lease terms or stipulation and areas closed to oil and gas leasing. Map 1 Map 2 Map 3 Map 4 Map 5

PREFACE

The following discussion is intended to assist the reader in locating specific information found in this document. A brief description of what type of material is provided in each section of the Oil and Gas RMP/EIS Amendment is furnished. It is critical to the comprehension of this document to realize the interdependence of each of the sections. To thoroughly understand the intent of the amendment, the document should be read in its entirety.

This document contains a summary of the information contained in the Management Situation Analysis (MSA). The MSA is on file at the Billings Resource Area office and is accessible to the public. Anyone wishing more detail than is contained in the amendment should consult the MSA.

The summary contains the introduction to the need and purpose of the document and what its application will be. The issues chosen to be addressed and the reasons why they were selected are given. An overview of the four alternatives is also provided.

Chapter One goes into more detail on the purpose and need for the amendment and what its application would be. The legal authority mandating the writing of this amendment is listed. The geographic area covered by the document is defined and areas to be excluded and the reasons why are discussed. The lands affected by this document and lands the amendment would not apply to are given. Table 1.2 contains information on the ownership of surface and subsurface estate within the planning area. A short discussion of the issues to be considered and those chosen not to be analyzed in the document is included in this chapter.

Chapter Two presents the four alternatives in detail and the rational for alternatives considered but subsequently eliminated from consideration. Management common to all four alternatives is discussed. Tables provided in this chapter compare the four alternatives with respect to the amount of lands available for oil and gas development. A detailed table is included comparing impacts resulting from each of the four alternatives. A general discussion on the leasing and stipulation procedures is included in this chapter.

Chapter Three contains a listing of resources to be considered and a description of each as it occurs within the planning area. It is a discussion of the natural resources and the economic and social conditions as they are presently found in the Billings, Powder River, and the South Dakota Resource Areas. This chapter deals with all aspects of the environment that would be affected by the four alternatives.

In Chapter Four the environmental impacts resulting from management decisions common to all alternatives and decisions specific to each of the four alternatives are discussed. Both beneficial and adverse impacts are described and for each alternative both direct and indirect impacts are given. The discussion under conclusion for each resource includes cumulative impacts, unavoidable adverse impacts, short-term impacts and long-term impacts.

Chapter Five contains a listing of all personnel involved in the preparation of the document and a listing of the public who participated through scoping meetings and letters. Comments from the public in the form of letters or transcripts of public meetings are printed along with the responses from the subject specialists.

The appendices contain material that is considered too detailed and analytical for the general discussions in the chapters. This data is used to substantiate analysis that is done in the body of the document. This RMP/EIS contains six appendices listed under the following headings: Oil and Gas Operations, Lease Forms and Stipulations for Alternatives, Oil and Gas Development Potential, Air Quality, EISs for Proposed ACECs, and the Biological Assessment.

The Glossary lists definitions of technical terms used in the amendment. The Bibliography includes the references cited in the document, and the Index is a listing of key words and where they are discussed within the document.

The large maps included with the amendment illustrate, in a general way, the stipulations applied to lands within the planning area. The stipulations, as shown on the map, do not necessarily apply to the entire section. The stipulations could apply to either a portion of the section or in some cases the entire section (see map for further explanation). It should be noted that these stipulations can be revised, withdrawn, or added to a specific lot, tract, aliquot part, or parcel of land if new data or changing environmental conditions warrant.

SUMMARY

This document is an amendment to the Resource Management Plans (RMP) and Environmental Impact Statements (EIS) for three resource areas in the Miles City District. The planning area for this amendment includes the Billings, Powder River, and South Dakota Resource Areas with more than 4.6 million acres of Federal oil and gas estate. The three RMPs are being amended to comply with Supplemental Program Guidance (SPG) for fluid mineral resource planning. Management decisions, in the form of stipulations and closures, have been developed to portray availability of lands for oil and gas leasing. The SPG requires that the BLM develop a leasing strategy based on resource values and the estimate of oil and gas development potential in the planning area. A Reasonably Foreseeable Development (RFD) scenario has been developed as the basis for analysis of cumulative environmental impacts to the resources managed by the BLM. This amendment also proposes the classification of two Areas of Critical Environmental Concern (ACEC) for Meeteetse Spires area and Weatherman Draw Rock Art Complex.

The Preferred Alternative (Alternative D) allocates lands for leasing or no leasing in the following categories:

—Open to leasing, subject to Lease Terms only (2,840,000 acres)

—Open to leasing, subject to Seasonal or other minor constraints (2,162,000 acres)

—Open to leasing, subject to No Surface Occupancy and Similar Major Constraints (108,000 acres)

—Closed to Leasing (60,000 acres)

Note: Stipulations designed to protect different resources overlap in some locations, so the total acres of the categories above may exceed the actual total acres of Federal lands administered by the BLM in the planning area.

Both nondiscretionary closures (areas closed by law or regulation) and discretionary closures (areas closed by choice of the responsible BLM official) are described. In this planning area these include Wilderness Study Areas, Fort Meade Recreation Area, Pryor Mountain Wild Horse Range, and Meeteetse Spires proposed ACEC. Included in the Preferred Alternative is the No Surface Occupancy protection of the Weatherman Draw proposed ACEC.

Upon approval, this oil and gas amendment will serve as a revision to the three RMPs, and Federal lands will be made available for lease as described in the amendment. The No Action Alternative (A) is the continuation of present management; Alternative B emphasizes the protection of natural and cultural resources; and Alternative C emphasizes the availability of public land for oil and gas exploration and development. Alternative D, the preferred, proposes a balance between the demands of oil and gas resource development and the protection of sensitive areas and other resources.

Major issues that were identified during the public scoping period are the following:

—conflicts with other resource values
—what impacts will be allowed
—areas open or closed to leasing
—method of determining the RFD for the planning area
—identification of mitigation measures
—oil and gas in multiple use management decisions
—hazardous materials

The lease stipulations chosen for the Preferred Alternative, along with 43 CFR 3101.1-2 and lease terms, will provide sufficient protection for the resources. Lease Notices are used for some resources to provide additional information to the operator when a stipulation is not needed.

Stipulations are identified for resources that require a greater level of protection than regulations or Lease Terms can provide. These are specific mitigation measures that set guidelines for oil and gas operations. The terms for Waivers, Exceptions, and Modifications (WEMs) give circumstances under which operators can apply to be released from the constraints of a stipulation. The WEMs are used when local conditions change from the usual patterns such as variable winter weather conditions, changes in the use of resources by wildlife, or new information from resource inventories.

Additional protection for surface resources is provided by Conditions of Approval (COA) which are attached to all approved permits for drilling and other field operations. The COAs are site-specific, designed to protect the unique characteristics of the area at each proposed oil and gas location.

The other three alternatives evaluate different management objectives for some of the resources. Alternative A (No Action) analyzes the current management of the oil and gas program. Standard and special stipulations are used to mitigate impacts to the other resources. Management decisions from the RMP/EISs being amended are carried forward in this alternative. Alternative B emphasizes the protection of natural and cultural resources. For several resources carried forward from the RMP/EISs, more re

strictive stipulations are being analyzed in this alternative. Alternative C emphasizes the availability of public land for oil and gas exploration. Regulations, Lease Terms and COAs, rather than use of a stipulation, would provide protection for soils. High development potential areas would have no stipulations applied except for Threatened and Endangered Species and Cultural Resources, both protected by law.

Alternative D, the preferred, is shown as having the least restrictive stipulations that provide mitigation measures for protecting the other resources while allowing oil and gas leases to be issued and developed.

ACRONYMS

ACEC	Area of Critical Environmental Concern
AFB	Air Force Base
ALMRS	Automated Land and Minerals Record System
AO	Authorized Officer
APD	Application for Permit to Drill
ARPA	Archeological Resources Protection Act of 1979
AUM	Animal Unit Month
BDRA	Big Dry Resource Area (BLM)
BLM	Bureau of Land Management
BO	Barrels of Oil
BOP	Blow-out Prevention (preventer)
CERCLA	Comprehesive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CRMP	Coordinated Resource Management Plan
CSU	Controlled Surface Use
DHES	Department of Health and Environmental Sciences (Montana)
DNRC	Department of Natural Resources and Conservation (Montana)
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESA	Endangered Species Act of 1973, as amended
FEIS	Final Environmental Impact Statement
FLPMA	Federal Land Policy and Management Act of l976 (PL 94-579)
FOOGLRA	Federal Onshore Oil and Gas Leasing Reform Act of 1987 (PL 100-203)
FOGRMA	Federal Oil and Gas Royalty Management Act
FS	Forest Service
FY	Fiscal Year (Federal: October 1 through September 30)
MBO	Thousand Barrels of Oil
MBOGC	Montana Board of Oil and Gas Conservation (Montana)
MCDO	Miles City District Office (BLM)
MCF	Thousand Cubic Feet
MCFPD	Thousand Cubic Feet of Gas Per Day
MMBO	Million Barrels of Oil
MMCF	Million Cubic Feet
MMS	Minerals Management Service
MSO	Montana State Office
MPM	Montana Principal Meridian
NEPA	National Environmental Policy Act of l969 (PL 91-190)
NOI	Notice of Intent
NOS	Notice of Staking
NPS	National Park Service
NSO	No Surface Occupancy
NTL	Notice to Lessee
ORCA	Online Recordation and Case Access
ORV	Off-road Vehicle
PMWHR	Pryor Mountain Wild Horse Range
PSD	Prevention of Significant Deterioration
RA	Resource Area (BLM)
RFD	Reasonably Foreseeable Development
RMP	Resource Management Plan
SCS	Soil Conservation Service
SMA	Surface Management Agency
SN	Sundry Notice

SOP	Standard Operating Procedures
SPG	Supplemental Program Guidance
SRMA	Special Recreation Management Area
T&E	Threatened and Endangered
TNC	The Nature Conservancy
TSP	Total Suspended Particulates
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VRM	Visual Resource Management
WEM	Waiver, Exception, and Modification
WSA	Wilderness Study Area

INTRODUCTION

This document is a final amendment to Resource Management Plans and supplement to the Environmental Impact Statements (RMP/EIS) for the Billings, Powder River, and South Dakota Resource Areas in the Miles City District, Montana. The planning area for this amendment is defined as these three Resource Areas. The remaining portion of the Miles City District, the Big Dry Resource Area, is currently preparing an RMP/EIS which will include the oil and gas environmental impact analysis for that resource area.

This amendment has been prepared in accordance with the Bureau of Land Management's (BLM) planning regulations in the Code of Federal Regulations and the Council on Environmental Quality regulations for implementing the National Environmental Policy Act of 1969 (NEPA). The information contained in the amendment reflects current policy and regulatory information as of June 1, 1991. After the amendment is finalized, new policy, regulatory changes, or changes in management direction will require that a new RMP/EIS amendment be written incorporating the changes.

PURPOSE AND NEED

The BLM has responsibility for leasing and managing Federally owned oil and gas resources. The purposes of this amendment are to analyze the environmental impacts associated with the leasing and development of oil and gas resources and ensure compliance with the Supplemental Program Guidance (SPG). The three RMP/EISs in this amendment were completed before the Supplemental Program Guidance (SPG) was issued (Table 1.1). During the last decade the process of leasing oil and gas has been changed to address the issues raised. Representatives of environmental groups and the oil and gas industry were consulted during the revision of the procedures which the BLM uses in the planning process. New standards were established for the analysis of the environmental impacts of oil and gas development. These are expressed in the Supplemental Program Guidance for Energy and Minerals, BLM Manual 1624, issued in 1986.

TABLE 1.1. RESOURCE MANAGEMENT PLAN/ ENVIRONMENTAL IMPACT STATEMENTS BEING AMENDED

Resource Area	Date of Approval
Billings	September 28, 1984
Powder River	March 15, 1985
South Dakota	April 14, 1986

The amendment will provide a master plan for leasing lands for oil and gas within the planning area for approximately 15 years. Using lease stipulations, it identifies resource values that will be protected or the impacts that will be mitigated during the conduct of oil and gas activities. Lands subject to lease stipulations, lands closed to oil and gas leasing, and lands protected only by regulations and the terms of the lease are identified. (See Section 6 of Lease Terms on Form 3100-11 in Appendix B.)

Most land use decisions for resources other than oil and gas will remain unchanged in the RMP/EISs being amended. Leasing procedures for oil and gas will include the identification of stipulations before the lease sale. This procedure is being revised to conform to new policy. The cumulative impacts for oil and gas development are based on the Reasonably Foreseeable Development (RFD). This is a projection of future oil and gas activity anticipated in the planning area within the next 15 years.

The decisions which result from this amendment will supersede all previous planning decisions for oil and gas in the three RMP/EIS documents. It will establish the purpose and areas of stipulations and the actions being restricted. All lease stipulations will be identified and published in the lease sale notice to inform prospective lessees of the requirements to be met when developing a specific Federal oil and gas lease.

This document also fulfills a need to establish two Areas of Critical Environmental Concern (ACEC). These are the proposed Meeteetse Spires ACEC and the proposed Weatherman Draw ACEC. These areas would be approved and designated as ACECs under Alternatives B, C, and D.

LOCATION OF THE PLANNING AREA

The planning area (Figure 1.1) is composed of three Resource Areas in the Miles City District. The Billings Resource Area and the Powder River Resource Area are located in the south-central and southeastern portions of Montana. The South Dakota Resource Area includes the entire state of South Dakota.

The planning area encompasses approximately 70.5 million acres. Surface acreage and subsurface oil and gas acreage administered by the BLM are shown in Table 1.2.

TABLE 1.2. PLANNING AREA ACREAGE

	RESOURCE AREA			
	Billings	Powder River	South Dakota	Total
Surface Estate				
BLM	425,336	1,080,675	280,672	1,786,683
Other	10,983,755	9,418,686	48,329,888	68,732,329
Total	11,409,091	10,499,361	48,610,560	70,519,012
Oil and Gas Estate				
BLM	662,066	2,522,950	1,485,203	4,670,219
Other	10,747,025	7,976,411	47,125,357	65,848,793
Total	11,409,091	10,499,361	48,610,560	70,519,012
LEASED OIL AND GAS ESTATE				
BLM	267,498	953,700	524,572	1,745,770

In Montana other major land holdings include the Crow and Northern Cheyenne Indian Reservations, the Custer National Forest, the Burlington Northern Railroad and the State of Montana. Other major holdings in South Dakota include the Standing Rock, Cheyenne River, Pine Ridge, and Rosebud Indian Reservations, the Custer National Forest, the Black Hills National Forest, grasslands of the Nebraska National Forest, Badlands and Wind Cave National Parks, the Burlington Northern Railroad and the State of South Dakota. East of the Missouri River the BLM manages fewer than 13,000 acres of Federal oil and gas. Major land holders east of the Missouri River are the U.S. Corps of Engineers, the Crow Creek and Lower Brule Indian Reservations which span the river, the Yankton and Sisseton Indian Reservations and the State of South Dakota.

LANDS AFFECTED BY AMENDMENT

This amendment will make leasing decisions for Federal oil and gas resources managed by BLM and only those Federal Surface Management Agencies (SMAs) with which BLM has an agreement regarding oil and gas leasing. Leasing decisions for Federal oil and gas resources not managed by BLM will be made by the SMA in cooperation with BLM. BLM will not issue Federal oil and gas leases without the consent of the SMA. This amendment does not apply to lands managed by the USDA-Forest Service, National Park Service, U.S. Fish and Wildlife Service, Bureau of Indian Affairs or tribal lands, and private or state owned oil and gas resources.

The Secretary of the Interior is authorized by the 1920 Mineral Leasing Act, As Amended, to lease oil and gas resources on public mineral estate. Lands which are excluded from leasing include most units of the National Park System, incorporated cities, towns, and villages, lands recommended for wilderness designation, Wilderness Study Areas (WSA), and lands within the National Wilderness Preservation System. A more detailed listing of excluded lands is found in the Code of Federal Regulations (CFR) Title 43, part 3100.0-3.

The cumulative impacts for lands excluded from leasing under the Mineral Leasing Act (MLA) are analyzed to the extent that some of these lands are subject to impacts from the development of adjacent BLM-administered lands. The MLA allows the leasing of some of these exempt lands adjacent to development when drainage of oil or gas may result in the loss of revenue to the United States. It is in these cases that the Secretary of the Interior, in concurrence with the SMA, is authorized to issue protective leases with NSO stipulations within areas otherwise unavailable for leasing.

There are no pre-FLPMA fluid minerals leases in any of the WSAs. Development of existing post-FLPMA oil and gas leases are subject to BLM Manual H-8550-1, Interim Management Policy and Guidelines For Lands under Wilderness Review. No new leases have been issued in WSAs since 1984 when an appropriations act created a moratorium on leasing in WSAs. Lands released by Congress for uses other than wilderness will be managed in accordance with the current land use plans.

Two kinds of maps are included in this amendment. Large-scale maps show locations where stipulations will be placed on future Federal oil and gas leases (see map packet). Small-scale maps present information from the geologic reports which determine the Reasonably Foreseeable Development (RFD) potential of oil and gas in the planning area (Appendix C). These maps are based on large-scale maps available for inspection in the Miles City District Office, and show the basis for establishing the RFD categories. This information is used to develop the cumulative

environmental impacts of Federal oil and gas development. This information is presented in terms of the number of wells and associated surface disturbance.

The Supplemental Program Guidance for oil and gas leasing requires that the plan amendment display the restrictions to be placed on Federal leases. Large scale maps show lands subject to stipulations, lands subject to lease terms only, and lands closed to leasing. The maps are compiled from resource inventories prepared by the specialists in the resource areas. The inventories identify areas of resource values where some protection or mitigation is needed when oil and gas operations are conducted. The resource data base is revised periodically when new data becomes available, primarily from updated field surveys. Future changes in the resource data base may indicate that changes are needed as to how stipulations are applied to protect the other resources. Such changes may be made either through plan maintenance or an amendment, as provided for in the BLM planning regulations. Periodic minor revisions are considered plan maintenance and generally will not require that a new amendment be written. Any major changes in the type of mitigation required or in the objectives used for mitigating impacts on a given resource will require an amendment to the RMP/EIS. The resource data base may be examined at the appropriate resource area office.

ISSUES

At the beginning of the planning process, the BLM contacted the general public, other Federal agencies, state and local governments, and tribal governments to identify issues and management concerns for the planning area. Responses to the scoping questionnaires identified the following issues:

—Other resource values to be considered in leasing oil and gas

—What impacts will be permitted to resource values

—What areas should be opened or closed to oil and gas activity

—Resolution of conflicts between oil and gas and other resource values

—Landowner involvement in decisions affecting split estate lands

—Determination of Reasonably Foreseeable Development of oil and gas resources and the impacts associated with development

—Identification of mitigating measures to minimize impacts from oil and gas resource development

—How the management of oil and gas resources relates to other multiple use management decisions

—Handling of hazardous materials related to the exploration and development of oil and gas resources

These issues are considered within the framework of this plan amendment. Resource values, protective or mitigation measures, the stipulation process, and the evaluation of oil and gas resources will be described. All of these factors are used to develop a set of alternatives which allow for the development of oil and gas resources while providing protection for the other resources which the BLM manages. At the beginning of the planning process, a decision was made to use existing resource data bases to identify the areas to be protected by stipulations on oil and gas leases. Most resource allocations that were established by the existing RMP/EISs will be continued in this plan.

The preferred alternative proposes some changes in management decisions for sensitive areas. These include No Lease decisions for several areas which were previously available for leasing with a No Surface Occupancy stipulation. The alternative also includes the establishment of two Areas of Critical Environmental Concern (ACEC) which have outstanding resource values. These areas are the Meeteetse Spires and Weatherman Draw.

ISSUES NOT ANALYZED IN THIS AMENDMENT

Geothermal Resources

During the life of this plan amendment, a demand for geothermal leases within the planning area is not anticipated. This could change if an energy crisis in the petroleum industry were to occur. Commercial development of geothermal resources in the planning area during the next 15 years is unlikely. The resources are either low-temperature geothermal waters in South Dakota and southcentral Montana, or corrosive hot water produced in the oil fields of eastern Montana.

Coalbed Methane

The Reasonably Foreseeable Development projections can accommodate the drilling of test wells and initial small-scale development of coalbed methane. The extension of the nonconventional fuels tax credit for wells drilled before December 31, 1993, should generate some activity in the planning area. This amendment does not contain either a hydrologic analysis of the RFD area or an environmental study of the impacts of building major pipeline systems. In order for full-field development to occur on Federal oil and gas lands, an additional environmental document tied to this amendment would be required.

INTRODUCTION

Four alternatives have been developed to analyze impacts and to address issues related to the leasing and production of oil and gas in the planning area. Alternatives were formulated using the following criteria.

One alternative:

—must display the actions and impacts for continuation of existing management. This is the "No Action" alternative.

One or more alternatives:

—must utilize Supplemental Program Guidance (SPG) for Fluid Minerals to determine the impacts from oil and gas development.

—should emphasize fluid minerals development with fewer restrictions. It still must consider essential resource objectives and mitigation.

—should emphasize resource protection while still retaining a workable leasing and development program.

All alternatives:

—will display direct and indirect impacts for resources.

—will utilize common data base and resource objectives from existing Land Use Plan decisions.

—will comply with provisions of the Endangered Species Act of 1973 for concerned species and their habitat. The alternatives will include approved national recovery plans for several threatened and endangered species which occur in the planning area. Will comply with provisions of all other Federal laws such as the National Historic Preservation Act and FLPMA.

—will use or amend existing Land Use Plan decisions and will clearly reveal any variance with those plans.

—will be compatible with other Federal, state, and local land use plans or will display any inconsistencies.

DESCRIPTION OF ALTERNATIVES

Using these criteria, four alternatives have been developed which can be implemented using the current laws and regulations.

Alternative A (No Action) is the continuation of present management decisions which are in the three RMP/EISs being amended in this document. Standard and special stipulations and lease terms would apply to all lands identified by existing resource inventories and land use decisions in these plans. This alternative was analyzed to identify any changes in resource allocations which should be made in order to develop oil and gas while protecting other resource values. Alternative A does not meet SPG for Fluid Minerals.

Alternative B emphasizes the protection of natural and cultural resources while allowing the development of oil and gas. Some stipulations from the No Action alternative would be changed to a more restrictive level in order to evaluate the protection afforded to other resources. Weatherman Draw and Meeteetse Spires are proposed as Areas of Critical Environmental Concern (ACEC). Discretionary No Lease decisions for the protection of Fort Meade Recreation Area, the Pryor Mountain Wild Horse Range, Meeteetse Spires proposed ACEC, Rosebud Battlefield, Dryhead Overlook, and the Powder River Big Horn Sheep Range are analyzed in this alternative.

Alternative C emphasizes the availability of public land for oil and gas exploration and development with minimum restrictions. Most of the stipulations from Alternative B would be used; however, some less restrictive stipulations would be analyzed. There would be no stipulation applied to the soils resource. Only WSAs would be designated No Lease. Only stipulations for Threatened and Endangered Species and Cultural Resources would be applied to lands in all townships having High Development Potential in which the predominant resource use is the production of oil and gas. In these townships other resources would be protected by provisions of the lease terms and regulatory authorizations. The High Development Potential townships were identified by the analysis of the Reasonably Foreseeable Development following SPG standards.

Alternative D, the Preferred Alternative, proposes a balance between the demands of oil and gas resource development and the protection of sensitive areas and other resources. It combines features of the other alternatives in a balanced approach to land use decisions. Stipulations from the other alternatives have been selected to provide protection to those resources while allowing the development of oil and gas resources. Only stipulations for Threatened and Endangered Species and Cultural Resources would be applied to selected townships having High Development Potential in which the predominant resource use is the production of oil and gas. In these townships other resources would be protected by provisions of the lease terms and regulatory authorizations.

Areas of Critical Environmental Concern

Alternatives B, C, and D propose establishment of two ACECs. Meeteetse Spires area has been proposed to protect two rare plants which are located in the Spires. Weatherman Draw Rock Art Complex is a significant assemblage of rock art and other cultural properties spanning nine centuries. Environmental Impact Statements for the two sites are contained in Appendix E.

ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL

Several alternatives were analyzed but dropped from further consideration because they are not feasible or were not identified in the public scoping process. These include a No Lease option, maximum oil and gas development, and minimum oil and gas development.

No Leasing Alternative

Although specific sites in the planning area are proposed for exclusion from oil and gas leasing, it is the opinion of the BLM that a No Lease alternative is not feasible for the entire planning area. Approximately 37 percent of the planning area is already leased and would remain so until existing leases expire or terminate. Many parts of the planning area are occupied presently by active oil and gas fields operating within approved environmental and procedural guidelines and rules. Most adverse impacts attributable to oil and gas activity can be mitigated using existing procedures. Because leasing is discretionary, resource conflicts can be addressed by use of existing authority including site specific no-lease decisions. An examination of the existing and proposed oil and gas leasing programs using mitigation measures already in effect does not inhibit other resource protection objectives.

Under the Federal Land Use Policy and Management Act (FLPMA) the BLM is legally bound to the concept of multiple use management of natural resources. The BLM has a long term commitment to ongoing resource use programs such as livestock grazing, timber production, mining, and mineral leasing and development. It does not appear that a No Lease proposal for the entire planning area would be practical or in compliance with FLPMA.

Maximum Fluid Mineral Development Alternative

The BLM did not analyze an oil and gas alternative that would remove or substantially reduce restraints on oil and gas development. Neither public scoping nor an internal analysis revealed a need to reduce protection of nonmineral resources for the benefit of oil and gas production.

Minimum Fluid Mineral Development Alternative

An analysis of public scoping and an internal examination of other resources did not reveal a need for a stringent reduction of the oil and gas leasing program. Existing and proposed mitigating measures adequately protect other resources and uses while still accommodating an active oil and gas program.

MANAGEMENT COMMON TO ALL ALTERNATIVES

Geophysical Management and Exploration

Appendix A gives a description of the management of geophysical exploration for oil and gas. This information is common to all alternatives.

Riparian and Wetland Management

In Montana and the Dakotas the Bureau policy is as follows: “our minimum goal for riparian-wetland managment will be to restore and maintain riparian-wetland areas so that 75 percent or more are in proper functioning condition by 1997.”

Operating Standards for Oil and Gas Exploration and Development

A summary of the steps required to obtain permission to drill and conduct surface operations is contained in Appendix A. The process of drilling a well from access onto the drillsite to the downhole completion of producing zones is common to all alternatives. Reporting requirements for drilling, production, and other leasehold activities are described in this appendix. Operations conducted under any of the alternatives would be required to follow these procedures.

Conditions of Approval

For all alternatives, Conditions of Approval are used with the approved Application for Permit to Drill and other surface permitting processes to describe site-specific oper-

ating practices. Appendix A shows a sample of the Conditions of Approval used by the Miles City District Office.

LEASING AND STIPULATION PROCEDURES

Mitigation measures are evaluated for the alternatives. Alternative A, No Action, is subject to standard and special stipulations which are based on resource decisions in the existing RMPs. Alternatives B, C, and D have stipulations written for specific locations for each mitigated resource. They use the same data base as Alternative A. In order to determine that the least restrictive measure needed to protect the resource has been chosen, some stipulations change between alternatives. This analysis will demonstrate that the appropriate level of protection has been selected for Alternative D, the Preferred.

Current Leasing Practices

Since the passage of the Federal Onshore Oil and Gas Leasing Reform Act (FOOGLRA) in 1987, all Federal lands must first be offered for lease at a competitive sale. If no bids are received, the lands are available for over-the-counter offers for the following 2 years.

Until the completion and approval of this plan, all leases receive the Oil and Gas Lease Stipulations (Form MT-3109-1, Appendix B). The lessee or operator does not know which specific stipulations included on this form will be enforced for the lease until the Notice of Staking (NOS) or Application for Permit to Drill (APD) is submitted to the Authorized Officer for approval. At the time of the pre-drill inspection the resource values requiring protection are identified and those portions of the Oil and Gas Lease Stipulations will be enforced.

Special stipulations, called Oil and Gas Surface Occupancy Stipulations (Forms MT-3109-2 through 4, Appendix B) are also used when necessary. These Occupancy Stipulations are identified by use of a set of "Comment Area" maps maintained by the resource specialists in the district and resource area offices. When a parcel is identified for a sale list or nominated over-the-counter in a "Comment Area", the lease is sent to the appropriate office for attachment of an Oil and Gas Surface Occupancy Stipulation. Other special stipulations are also used when required. These include Limited Surface Use Stipulations (MT-3109-6), Activity Coordination Stipulations (MT-3109-7), and special stipulations required by the Surface Management Agencies for which the Bureau leases land (Appendix B). Under the current system of leasing, the lessee knows only the restrictions identified by the special stipulation forms at the time the lease is sold.

Uniform Format For Oil And Gas Lease Stipulations

Stipulations were developed for this amendment using the "Uniform Format for Oil and Gas Lease Stipulations" (USDI and USDA, 1989b). Resource values which require protection or mitigation during oil and gas development were identified from existing data inventories by resource specialists. Only resources which cannot be protected by moving proposed oil and gas operations up to 200 meters or delaying them by 60 days were identified for protection of a stipulation. Stipulations and Lease Notices used for Alternatives B, C, and D are displayed in Appendix B.

Stipulations

Three types of stipulations describe how lease rights are modified in order to protect the resource. This amendment uses the land use planning and National Environmental Policy Act (NEPA) analysis to identify what resources will be protected or mitigated, the reasons protection is required, and the manner in which it will be accomplished. The No Surface Occupancy is considered a major stipulation; Timing and Controlled Surface Use are minor stipulations.

The No Surface Occupancy stipulation prohibits entry on the lease for development of oil and gas unless protection of the resource can be assured. This stipulation is used for resource values which require year-round protection. An example of this stipulation is critical habitat for a Threatened and Endangered species such as the Bald Eagle.

The Timing stipulation is used to protect resource values which are seasonal in nature. It is used when access will be denied for only part of the year. This includes habitat protection for crucial winter range or breeding season for sensitive animal species.

The Controlled Surface Use stipulation is used to ensure that resource values are protected when surface occupancy is permitted. Access is generally available year-round, but the location and conduct of operations may be controlled to prevent impacts to resources within the stipulated area. The soils resource is one example of this stipulation. Before oil and gas operations begin in areas having steep or fragile soils an engineering/reclamation plan must be approved.

A Lease Notice is used to provide additional information to the lessee. It is not a restriction to operations under the lease. The Notice may help the lessee submit an acceptable plan of operations or give information about applicable laws and regulations.

Waivers, Exceptions, and Modifications

Stipulations may be changed by application of Waivers, Exceptions, or Modifications (WEMs) to protect or mitigate other resource values while allowing development of oil and gas resources. A WEM is a statement of conditions for resource protection or mitigation to be achieved when oil and gas resources are developed in sensitive areas. Application of the WEMs generally occurs as part of the APD approval process and is described in Appendix B.

Development of Stipulations for Amendment

At the beginning of this project, the specialists identified each resource requiring the protection of a stipulation. The data base is the same resource inventory used in the old system which is being replaced. Information from field observations, from the comment-area maps, and from other ground-based data were used to compile the inventory for each resource. The stipulated areas have been identified by legal descriptions to the same level of detail as a lease parcel (Township, Range, section, and aliquot part, lot, or tract).

Regulatory Authority for Resource Protection

The Code of Federal Regulations at 43 CFR 3101.1-2 describes surface use rights of the lessee. Some protection for resources is given in this section, which says, "At a minimum, measures shall be deemed consistent with lease rights granted provided that they do not: require relocation of proposed operations by more than 200 meters; require that operations be sited off the leasehold; or prohibit new surface disturbing operations for a period in excess of 60 days in any lease year."

When the stipulations were developed for the planning area, each resource specialist identified only those resources which would not be protected by the regulatory provisions of a 200-meter move or a 60-day delay. When more protective measures were required, the lands in question were identified for stipulation(s).

COMPARISON OF ALTERNATIVES

Alternative A (No Action)

The stipulations used in this alternative are basically the same as the Preferred Alternative except: standback distances for grouse leks, fisheries and recreation sites are less than in the preferred. The standback distance for Federal sensitive species is one fourth mile; in Alternatives B, C, and D, the preferred, distances for Bald Eagles, raptors, peregrine falcons, and ferruginous hawks are increased. The NSO stipulation for raptor nest sites covers less total area (one fourth versus one half mile stand back) than the Timing stipulation in the Preferred Alternative. Impacts to those resources would be slightly more significant. Table 2.1 shows the acres available for leasing under Alternative A, No Action. This alternative includes a No Lease decision only for WSAs and does not propose any ACECs.

TABLE 2.1 AVAILABILITY OF LANDS FOR OIL AND GAS DEVELOPMENT IN ALTERNATIVE A*

Management Category	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Lease Terms Only					2,912,000
Minor Stipulations	198,000	1,678,000	59,000	0	1,934,000
Major Stipulations	7,000	238,000	19,000	0	264,000
Discretionary Closure	0	0	0	0	0
Nondiscretionary Closure	0	14,000	27,000	0	41,000

*Numbers are not additive due to overlap from more than one stipulation in an area.

Alternative B

Stipulations in this alternative are basically the same as for the Preferred Alternative. Because more restrictive versions of some stipulations apply, the impacts to other resources in this alternative should be slightly less overall. Impacts to oil and gas will be slightly more overall. Raptor nests are protected with the NSO restriction rather than the Timing stipulation of the Preferred Alternative. Soils are protected by No Surface Occupancy rather than by Controlled Surface Use which results in a significant reduction in areas available to surface occupancy. The result is less revenue from both the public and private sectors. Thirty-two (32) fewer wells are projected than in the Preferred Alternative due to surface restrictions, but this is not considered significant over the 15 years for the life of the plan. Table 2.2 shows lands which are available for leasing under Alternative B. This alternative includes the classification of ACECs for Weatherman Draw and Meeteetse Spires. Discretionary No Lease decisions are analyzed for Meeteetse Spires, Pryor Mountain Wild Horse Range, Fort Meade Recreation Area, Rosebud Battlefield, Dryhead Overlook, and the Powder River Breaks Bighorn Sheep Range.

Alternative C

This alternative is the least restrictive of the four analyzed in this amendment. The soils resource is protected only by lease terms. Timing and Controlled Surface Use stipulations are proposed for some wildlife species which have the No Surface Occupancy stipulation in Alternative B. This includes raptors and reintroduction and habitat sites for black-footed ferrets. In this alternative only Visual Resource Class II would be protected by a stipulation. No stipulations would be applied to resources in high development townships except for threatened and endangered species and cultural resources which require protection by law. Table 2.3 shows the acres available for leasing under Alternative C. This alternative includes a No Lease decision only for WSAs.

TABLE 2.2 AVAILABILITY OF LANDS FOR OIL AND GAS DEVELOPMENT IN ALTERNATIVE B*

Management Category	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Lease Terms Only					2,735,000
Minor Stipulations	83,000	643,000	28,000	0	754,000
Major Stipulations	128,000	1,438,000	33,000	0	1,600,000
Discretionary Closure	0	18,000	16,000	0	34,000
Nondiscretionary Closure	0	14,000	27,000	0	41,000

*Numbers are not additive due to overlap from more than one stipulation in an area.

TABLE 2.3 AVAILABILITY OF LANDS FOR OIL AND GAS DEVELOPMENT IN ALTERNATIVE C*

Management Category	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Lease Terms Only					3,768,000
Minor Stipulations	3,000	859,000	29,000	0	891,000
Major Stipulations	2,000	88,000	19,000	0	109,000
Discretionary Closure	0	0	0	0	0
Nondiscretionary Closure	0	14,000	27,000	0	41,000

*Numbers are not additive due to overlap from more than one stipulation in an area.

Alternative D, the Preferred

The combination of stipulations used in this alternative is the least restrictive that will provide the needed level of protection to the various resources. The stipulations are chosen from those analyzed in Alternative A, the No Action, B, and C. Setback distances used for a number of the wildlife stipulations are based on sensitivity of a given species. The No Surface Occupancy stipulation is used for sensitive species. The Timing and Controlled Surface Use stipulations are used for other species when year-round protection is not required. The soils resource is protected by a Controlled Surface Use stipulation which allows access with an approved reclamation/engineering plan. Table 2.4 shows the acres available for leasing under Alternative D. The Preferred Alternative includes the classification of Weatherman Draw and Meeteetse Spires proposed ACECs. Discretionary No Lease decisions are carried forward from Alternative B for the proposed Meeteetse Spires ACEC, Pryor Mountain Wild Horse Range, and Fort Meade Recreation Area.

Comparison of Alternatives

Table 2.5 compares impacts by resource for each alternative. Stipulations and the acres affected are summarized in Table 2.6.

TABLE 2.4 AVAILABILITY OF LANDS FOR OIL AND GAS DEVELOPMENT IN ALTERNATIVE D*

Management Category	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Lease Terms Only					2,840,000
Minor Stipulations	107,000	1,997,000	59,000	0	2,163,000
Major Stipulations	7,000	98,000	3,000	0	108,000
Discretionary Closure	0	3,000	16,000	0	19,000
Nondiscretionary Closure	0	14,000	27,000	0	41,000

*Numbers are not additive due to overlap from more than one stipulation in an area.

TABLE 2.5 COMPARISON OF IMPACTS FOR ALTERNATIVES

Resource	Alternative A, No Action	Alternative B	Alternative C	Alternative D, the Preferred
Air Quality	Impacts short-term and localized	Same as Alternative A	Same as Alternative A	Same as Alternative A
	Increase up to a maximum 4 tons/ year SO_2 during next 15 years	Slightly less SO_2 than Alternative A due to 32 fewer wells in 15 years	Same as Alternative A	Same as Alternative A
Minerals				
Oil & Gas	4,629,000 acres available for lease	4,595,000 acres available for lease	Same as Alternative A	4,610,000 acres available for lease

TABLE 2.5 COMPARISON OF IMPACTS FOR ALTERNATIVES (CONTINUED)

Resource	Alternative A, No Action	Alternative B	Alternative C	Alternative D, the Preferred
Minerals				
Oil & Gas (continued)	41,000 acres closed to leasing	75,000 acres closed to leasing	Same as Alternative A	60,000 acres closed to leasing
	2,912,000 acres not stipulated	2,735,000 acres not stipulated	3,768,000 acres not stipulated	2,840,000 acres not stipulated
	630 Federal wells will disturb 2,447 acres	598 Federal wells will disturb 2,322 acres	Same as Alternative A	Same as Alternative A
	18,865 acres not available for Surface Occupancy until coal mining is completed	Same as Alternative A	Same as Alternative A	Same as Alternative A
Coal	No impact to coal leases with approved mine plans	Same as Alternative A	Same as Alternative A	Same as Alternative A
Mineral Materials	No significant impacts	Same as Alternative A	Same as Alternative A	Same as Alternative A
Hydrology	Impacts infrequent, short-term and localized	Same as Alternative A	Same as Alternative A	Same as Alternative A
Soil	Most impacts are short-term and not significant Impacts are more severe and long-term on sloping soils	Same as Alternative A	No stipulation for soils Impacts to soils and sloping soils are more severe than in other alternatives	Same as Alternative A
	Some irretrievable loss to soil through erosion	Same as Alternative A	Irretrievable loss through soil erosion greatest in Alternative C	Same as Alternative A
Vegetation	Overall insignificant impacts in all alternatives - 2,447 acres disturbed	Fewer acres (2,322) disturbed in this alternative	Same as Alternative A	Same as Alternative A
Livestock Grazing	Overall insignificant impacts in all alternatives - temporary loss of 490 AUMs	Same as Alternative A except temporary loss of 464 AUMs	Same as Alternative A	Same as Alternative A
Cropland	No significant impacts	Same as Alternative A	Same as Alternative A	Same as Alternative A

TABLE 2.5 COMPARISON OF IMPACTS FOR ALTERNATIVES (CONCLUDED)

Resource	Alternative A, No Action	Alternative B	Alternative C	Alternative D, the Preferred
Pryor Mtn. Wild Horse Range	No anticipated impacts	Same as Alternative A	Same as Alternative A	Same as Alternative A
Fort Meade Recreation Area	No anticipated impacts	Same as Alternative A	Same as Alternative A	Same as Alternative A
Meeteetse Spires Area	No anticipated impact to rare plants	Same as Alternative A	Same as Alternative A	Same as Alternative A
Weatherman Draw	No significant impacts	Same as Alternative A	Same as Alternative A	Same as Alternative A
Wildlife	Minor impacts primarily due to disruption of crucial winter range, plus smaller areas of habitat being protected by stipulation than in other alternatives	Insignificant impacts due to larger areas of habitat being protected by stipulation or No Lease decisions	Same as Alternative B	Same as Alternative B
Cultural Resources	No significant impacts	Same as Alternative A	Same as Alternative A	Same as Alternative A
Paleontological Resources	No significant impacts	Same as Alternative A	Same as Alternative A	Same as Alternative A
Wilderness	No impacts	Same as Alternative A	Same as Alternative A	Same as Alternative A
Recreation	No significant impacts Minor impacts would be localized (visual, noise, smells)	Same as Alternative A	Same as Alternative A	Same as Alternative A
Visual Resources	No significant impacts	Same as Alternative A	Same as Alternative A except 19,000 acres would be protected by lease terms rather than stipulations	Same as Alternative A except 18,500 acres would be protected by lease terms rather than stipulations
Social and Economic Conditions	Insignificant impact on earnings and employ-ment	Same as Alternative A	Same as Alternative A	Same as Alternative A
	No Surface Occupancy and No Lease decisions would cause $1.1 million in lost revenue and 3.0 percent loss in rental and royalties	Same as Alternative A except $3.4 million in lost revenues and 9.0 percent loss in rental and royalty	Same as Alternative A	Same as Alternative A except $1.6 million in lost revenue and 4.1 percent loss in rental and royalty

TABLE 2.6 SUMMARY OF THE ALTERNATIVES SHOWING APPROXIMATE STIPULATED ACRES

Resource and Objective	Alternative A, No Action	Alternative B	Alternative C	Alternative D, the Preferred
Coal — to protect existing coal leases with approved mine plan	No Surface Occupancy on 18,865 acres of lands leased for coal	Same as Alternative A	Same as Alternative A	Same as Alternative A
Riparian/ Hydrology — to protect the unique biological and hydrologic features	No Surface Occupancy on 28,668 acres	Same as Alternative A	Same as Alternative A except it applies to 24,336 acres	Same as Alternative A except it applies to 28,668 acres
Soils — to maintain soil productivity, prevent excessive erosion, and avoid areas of fragile soils	Controlled Surface Use on 1,299,592 acres	No Surface Occupancy on 1,299,592 acres	No stipulation, Lease Terms only	Controlled Surface Use on 1,220,682 acres
Pryor Mtn. Wild Horse Range — to protect habitat used by wild horse herds	No Surface Occupancy on approximately 11,500 acres outside WSAs	No Lease on approximately 11,500 acres outside WSAs	Same as Alternative A	Same as Alternative B
Fort Meade Recreation Area — to protect developed recreation site and historical values	No Surface Occupancy on 6,629 acres	No Lease on 6,629 acres	Same as Alternative A	Same as Alternative B
Meeteetse Spires proposed ACEC — to protect esthetic quality of pinnacles and habitat of rare plant species	New initiative proposed in this amendment	No Lease on 960 acres NOTE: Two current leases will expire in 1995 and 1996	No Surface Occupancy on 960 acres	Same as Alternative B
Weatherman Draw proposed ACEC — to protect significant rock art complex	ACEC is new initiative proposed in this amendment No Surface Occupancy on 2,250 acres	Same as Alternative A NOTE: Part of the Cultural Resources stipulation	Same as Alternative A NOTE: Part of the Cultural Resources stipulation	Same as Alternative A NOTE: Part of the Cultural Resources stipulation

TABLE 2.6 SUMMARY OF THE ALTERNATIVES SHOWING APPROXIMATE STIPULATED ACRES (CONTINUED)

Resource and Objective	Alternative A, No Action	Alternative B	Alternative C	Alternative D, the Preferred
Crucial Winter Range — to protect crucial habitat for winter use season	Timing restriction from Dec. 1 to May 15 on 242,281 acres	Timing restriction from Dec. 1 to March 31 on 242,281 acres	Same as Alternative B except it applies to 186,014 acres	Same as Alternative B
Elk Spring Calving Range — to protect calving range during spring use season	Timing restriction from May 1 to June 30 on 3,856 acres	Timing restriction from April 1 to June 15 on 3,856 acres	Same as Alternative B except it applies to 2,244 acres	Same as Alternative B
Bighorn Sheep — to protect the limited habitat in southeastern Montana	No Surface Occupancy on 13,626 acres	No Lease on 13,626 acres	Timing restriction from Dec. 1 to June 30 on 13,626 acres	Same as Alternative A
Grouse Lek — to protect traditional breeding grounds	No Surface Occupancy within 500 feet of lek on approximately 370 acres	No Surface Occupancy within 1/4 mile of lek on 2,581 acres	Same as Alternative B	Same as Alternative B
Grouse Nesting — to protect nesting habitat adjacent to leks	Timing restriction from March 1 to June 30 for nesting areas associated with leks on approximately 50,000 acres	Timing restriction from March 1 to June 15 within 2 miles of a lek on 182,588 acres	Same as Alternative B, except it applies to 176,921 acres	Same as Alternative B
Raptors — to protect nest sites of species of special concern	No Surface Occupancy within 1/4 mile on approximately 15,000 acres	No Surface Occupancy within 1/2 mile on 56,864 acres	Timing restriction from March 1 to August 1 within 1/2 mile on 56,434 acres	Same as Alternative C except it applies to 56,864 acres
Reservoirs with Fisheries — to protect fishery and recreational values	No Surface Occupancy within 500 feet on approximately 350 acres	No Surface Occupancy within 1/4 mile on 1,844 acres	Same as Alternative B	Same as Alternative B
Black-footed Ferret Reintroduction Sites — to protect designated or potential habitat sites	No Surface Occupancy on 136,513 acres	Same as Alternative A	Controlled Surface Use on 136,513 acres	Same as Alternative C

TABLE 2.6 SUMMARY OF THE ALTERNATIVES SHOWING APPROXIMATE STIPULATED ACRES (CONTINUED)

Resource and Objective	Alternative A, No Action	Alternative B	Alternative C	Alternative D, the Preferred
Potential Black-footed Ferret Habitat 80 acres or more — to protect and locate habitat	Controlled Surface Use on 13,586 acres	No Surface Occupancy on 13,586 acres	Same as Alternative A	Same as Alternative A
Bald Eagle — to protect nesting sites and habitat of an endangered species	No Surface Occupancy within 1/4 mile on approximately 625 acres	No Surface Occupancy within 1/2 mile on 2,473 acres	Same as Alternative B	Same as Alternative B
Peregrine Falcon — to protect habitat of an endangered species	No Surface Occupancy within 1/4 mile on approximately 60 acres	No Surface Occupancy within 1 mile on 661 acres	Same as Alternative B	Same as Alternative B
Ferruginous Hawks — to protect a Category 2 species	No Surface Occupancy within 1/4 mile on approximately 2,800 acres	No Surface Occupancy within 1/2 mile on 10,803 acres	Same as Alternative B	Same as Alternative B
Piping Plover — to protect habitat of a threatened species	No Surface Occupancy within 1/4 mile NOTE: No birds have been found on Federal oil and gas lands in the planning area	Same as Alternative A	Same as Alternative A	Same as Alternative A
Interior Least Tern — to protect habitat of an endangered species	No Surface Occupancy within 1/4 mile NOTE: No birds have been found on Federal oil and gas lands in the planning area	Same as Alternative A	Same as Alternative A	Same as Alternative A
Cultural Resources — to protect identified, cultural properties	No Surface Occupancy on 13,824 acres NOTE: Includes 2,250 acres for Weatherman Draw rock art complex	Same as Alternative A, except it applies to 12,447 acres	Same as Alternative A	Same as Alternative A
Paleontological Resources — to protect significant sites	No Surface Occupancy on 480 acres	Same as Alternative A	Same as Alternative A	Same as Alternative A

TABLE 2.6 SUMMARY OF THE ALTERNATIVES SHOWING APPROXIMATE STIPULATED ACRES (CONCLUDED)

Resource and Objective	Alternative A, No Action	Alternative B	Alternative C	Alternative D, the Preferred
Recreation — to protect developed and undeveloped recreation sites	No Surface Occupancy on 14,586 acres	Same as Alternative A	Same as Alternative A except it applies to 14,106 acres	Same as Alternative A
Visual Resources — to control visual impacts	Controlled Surface Use for VRM Classes II, III, and IV on 324,912 acres	Same as Alternative A	Controlled Surface Use on VRM Class II on 305,906 acres	Same as Alternative C except it applies to 306,419 acres

INTRODUCTION

This chapter contains a description of the resource, social, and economic conditions in the planning area. Each section discusses the resources which will be affected by oil and gas activities, and in turn, will influence the way in which those activities are conducted. Detailed descriptions of the oil and gas operations are contained in Appendices. Much of the resource information is summarized from the three RMP/EISs being amended by this plan. This material and other information provided by the resource specialists in the district and resource areas make up the Management Situation Analysis (MSA) document on file in the Miles City District Office.

CLIMATE

The climate in the planning area varies from dry or semiarid to modified (mountainous) continental. Most weather is of Pacific origin. Temperatures and precipitation may fluctuate greatly during all seasons.

The largest part of the planning area contains rolling plains with a dry to semiarid continental climate. Precipitation ranges from 6 to 19 inches, most of which occurs as rain from April through June. During the summer months, thunderstorms may be severe enough to cause high wind or hail damage. Normally, summers are short and winters long. Average low temperature in January is 8°F and the average high in July is 90°F. Occasional extremes of -40°F and 110°F do occur.

In the mountains and foothills of Montana and in the Black Hills area of South Dakota, precipitation ranges from 15 to 23 inches. Seasonal snowfall in these areas averages from 125 to 150 inches. Summers are short with moderate days and cool nights; winters can be long and cold. Average temperatures are 0°F in January and 86°F in July.

AIR QUALITY

Ambient air quality in the planning area is good overall. Localized elevated levels of total suspended particulates (TSP) and sulfur dioxide (SO_2) occasionally occur due to oil and gas production, coal mining, and industrial and refining activities.

Air pollution is controlled through the ambient air quality and emission standards established by the Clean Air Act (P.L. 98-213) and appropriate state laws. The Clean Air Act Amendments of 1977 established a system for the Prevention of Significant Deterioration (PSD) of "attainment" and "unclassified" areas. PSD Class I areas are those areas where any degradation of air quality would be considered significant. Class I areas which are located within the planning area are the Northern Cheyenne Indian Reservation, Wind Cave National Park, and Badlands National Park. PSD Class II areas allow moderate, controlled air impacts, and Class III areas permit the most degradation of air quality. Oil and gas activities in the planning area occur within PSD Class III and unclassified areas. Table 1, Appendix D, lists the Federal and state air quality standards which apply in the planning area.

Terrain surrounding pollution sources, in conjunction with climatological conditions, greatly influences the concentration of pollutants and the dispersion capacity of a given airshed. Because the effects are highly localized, Federal oil and gas actions causing air pollution are normally addressed at the operations approval stage (drilling permit and sundry notice). Table 2, Appendix D, is a summary of source and types of air quality pollutants associated with oil and gas activities. Common air pollutants associated with these activities are:

—Particulates/Fugitive Dust generated by construction activities which may promote wind erosion. These same particulates also are generated by diesel and gasoline engines.

—Nitrogen Oxides originating from internal combustion engines. The effects are summarized in Table 3, Appendix D.

—Natural Gas/Methane vented during normal production operations. Within the study area, venting volumes range from 2 to 5 MCF per day. Montana requires that non-recoverable gas volumes in excess of 20 MCF per day for 72 hours be burned (flared).

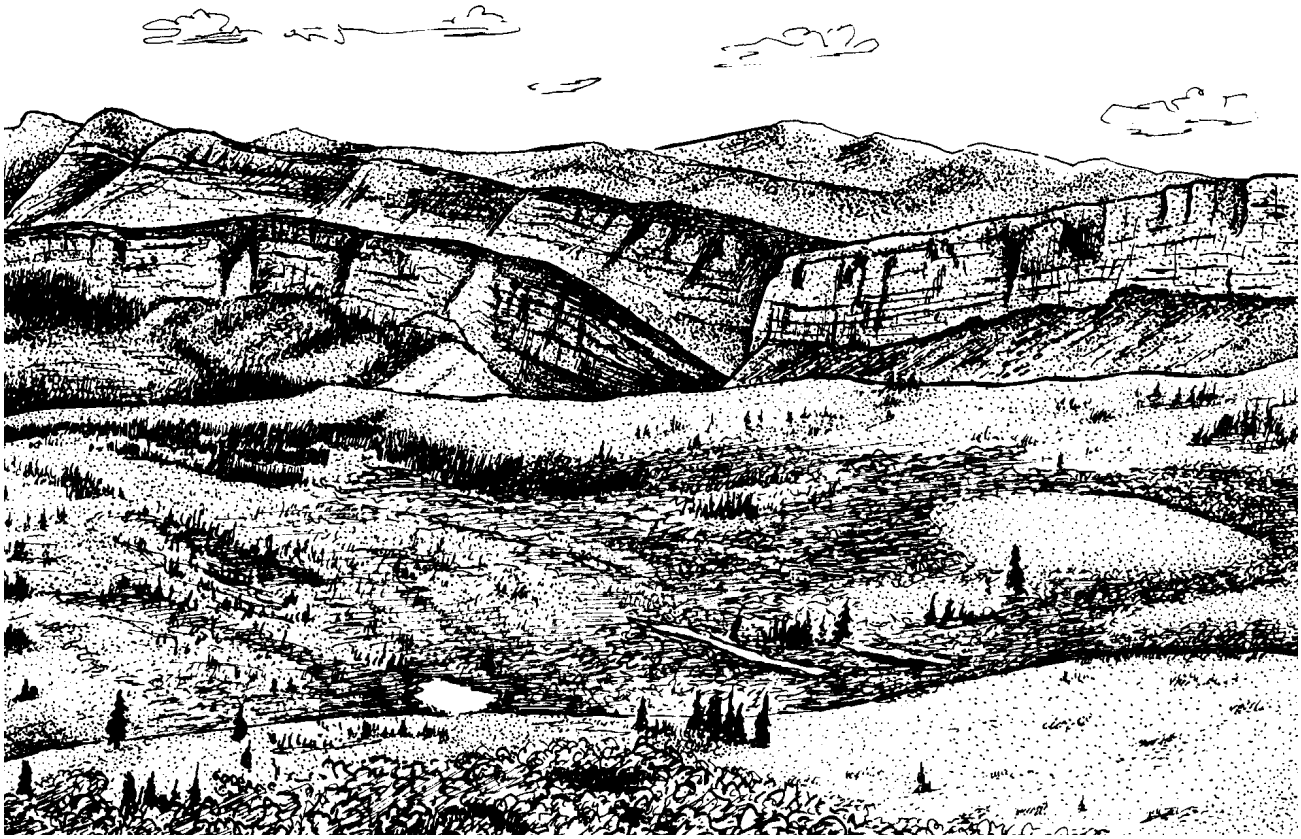
—Sulfur Dioxide primarily produced from the flaring/burning of H_2S-bearing natural gas.

—Hydrogen Sulfide occurring naturally in oil and gas formations. It is heavier than air, highly toxic, and collects in low-lying areas during optimum weather conditions. Table 4, Appendix D, summarizes hydrogen sulfide effects on humans.

GEOLOGY AND MINERALS

Topographic Setting

The planning area is situated within the Missouri Plateau subdivision of the Great Plains physiographic province.



The terrain is primarily plains topography, with isolated mountain ranges rising from the plains and stream valleys forming a dissected landscape of plateaus, breaks, flat-bottomed valleys, and rolling prairie (Perry, 1962). Two major rivers, the Yellowstone and Missouri, and their tributaries drain the eastern part of Montana. The South Dakota Resource Area is bisected by the Missouri River, and its tributaries drain most of it. The northeast corner of South Dakota is part of the Red River of the North drainage. Each of the three resource areas has unique distinguishing geologic features (Figure 3.1). Some of these features are the focus for oil and gas accumulation and exploration activities. A detailed stratigraphic correlation diagram for the planning area is in Appendix C, Figure 2.

Oil And Gas Resources

BILLINGS RESOURCE AREA

This resource area, in the westernmost part of the district, is ringed by mountain ranges. Four different mountain-building processes account for these ranges. The Absaroka-Beartooth and Pryor Mountains were formed by faulting of basement rocks and folding of overlying sediments. Igneous and metamorphic basement rocks are exposed in some localities, adjacent to the sedimentary rocks which normally contain the oil and gas reservoir rocks. Between these two mountain ranges is the Bighorn Basin which produces oil and gas in this resource area. The Central Montana Uplift, called the Big Snowy Anticlinorium on Figure 3.1, created a series of anticlines (upfolds) and synclines (downfolds) which formed the Snowy and Little Belt Mountains. This area contains many of the oil and gas fields in the northern part of the resource area. Deep erosion of nearly flat-lying sediments formed the Bull Mountains. An intrusion of molten rock, or magma, formed the Crazy Mountains. Neither of these areas has experienced oil and gas development.

The surrounding plains areas are flat-lying or gently dipping sedimentary rocks. Folding and faulting associated with mountain building has affected the bedding and outcrop pattern of these rocks, especially in the foothills. Unconsolidated rock material, eroded from higher ground, has been deposited at the base of the mountains and in the stream valleys by gravity and by running water.

Wells in the Billings Resource Area produce from two principal oil and gas provinces, the Bighorn Basin in south-central Montana and the Central Montana Uplift. The first producing oil well in Montana was drilled in the Bighorn Basin, an extension of the Elk Basin Field in Wyoming. Other fields are located in the Lake Basin fault zone along the Nye-Bowler lineament, or scattered across the resource area where structural features or stratigraphic conditions caused the accumulation of hydrocarbons. During 1989 this resource area had more than 45 active oil and gas fields (Tables 3.1 and 3.2).

TABLE 3.1 ACTIVE OIL FIELDS IN THE BILLINGS RESOURCE AREA, 1989

Field	Formation	Year Disc.	Depth	Cumulative Production (in MBO)	Associated Gas (MCF) in 1989
Big Gully	Tyler	1976	3,800	104	—
Big Gully, N	Tyler	1977	3,900	27	—
Big Wall	Amsden	1953	2,500	998	—
"	Lower Tyler	1948	3,000	6,649	—
"	Upper Tyler	1948	3,000	36	—
Crooked Creek	Dakota	1985	6,100	27	—
Dean Dome	Greybull	1966	2,500	93	—
Delphia	Amsden	1967	6,300	330	—
Devils Pocket	Heath	1920	2,030	26	—
Dry Creek	Greybull	1981	5,580	33	90,036
"	Eagle/Virgelle	1929	2,600	4,107	—
Elk Basin	Tensleep	1942	5,000	22,849	[411,818]
"	Madison	1942	5,300	2,177	—
"	Frontier	1915	1,400	1,745	—
Elk Basin NW	Madison/Tensleep	1964	6,000	1,635	76,615
Frannie	Tensleep	1929	2,700	768	24
Gage	Amsden	1944	6,000	641	—
Golden Dome	Greybull/Frontier	1953	6,000	78	42,599
Hiawatha	Tyler	1967	5,000	1,558	1,889
Howard Coulee	Tyler	1974	3,500	143	—
Ivanhoe	Tyler/Heath	1956	4,100	4,500	—
"	Morrison	1960	4,135	9	—
Jim Coulee	Tyler	1971	3,700	3,920	3,934
Jim Coulee N	Tyler	1972	3,750	295	196
Keg Coulee	Tyler/Stensvad	1960	4,650	63	—
"	Tyler	1960	4,600	6,038	75
Kelley	Tyler	1966	4,400	1,003	706
Little Wall Creek	Tyler/Stensvad	1970	3,700	3,871	16,368
Mason Lake	Amsden/Cat Creek	1964	4,200	946	—
Melstone	Tyler	1948	4,400	3,590	14,583
Mosser Dome	Kootenai	1936	1,000	373	—
Ragged Point	Tyler	1956	3,600	3,854	2,548
", SW	Tyler	1973	4,100	169	—
Sheepherder	Tyler	1974	4,900	77	—
Snyder	Tensleep	1952	4,600	461	—
Stensvad	Tyler	1958	5,500	10,143	—
Tinder Box	Tyler	1988	4,280	6	322
Tippy Buttes	Tyler	1980	5,000	125	364
Weed Creek	Amsden	1966	6,200	605	742
Willow Creek, North	Tyler	1970	4,000	352	—
Winnett Junc.	Tyler	1973	2,500	842	—
Wolf Springs	Amsden	1955	6,200	4,685	—

Sources: Montana Board of Oil and Gas Conservation, 1990
Tonnsen, 1985

TABLE 3.2 ACTIVE GAS FIELDS IN THE PLANNING AREA, 1989

Field	Formation	Year Disc.	Depth	Production in MCF (1989)
Billings Resource Area				
Big Coulee	Morrison/Cat Creek	1954	2,200	189,813
Broadview	Frontier	1974	2,400	88,542
Clarks Fork	Greybull	1954	8,850	21,890
Dry Creek	Frontier, Judith River, Virgelle	1929	4,320	730,386
Dry Creek, Middle	Frontier	1958	4,000	30,777
Dry Creek shallow gas	Virgelle	1975	2,975	30,253
Dry Creek, West	Greybull	1976	6,600	45,380
Golden Dome	Greybull, Frontier, Eagle	1954	5,850	123,958
Lake Basin	Claggett, Eagle/Virgelle, Telegraph Creek, Frontier	1924	1,100	137,836
Lake Basin, North	Eagle	1958	1,100	3,922
Little Basin	Frontier	1985	1,350	21,759
Park City	Virgelle	1981	1,200	5,906
Rapelje	Eagle/Virgelle, Claggett	1960	1,250	32,551
Powder River Resource Area				
Liscom Creek	Shannon			69,353
South Dakota Resource Area				
Cady Creek	Shannon	1978	1,350	157
West Short Pine Hills	Shannon	1977	1,650	621

Sources: Montana Board of Oil and Gas Conservation, 1990
South Dakota Department of Water and Natural Resources, 1990
Tonnsen, 1985

POWDER RIVER RESOURCE AREA

This resource area, located in the southeast corner of Montana, is characterized by flat-lying sedimentary rocks cut by numerous streams. This has created a dissected landscape of plateaus, rough breaks, flat-bottomed valleys, and rolling plains. The southeastern corner of the resource area is influenced by the Black Hills Uplift where the oldest rocks are exposed.

The major structural feature which affects the accumulation of hydrocarbons is the Powder River Basin, (Figure 3.1) a structural trough covering the western two-thirds of the resource area. The active oil and gas fields in the area are in the Powder River Basin and on the western flank of the Black Hills Uplift in Carter County. During 1989 one gas field and four oil fields were active in the resource area (Tables 3.2 and 3.3). The southeast end of the Central Montana Uplift, which is part of the Billings Resource Area, is present in the northwestern part of Powder River Resource Area, but production has not yet been established.

SOUTH DAKOTA RESOURCE AREA

The western part of this area is dominated by the Black Hills Uplift. Outside the Black Hills Uplift are the nearly flat-lying sedimentary rocks dissected by streams to form the plateaus, badlands, flat-bottomed valleys, and rolling plains that characterize most of South Dakota. East of the Missouri River the topography is shaped by two successive periods of glaciation during the Pleistocene. Numerous small kettle lakes occur in this area with the heaviest concentration in the northeast corner of the state.

Oil and gas fields are located in two areas of South Dakota. Producing fields in Harding County and noncommercial accumulations in Butte County are part of the southern reach of the Williston Basin (Figure 3.1). The structures which produce in this area, such as Buffalo and West Short Pine Hills, are genetically related to the Cedar Creek Anticline. They are either on trend or are parallel trends. The trapping mechanisms in the fields like Buffalo are primarily stratigraphic with minor structural closure. All

production from Harding County oil fields has been from the Ordovician Red River formation. Two Cretaceous Shannon gas fields, West Short Pine Hills and Cady Creek, have been discovered on trend with Cedar Creek Anticline and its subsidiary structures. These are combination traps, anticlinal folds with stratigraphic boundaries. In the southwestern corner of the state, fields have been discovered in Custer and Fall River Counties at the southern end of the Black Hills Uplift. This area is on the southeastern flank of the Powder River Basin. All fields to date have produced from the Permian-Pennsylvanian Minnelusa Formation (South Dakota, 1990).

Buffalo, discovered in 1954, is South Dakota's oldest field. In 1989 there were 22 active fields (Tables 3.2 and 3.4), two of them producing gas. Seventeen of the 20 oil fields produce associated gas.

TABLE 3.3 ACTIVE OIL FIELDS IN THE POWDER RIVER RESOURCE AREA, 1989

Field	Formation	Year Disc.	Depth	Cumulative Production (in MBO)	Associated Gas (MCF) im 1989
Bell Creek	Muddy	1967	4,400	130,181	7,306
Leary	Muddy	1969	5,800	605	—
Repeat	Red River	1956	8,600	545	1,200
Wright Creek	Muddy	1969	4,800	289	—

Source: Montana Board of Oil and Gas Conservation, 1990

TABLE 3.4 ACTIVE OIL FIELDS IN THE SOUTH DAKOTA RESOURCE AREA, 1989

Field	Formation	Year Disc.	Depth	Cumulative Production (in MBO)	Associated Gas (MCF) in 1989
Alum Creek	Minnelusa	1980	3,250	1,600,704	380
Barker Dome	Minnelusa	1955	1,450	256,270	—
Buffalo	Red River	1954	8,500	13,039,714	3,516
Bull Creek	Red River	1978	8,700	385,141	5
Cheyenne Bend	Minnelusa	1987	2,580	16,347	—
Corey Butte	Red River	1975	9,250	67,240	1
East Harding Springs	Red River	1976	9,700	490,433	4
East Simms Draw	Minnelusa	1984	3,800	270,717	9
Edgemont	Minnelusa	1980	2,745	172,351	3
Harding Springs	Red River	1973	9,290	200,928	1
Indian Creek	Minnelusa	1978	3,850	311,341	4
Jones Creek	Red River	1975	8,600	406,175	1
North Hollingsworth	Minnelusa	1984	3,530	348,193	31
Porter Ranch	Minnelusa	1987	2,845	24,633	—
Provo	Minnelusa	1986	3,775	12,984	—
S. Medicine Pole Hills	Red River	1972	9,300	661,322	4
State Line	Red River	1973	9,100	677,270	7
Table Mountain	Red River	1983	8,950	185,155	—
Travers Ranch	Red River	1973	9,100	900,773	1
Yellow Hair	Red River	1971	9,000	627,093	2

Source: South Dakota Department of Water and Natural Resources, 1990

Geologic reports for the Reasonably Foreseeable Development (RFD) projections describe the potential for oil and gas occurrence and development in the planning area. They are presented in Appendix C with a small geologic map which illustrate major structural features that have influenced the location and accumulation of oil and gas resources.

PRODUCTION TRENDS

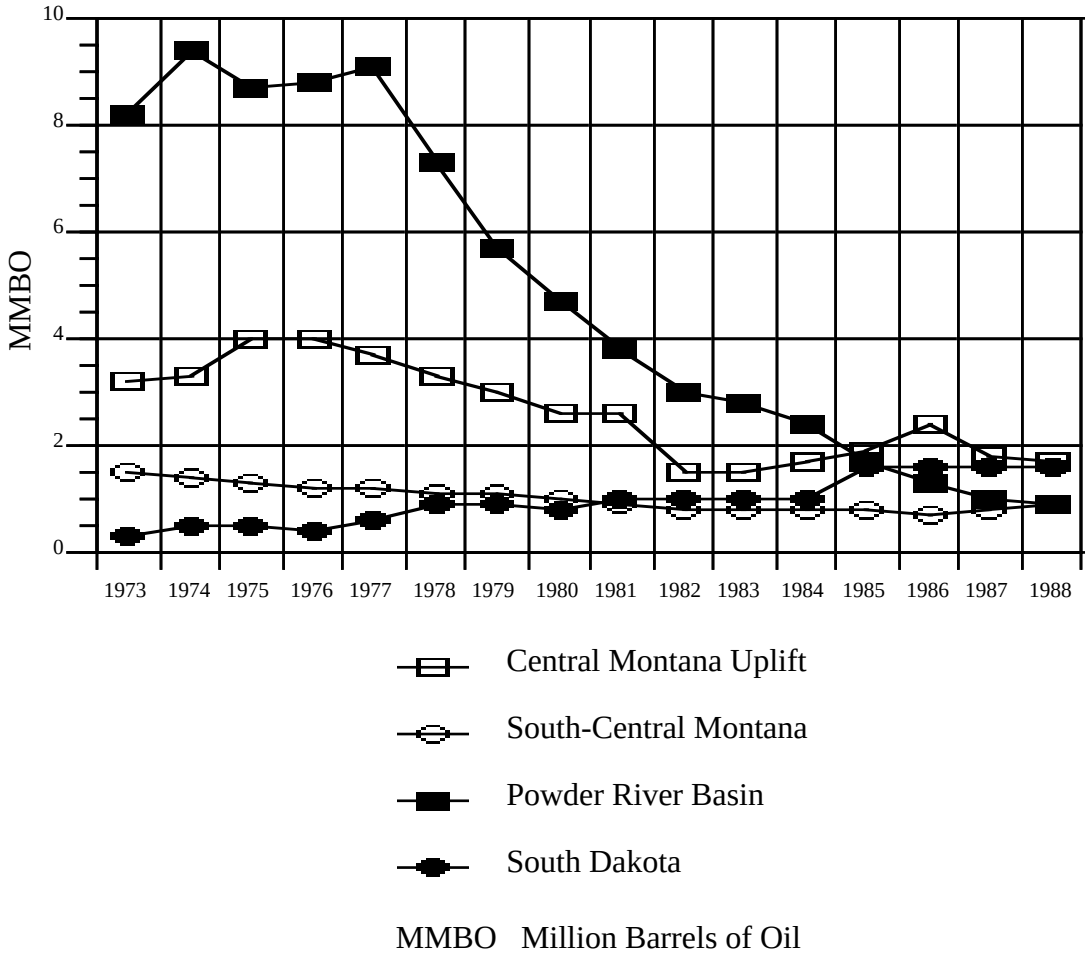
The RFD projections for the planning area are based on the historic period 1973-1987. During that time total oil production in Montana has shown a steady decrease except for a 3-year period during the boom cycle in the Williston Basin. This area is in the Miles City District, but outside the scope of this document. Production from oil producing provinces within the planning area has remained steady or shown declines (Figure 3.2).

Oil recovery in the Powder River Basin showed a marked change in 1978 (Figure 3.2), primarily associated with a steady decline in Bell Creek field production. Production in Bell Creek has continued to decline even though a tertiary recovery phase was begun in 1981 (USDI BLM, 1984b). The dramatic increase of Minnelusa discoveries in the Wyoming portion of the Powder River Basin has not been duplicated in Montana because the same geologic conditions which formed these Minnelusa reservoirs have not yet been identified in the Montana portion of the Basin.

Production in the fields of southcentral Montana oil-producing provinces has generally remained steady or decreased slightly. The fields in the southcentral province have shown a slow decline mostly due to the aging of fields with no major new discoveries. Some of the oldest fields in Montana are located in the south central and central oil-producing regions. Production in the Montana portion of Elk Basin was established in 1915 with the completion of the first successful well in Carbon County. Cat Creek was discovered in 1920 in central Montana. Wells in both these fields are still producing today.

The southern part of the Billings Resource Area is dominated by the Absaroka-Beartooth Uplift and the Pryor Mountains. The overthrust edge of the Beartooth Uplift

FIGURE 3.2 ANNUAL PRODUCTION OF OIL IN THE PLANNING AREA, 1973-1988



south of Red Lodge has been the focus of oil and gas interest. It was the location for a test well drilled by Amoco in 1986-1987. A well drilled by Phillips was begun in 1990 to test a new area adjacent to the overthrust. The formations underlying the thrust are thought to be the northern extension of the Bighorn Basin, location of numerous oil fields in Montana and Wyoming. Elk Basin and Northwest Elk Basin in Carbon County produce oil from multiple reservoirs in the Montana portion of Bighorn Basin. Producing fields are also concentrated on the Nye-Bowler lineament, a fault trend on the northeastern end of the Bighorn Basin. These fields, Dry Creek, Golden Dome and others, produce from multiple zones in faulted reservoirs.

The western boundary of the Billings Resource Area includes part of the Crazy Mountains complex. The mountains were formed by intrusion of molten rock (magma). Exploration activity has been low in the area with no discoveries made to date.

The uplift of the Snowy and Belt Mountains in central Montana formed many structures which are the location of oil and gas fields. Domes and elongate anticlinal folds trap oil in the western end of the Central Montana Uplift. The eastern end of the Central Montana Uplift is characterized by many prehistoric stream channel deposits which contain oil. Exploration has continued in central Montana with moderate results (J.R. Fanshawe in Tonnsen, 1985, p. 48).

South of the Central Montana Uplift, the Bull Mountains are an area of high relief caused by the dissection of nearly flat-lying sediments which had been uplifted by their proximity to the Central Montana Uplift. No discoveries of oil and gas have been made to date in the Bull Mountains, although the rocks favorable for generation and entrapment of hydrocarbons are present in the subsurface.

The discovery of new fields in South Dakota has led to a steady increase in production since the early 1970s (Figure 3.2). Oil production rose from approximately 280,000 barrels in 1973 to more than 1.6 million barrels in 1988. The two producing regions are the northwest and southwest corners of the state. Drilling in the area between the Black Hills and the Missouri River has produced shows of oil and gas, but no commercial production has been established. The chronically weak gas market (Petres, 1989, p. 78) may be a factor in the lack of exploration in this area.

Coalbed Methane

Coalbed methane is one of the unconventional oil and gas resources which receive a tax credit under provisions of the Windfall Profits Tax Act of 1980. The Department of the Interior and Related Agencies Appropriations Act, 1991, has extended the tax credit through December 2001, but all wells must be drilled by the end of December 1993. Coalbed methane test wells are being drilled in two areas of Montana to evaluate the potential for production. Several factors will determine the ultimate success of the projects:

(1) volume of gas;
(2) amount of produced water for disposal;
(3) availability of a production pipeline;
(4) continuation of the tax credit.

Methane is a component of the volatile materials driven off during coalification of organic materials. This results from thermal alteration associated with depth of burial. The most productive coals are high-and medium-volatile bituminous coals such as those in the Appalachian basins of the east. Coalbed methane occurs in two structural basins in the planning area.

Coal resources in the Powder River Basin are in the Paleocene Fort Union Formation. About half of the estimated 30 trillion cubic feet of in-place coalbed methane resource is recoverable. Less than half the coal resources occur in the Montana portion of the Basin. These subbituminous coals have low concentrations of gas per unit volume (Choate and others, 1984). However, because of the immense total coal thickness which reaches 170 feet in some areas in Montana (Campen, 1990), vast quantities of coalbed methane are present.

During the summer of 1990 four coalbed methane tests were planned for the Powder River Basin. Two wells on the Northern Cheyenne Indian Reservation are beyond the scope of this amendment. Two other wells were drilled near Decker, Montana: one south of Spring Creek Mine, and one east of East Decker Mine. Results had not been released to the public as of July 1, 1991.

Two formations in the Bighorn Basin contain coal. The Red Lodge-Bearcreek deposit is in the Paleocene Fort Union Formation. The coals are classed as subbituminous. A methane explosion was responsible for three mine accidents which killed 91 miners (Campen, 1990). Nine coal beds have an average total thickness of approximately 45 feet (Darrow, 1954). The status of four test holes was reported in the May 24, 1991, issue of the Montana Oil Journal, but none is reported to be completed for production. The Bridger Coal Field is in the upper Cretaceous Eagle Formation. The coal is bituminous in rank. Three coal beds totaling 18 feet are known in this deposit (Campen, 1990). The extent of the coals is not known, although the coal may be a source of methane for Cretaceous sands in the Golden Dome-Dry Creek fields, 5 to 10 miles southwest of Bridger, Montana. There are currently no known proposals to evaluate the coalbed methane potential of the Bridger coal deposit.

Projections of the Reasonably Foreseeable Development (RFD) were prepared for coalbed methane in the planning area (Appendix C). Test wells projected for conventional

oil and gas resources in these areas could also cover an exploratory level of drilling, but would not be large enough to include development of both traditional and unconventional resources in the area.

An unknown factor in assessing impacts beyond exploratory drilling is the quantity of water which must be removed before coalbed methane can flow. This amendment does not contain a detailed hydrologic analysis for the coalbed methane areas. To manage full-field development within the planning area, a disposal plan for produced water would need to be devised as an amendment to this document. Standard water disposal requirements (NTL-2B) are sufficient for managing exploratory operations.

Currently, neither test area is served by a pipeline for collection and distribution of gas. Coalbed methane is generally clean enough to go directly into distribution lines. The closest lines to the Powder River Basin tests are near Sheridan, Wyoming, 15 to 20 miles southwest of the Decker area. A distribution line serves Red Lodge about 5 miles from the initial test. Transmission pipelines serve Dry Creek, Golden Dome, and Elk Basin fields fewer than 10 miles from the planned tests.

Coal

Coal occurs in the planning area. Several mines are active in the Powder River Resource Area where the most coal reserves are found. The Powder River Resource Area RMP/EIS (USDI, 1984b) contains the management decisions which guide the BLM's coal policy for this area.

Coal is also present in the Billings Resource Area. Historically, coal mining occurred in two areas: between Red Lodge and Bridger, and in the Bull Mountains. A small mine is active at present in the Bull Mountains. The Final EIS for the Bull Mountains Exchange was issued April 25, 1991. Within 5 years an underground coal mine may be started in the area of the exchange. There are no known plans for coal mines in the Red Lodge-Bridger area. A more detailed analysis of the probability of mining is included in the Billings Resource Area RMP/EIS (USDI, BLM, 1983).

Thin coal beds exist in the northwestern corner of South Dakota, but it is unlikely that this coal is of commercial value.

Mineral Materials

Several materials which are classified as saleable minerals are found in the planning area. These include sand and gravel, clinker, common clay, and common stone and materials not subject to regulation under the 1872 Mining Law. Under some circumstances they are available on public lands with a free use permit. Detailed descriptions of management practices regarding these commodities are given in the RMP/EISs being amended by this plan (USDI BLM, 1983, 1984b, 1985b).

Locatable Minerals

Locatable minerals are subject to provisions of the 1872 Mining Law. Metallic minerals such as vanadium, uranium, gold and silver, as well as gypsum and uncommon varieties of bentonite are found in the planning area. Mining claims have been located on all these minerals, and some development has occurred. Detailed descriptions of management practices for locatable minerals are given in the RMP/EISs being amended by this plan (USDI BLM, 1983, 1984b, 1985b).

HYDROLOGY

The planning area is drained by the Yellowstone and Missouri Rivers. Snowmelt and intense summer rainstorms which produce the largest percentage of the annual runoff are carried into the rivers by a network of tributaries. Groundwater in shallow aquifers is found in a variety of formations and ranges in quality from fresh to saline.

Surface Water

Runoff from the network of smaller tributaries in the Billings Resource Area drains into the Yellowstone and its tributaries: the Clarks Fork of the Yellowstone, Boulder, Stillwater, and Bighorn Rivers. The northern portion of the resource area is drained by the Musselshell River which flows into the Missouri River. Each major stream is characterized by a dendritic pattern of tributaries that range from ephemeral to perennial. The Yellowstone River, one of the longest free-flowing rivers in the United States, enters the Billings Resource Area near Springdale, Montana, and flows northeasterly across the Miles City District to its confluence with the Missouri River several miles east of the Montana-North Dakota border.

A high percentage of the annual runoff in the Billings Resource Area (Rioux and Dodge, 1980) occurs from March through June. Snowmelt, intense rainstorms and saturated or frozen soils are some factors contributing to high runoff during the spring. Severe thunderstorms in the summer months generally result in local flooding. These intense storms are significant because some soils in the resource area are extremely susceptible to erosion.

Lands in the Powder River Resource Area are drained by the Yellowstone and Missouri Rivers and their tributaries. Major tributaries of the Yellowstone include Rosebud, Otter, Armells, Hanging Woman and Mizpah Creeks, and the Tongue, Little Powder, and Powder Rivers. Major tributaries of the Missouri River are the Little Missouri River and Box Elder Creek.

High runoff usually results from snowmelt and intense summer storms. Streamflow decreases from July through early September because precipitation is low and moisture loss from soil and vegetation is high. Surface water is used primarily for stock watering and irrigation.

The South Dakota Resource Area is drained by tributaries of the Missouri River. The major tributaries include the Grand, Moreau, White, Belle Fourche, Cheyenne, Bad, and Little Missouri Rivers. Lands in the eastern third of the state are drained by the Red River of the North and its tributaries.

Runoff from the ephemeral and intermittent tributaries results from snowmelt and intense summer storms. Because many of these smaller tributaries are underlain by Pierre shale or other heavy clay soils, runoff from intense rainfall is rapid and often reaches flood stage within a single day. Water quality is variable due to the highly erratic discharge. Usually the water is of relatively poor quality.

There are no National Wild and Scenic rivers in the planning area. The following rivers/streams in the planning area are listed in the National Rivers Inventory (The National Rivers Inventory, NPS, USDI, January 1982) as potential wild and scenic river candidates: James, Little Minnesota, North Fork Whetstone, Big Sioux, Belle Fourche, Cheyenne, Missouri, White, French and Little Spearfish.

Ground Water

The Billings Resource Area is underlain by sandstones and limestones that provide large quantities of water to wells. Two primary aquifers are the Kootenai Formation in the northern portion of the resource area and the Madison Limestone in the south. In the Bull Mountains three shallow aquifers provide significant quantities of water to wells and springs. They are the Fox Hills-lower Hell Creek, Tullock, and Tongue River aquifers (USDI BLM, 1990a, p. 72).

In the Powder River Resource Area, shallow aquifer systems occur generally wherever members of the Fort Union, Hell Creek, or Fox Hills Formations are present. The Fox Hills-Hell Creek aquifer is the most extensive of the shallow aquifers. However, these formations have been eroded away in large parts of Treasure and Carter Counties. The Bearpaw and Pierre shales which are exposed in these counties have very low permeability and generally do not yield water wells. In much of the resource area the lack of adequate surface water quantities necessitates a heavy dependence on ground water. Wells are used primarily for domestic use and stock watering (MBMG, 1978). A smaller number of wells supplies municipal and irrigation needs.

The aquifers most commonly used in the Fort Union Formation are sandstone and coal beds. The sandstone beds are lenticular and generally do not extend more than a few miles, whereas coalbed aquifers are more aerially extensive. Wells average 200 feet in depth and provide adequate water for domestic and stock use. Alluvium in the major rivers is probably the most productive aquifer in the area; however, because of the limited areal extent of alluvial aquifers, they are rather minor producers of ground water (Slagle, 1983, 1986). In the Yellowstone Valley alluvium is used extensively for domestic purposes. The same is true for the Tongue River and Musselshell Valley but on a much smaller scale.

In most of the South Dakota Resource Area, shallow ground water is absent or scarce. Shallow ground water can be obtained from the Fox Hills, Hell Creek, and Fort Union Formations. The only public lands overlying these aquifers are in Harding and Perkins Counties. Small to moderate yields can be expected from the Fox Hills and Hell Creek at depths up to 250 feet. Water quality ranges from good to highly mineralized and is used for stock, domestic, and municipal supplies. The Fort Union supplies moderate amounts to farms and ranches from depths to 420 feet. The water is saline and has a high sodium sulfate content. Most of the water does not meet the criteria for domestic use, but is utilized because it is the only water available.

Water also can be obtained from shallow alluvial deposits located in the larger stream valleys throughout the resource area. Yields and water quality are highly variable. The quality ranges from good to highly mineralized, with most wells suitable only for stock use. High concentrations of sodium and sulfate are the principal deterrents for domestic use.

Water Quality

Water quality in the rivers and streams in the Billings Resource Area is generally good. Pollution problems are primarily non-point source which are related to agricultural practices. High sediment and salinity are the two most common forms of pollution. The BLM is also concerned about water quality in its man-made reservoirs which range from small livestock ponds to large irrigation, flood control, and wildlife reservoirs.

Water quality characteristics often are influenced by whether the water was contributed to the stream as surface runoff or as base flow. Water contributed as base flow has been in

contact with soil and rocks for long periods of time; therefore, it contains larger concentrations of dissolved solids than surface runoff water (Slagle, 1983 and 1986). Most streams exhibit an increase in dissolved solid concentrations downstream because of irrigation return flow, increased base flow contributions, and pollution from human activities.

HAZARDOUS MATERIALS

The Hazardous Materials program priorities are to protect the public health and safety; protect natural and environmental resources; and comply with applicable Federal and state laws and regulations, minimize future hazardous substance risks, costs, and liabilities on public lands.

It has been established by CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act of 1980) that the owner of the land is ultimately responsible for hazardous materials or substances placed or released on their lands. Under CERCLA the term "hazardous substance" is typically any toxic, corrosive, ignitable, explosive, or chemically reactive substance but does not include petroleum, crude oil, natural gas, natural gas liquids, liquified natural gas, or synthetic gas usable for fuel, or mixtures of natural gas and synthetic gas.

The oil and gas industry transports considerable quantities of hazardous materials on the highways, stores and uses the materials at the sites, and produces some hazardous wastes. This presents a high potential for spills, leakage, and illegal disposal. Reserve pits may be required to be lined; this reduces but does not eliminate leaks. District Office records indicate an average of 10 flowline ruptures per month. Approximately 95 percent of these ruptures are classified as minor events (fewer than 100 barrels lost) and usually are caused by freezing of corroded lines. Produced water is the predominant fluid but some hazardous substances also are released. The content of the releases or spills will be varied and unpredictable. At the present time, oil and gas field operations are excluded from hazardous materials regulations under the Resource Conservation and Recovery Act of 1976 (RCRA), but are covered under CERCLA or the Clean Water Act. Releases must be reported to the National Response Center the same as any release covered under CERCLA.

The BLM will coordinate with the Montana Department of Health and Environmental Sciences Solid and Hazardous Waste Bureau to determine if CERCLA hazardous substances reporting and disposal standards are being met and to monitor the level of risk to public health and safety, and the environment.

SOILS

The planning area's soils and prime farmland can be separated into four distinct soil units, based largely on geography. Data pertinent to these soil units is derived from the USDA Agriculture Handbook 296 (USDA SCS, 1981). The four units discussed are the Northern Intermountain Desertic Basin, the Northern Rocky Mountains and Foothills, the Northern Great Plains, and the Western Great Plains. Prime farmlands are also defined and briefly discussed.

Northern Intermountain Desertic Basin

This is a semidesert region which includes the northern Bighorn Basin in southcentral Montana (Figure 3.3, Map Area D). Elevations range from 3,600 to 5,900 feet. The dominant soils are typical of dry climates. They have low organic matter and are relatively pale in color. Soils in the area vary from young, undeveloped soils to well developed soils. The younger soils occur on steep slopes and over rock outcrops, varying in depth from shallow to deep. (See glossary for an explanation of Soil Depth Classes.) Textures vary from sandy to clayey. Typically, these soils are relatively dry most of the year.

The older, well developed soils occur mainly on more level slopes over sandstone and clay shale. The majority of these soils have clayey and loamy textures and are relatively dry most of the year. In addition, some are sodium-affected which limits the variety of vegetation that can grow on them. The depths of these soils generally are moderately deep to deep.

Northern Rocky Mountains and Foothills

The Beartooth and Pryor Mountains (Figure 3.3, Map Area E) are the dominant features of this region, but there are some broad valleys and remnants of high plateaus. Elevations range from 1,300 feet to more than 11,000 feet. At the higher altitudes, the dominant soils are relatively young, are shallow to moderately deep, and have mostly loamy textures. These soils are generally light in color. Some soils, however, contain volcanic ash which creates a finer texture and darker color. These soils are cool and moist most of the year. Rock outcrops occur on peaks and ridges above timberline.

In the foothills, dominant soils include both well-developed, older soils and less-developed, younger soils which form on eroded slopes and in alluvium. In the valleys, dominant soils are well-developed, well-drained, and deep to moderately deep. Soil textures vary from clayey to sandy.

A few of these soils are sodium affected; this limits their vegetative productivity. Textures are mostly loamy. Many of these soils support farming activities.

Northern Great Plains

Most of the soils and the dominantly smooth topography of the northcentral part of South Dakota, western North Dakota and northeastern and northcentral Montana (Figure 3.3, Map Area F) are favorable for agriculture. Elevations range from 1,300 to 4,600 feet. Soils in the area are primarily brown and black cool soils of high latitudes. In the eastern extent of this area, soils are well drained and receive moisture for a large part of the growing season. Some of these soils occur on glaciated plains where the dominant land uses are farming and ranching. Soils are well-developed, moderately deep to deep, and well-drained. Textures vary from clayey to sandy. These are productive soils for the most part, except in the depressions and low areas where some soils are sodium affected.

Western Great Plains

Central and southeastern Montana and the western half of South Dakota (Figure 3.3, Map Area G) are rolling uplands and prairie with some rugged, dissected areas also. Elevations range from 1,300 feet along the Missouri River bottom lands to 7,200 feet at Harney Peak in the Black Hills of South Dakota. Soils in this region exhibit the widest range of characteristics and productivity of all the soils in the planning area. This is related to the geologic variety of the plains region. The soils are underlain by clay shale, siltstone, soft sandstone, and locally thick alluvium. These soils range from pale, cool-climate soils to black, cold soils of high latitudes. Young soils have formed in the foothills and alluvial valleys. They generally have shallow soil profiles. Soil depths range from shallow to deep; textures vary from sandy to clayey. Many of these soils types support some type of ranching or farming activity. Most of the soils in the uplands support grassland vegetation.

Prime Farmland

Prime farmland includes those agricultural lands that are best suited to producing food, forage, feed, fiber, and oilseed crops. They have superior soil quality, good length of growing season and the moisture regime necessary to economically produce a sustained, high yield when these soils are managed properly. The prime farmland may consist of cultivated cropland, range, or woodland. It does not include built-up areas, urban or water areas. Most of the prime farmland occurs along stream and river valleys and terraces as well as gently sloping upland areas.

VEGETATION

Vegetative resource units cover geographic areas, usually several thousand acres in extent, that are characterized by a particular pattern of soils, climate, water resources, and land uses. The descriptions are based on information from many sources, mainly from the Agriculture Handbook 296 (USDA SCS, 1981).

There are four major vegetative resource units associated with soils in the planning area (Figure 3.3). They are described, as follows, using common names:

Northern Intermountain Desertic Basins

This region's natural vegetation is a shrub-grass association of the following: big sagebrush, garner saltbrush, rhizomatous wheatgrasses, Indian ricegrass, needleandthread, black sage, gardner saltbrush, and bluebunch wheatgrass.

Northern Rocky Mountains and Foothills

Natural vegetation consists of grass in the valleys and foothills, primarily bluebunch wheatgrass, rough fescue, Idaho fescue, and western wheatgrass. In higher elevations, ponderosa pine, Douglas fir, and subalpine fir are associated with alpine grasses and shrubs.

Northern Great Plains

The vegetation consists of prairie grasslands in the rolling prairie, and shrub grassland type in the draws. Principal species are bluebunch wheatgrass, needleandthread, western wheatgrass, green needlegrass, basin wildrye, and blue grama. Shallow or steep slopes support big bluestem and prairie sandreed while prairie cordgrass, northern reedgrass, and slim sedge are found on wetter sites. Western snowberry, stiff goldenrod, coneflower, and prairie rose are typical rolling prairie species, associated with buffaloberry and chokecherry in valleys and draws.

Western Great Plains

Natural vegetation in this region is quite varied due to the wide range in elevation and topography. The most common grass species are western wheatgrass, green needlegrass, needleandthread, little bluestem, blue grama, and sideoats grama. Various mid-and tall-grass species such as switchgrass, Indiangrass, big bluestem, prairie sandreed, little bluestem, sand lovegrass, and needleandthread are found in

the sandhills with prairie cordgrass, rushes, and sedge in wetter sites.

In most plains and prairie areas, big sagebrush, silver sagebrush, and prairie rose are common. Draws and north slopes support bur oak and quaking aspen, with Rocky Mountain juniper on drier slopes. High plains, tablelands, foothills and mountains support one or more of the following tree species: ponderosa pine, green ash, Black Hills spruce, eastern hophornbeam, American elm, paper birch, eastern redcedar, bur oak, quaking aspen, willow, and cottonwood.

Timber

There are approximately 158,421 acres of woodlands or forests in the planning area, consisting of 14,255 acres in the Billings Resource Area, 134,252 acres in the Powder River Resource Area, and 9,914 acres in the South Dakota Resource Area. These woodlands or forests are scattered throughout various elevations, growing on most types of soil and on varying slopes. They are managed for wildlife habitat and watershed, primarily; incidental forest products harvested are: Christmas trees, posts and poles, firewood, saw timber and pulp wood. These woodlands or forests are presently being managed on a "by request only" basis because of the small volume of forest products, the existing land pattern and the lack of public access. Advertised sale of commercial forest products would be the exception rather than the rule since timber harvesting is less than 150 thousand board feet per year in the planning area.

The commercial saw timber species present are listed in order of abundance and include ponderosa pine, Douglas fir, lodgepole pine, Engelmann spruce, and alpine fir. The stands of timber vary in age and size from young reproduction timber less than ten years old to fully mature or old saw timber that is 200 years old or more. Scattered throughout are other minor forest species of juniper and mixed hardwood trees.

Riparian-Wetland

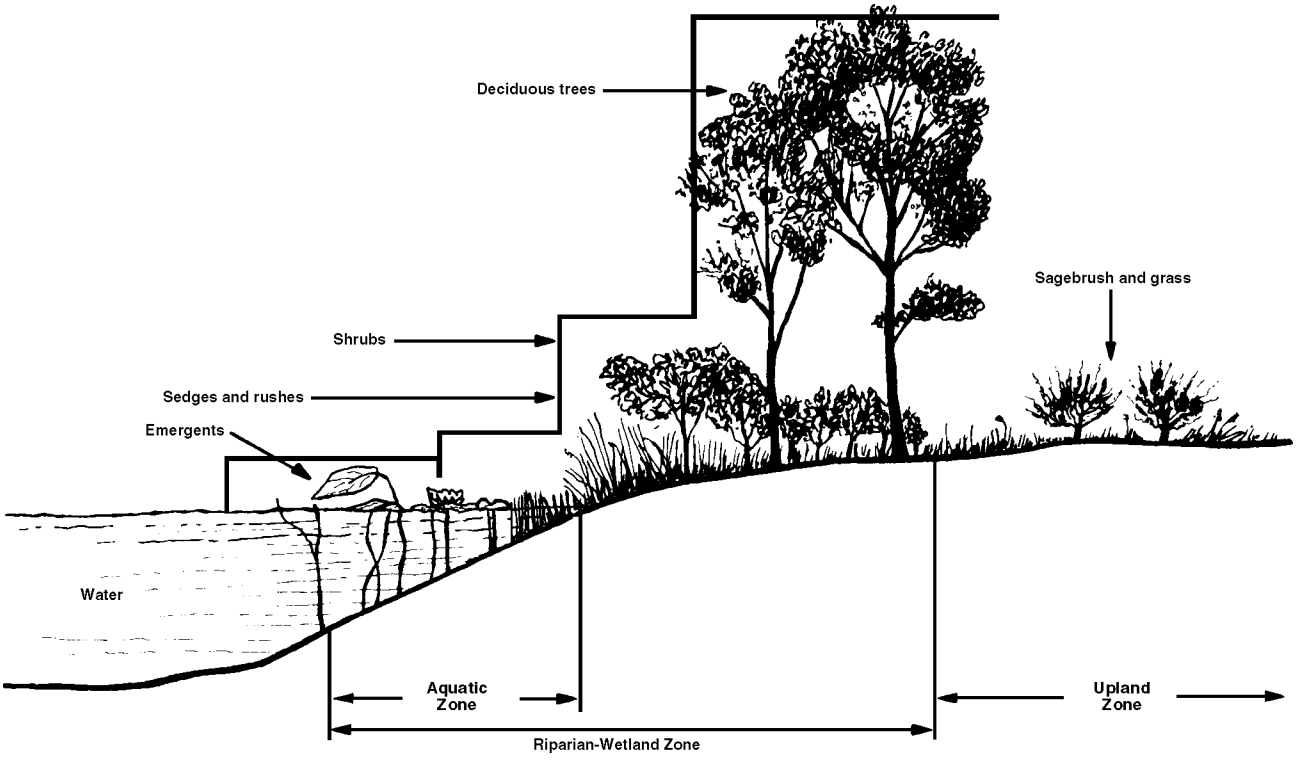
Riparian-wetland areas are among the most productive and important ecosystems, comprising approximately one percent of the public lands. Characteristically, riparian-wetland areas display a greater diversity of plant, fish, wildlife, and other animal species and vegetative structure than adjoining ecosystems. Some of the more common vegetative species that occur in riparian-wetland areas include prairie cordgrass, switchgrass, Canada wildrye, western wheatgrass, sedges, rushes, willow, chokecherry, buffaloberry, and plains cottonwood. Healthy riparian systems filter and purify water as it moves through the riparian-wetland zone, reduce sediment loads and enhance soil stability, provide micro-climate moderation when contrasted to temperature extremes in adjacent areas, and contribute to ground water recharge and base flow (USDI, BLM, 1987b).

In a Bureau policy statement (USDI, BLM 1987b), a riparian-wetland area is defined in this way: "It is an area of land directly influenced by permanent water. It has visible vegetation or physical characteristics reflective of permanent water influence. Lake shores and stream banks are typical riparian-wetland areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil." The riparian-wetland zone (Figure 3.4) occurs between the upland or terrestrial zone and the aquatic or deep water zone (Hansen and others, 1990, p. 6).

Abundant water, forage, and habitat attract a greater amount of use to a riparian-wetland area than its small area would indicate. Riparian-wetland areas are of prime importance to water quality and quantity, stream stability, and fisheries habitat.

Riparian-wetland areas are a small part of a larger area composed primarily of the rolling prairies of the Great Plains. The native vegetation of the region is largely short grass prairie typical of the western portion of the northern Great Plains. In localized areas trees, shrubs, and other vegetation types occur where topography, elevation, climate, or local water sources allow. In the planning area woodland vegetation is confined to stream courses or to other locations such as the mountains and foothills where combinations of soil and topography cause greater than average accumulation of moisture. There are 17 major riparian-wetland habitat types and 11 major riparian-wetland community types in the planning area. There also are numerous minor and incidental riparian-wetland habitat and community types in the planning area. All are important, even though their numbers are small and they occupy a small acreage on the landscape.

FIGURE 3.4 RIPARIAN-WETLAND ZONE
(modified from Thomas, Maser, and Rodiek, 1979)



The goal of the BLM in Montana and the Dakotas is to restore and maintain riparian-wetland areas so that 75 percent or more are in proper functioning condition by 1997. The Miles City District has an ongoing program of inventory and monitoring for the riparian-wetland areas based on a statewide classification system (Hansen and others, 1990). The district works with grazing permittees to develop best management practices for riparian-wetland resources encompassing grazing systems, site potential analysis, and rehabilitation needs. A cooperative management approach among permittees, private landowners, private industry, and other governmental agencies is being utilized to improve the riparian-wetland resources.

Noxious Weeds

Noxious weeds occur in scattered isolated populations throughout the planning area. The most common species of noxious weeds are leafy spurge, Russian knapweed, spotted knapweed, and Canadian thistle. Noxious weed control is the responsibility of the Surface Management Agency in cooperation with the local weed control board. Chemical and biological control methods are utilized with chemical control being the more predominant.

Threatened and Endangered Species

There are 29 plant species of special concern found in the Billings Resource Area, and 3 plant species of special concern found in the Powder River Resource Area as listed by the Montana Natural Heritage Program (Table 3.5). Figure 3.5 shows the township location of these plant species of special concern.

The South Dakota Resource Area has 3 species listed as shown in Table 3.6. Locations of these Threatened and Endangered or candidate plant species are not available.

LANDS AND LAND USES

There are 1,786,683 acres of public surface estate in the planning area. Federal oil and gas estate totals 4,670,219 acres. This amendment sets standards for the leasing of Federal oil and gas where impacts may occur to surface resources overlying the mineral estate. Federal ownership of oil and gas rights underlies public domain, acquired lands including Land Utilization (LU) lands, and Bankhead-Jones Act lands. Additional Federal oil and gas rights are part of a split estate ownership pattern where the surface is owned by private interests or local governments.

The BLM grants a variety of Land Use Authorizations. It is the Bureau's responsibility to protect surface uses when a Federally approved action is proposed. A Lease Notice (Appendix B), will be used as an informational attachment to some oil and gas leases issued in the planning area. It will alert the lessee to existing Land Use Authorizations within the lease boundary in order to prevent conflicts which might destroy or interfere with other surface uses. These include rights-of-way, leases, permits, conservation easements, and Recreation and Public Purpose leases and patents.

Acquisitions

Lands and specific rights acquired through exchanges, purchase or donation may be opened to entry under the public land laws, the mineral leasing and mining laws in accordance with the Federal Land Exchange Facilitation Act (FLEFA) and the Federal Land Policy and Management Act (FLPMA). If the oil and gas estate is acquired and a formal withdrawal has not been executed, the acquired land may be leased for oil and gas with appropriate lease terms and stipulations based on resource values, land uses, and topography.

Reconveyed Lands

Land may revert to Federal ownership under various statutes. The Recreation and Public Purposes Act allows for patents to revert due to noncompliance. The Carey Act allows grants to revert to the BLM if the land was not deeded by the State under the provisions of that Act. The Bankhead-Jones Act allows reversion of mineral ownership to the BLM. If the oil and gas rights are not leased, these rights come under BLM regulations immediately. If the oil and gas rights are leased at the time of reversion, the lease terms remain intact for the life of the lease.

The Federal Land Policy and Management Act (FLPMA) and the USDI Manual mandate review of lands withdrawn from various public land laws. The mineral or leasing laws reviewed determine whether the lands involved are still needed or used within the original intent of the withdrawal. These lands have the withdrawal extended, relinquished, or modified. The relinquished withdrawal lands revert to BLM ownership and jurisdiction. The lands which revert to BLM ownership may be leased for oil and gas activities with lease terms and appropriate stipulations. Where Bureau Of Reclamation withdrawal lands are within the Crow Ceded Area, minerals are and will remain under the jurisdiction of the BIA. BLM will receive the surface rights only.

A detailed description of other land actions concerning ownership patterns is given in the RMP/EISs which are being amended (USDI BLM, 1983, 1984, 1985). These actions include land exchanges, sales, and acquisitions.

TABLE 3.5 PLANT SPECIES OF SPECIAL CONCERN, BILLINGS AND POWDER RIVER RESOURCE AREAS

Botanical Name	Common Name	Status USF&WS	Status State
Astragalus aretioides	Sweetwater Milkvetch	—	WL
A. barrii	Barr's Milkvetch	C2	WL
A. chamaeleuce	Ground Milkvetch	—	T
A. grayi	Gray Milkvetch	—	S
A. oreganus	Wind River Milkvetch	—	S
Camissonia andina	Oscure Evening Primose	—	S
C. minor	Small Flowered Evening Primrose	—	S
C. scapoidea	Naked Stem Evening Primrose	—	S
Cleome lutea	Stink Clover	—	S
Conioselinum scopulorum	- - -	—	S
Cryptantha flavoculata	Miners' Candle	—	S
Delphinium geyeri	Geyer Larkspur	—	S
Erigeron allocatus	Bighorn Fleabane	3C	WL
Gilia inconspicua	Gilia	—	S
G. leptomeria	Bird's Eye	—	S
Grayia spinosa	Spiney Hopsage	—	S
Ipomopsis pumila	- - -	—	S
Leptodactylon caespitosum	Prickly Phlox	—	S
Linaria canadensis	Blue toadflax	—	S
Malacothrix torreyi	Desert Dandelion	—	S
Mentzellia pumila	Dwarf Mentzellia	—	S
Penstemon caryi	Cary's Beardtongue	3C	WL
Phacelia ivesiana	- - -	—	S
Quercus macrocarpa	Burr Oak	—	E
Shoshonea pulvinata	Shoshonia	C2	S
Stanleya tomentosa	Wooly Princes Plume	—	S
Streptanthella longirostris	- - -	—	S
Sullivantia hapemanii	- - -	3C	S
Townsendia incana	Hoary Townsendia	—	S
T. spathulata	Sword Townsendia	3C	S
Wyethia scabra	Rough Mules Ear	—	S
Xylorhiza glabriuscula	Woody Aster	—	S

EXPLANATION OF KEY CODES

C2 Candidate for Federal Listing
Notice of Review, Category 2 (some evidence of vulnerability, but not enough data to support listing at this time)

3C Taxa that have proven to be more abundant or widespread than was previously believed, or those that are not subject to any identifiable threat

E Endangered*
S Sensitive*
T Threatened*
WL Watch List*

*Montana Status: Lesica and Shelly (1991) placed plants (species, subspecies or varieties) in one of the above status categories based on degree of threat to the plant in Montana. There are no state laws that provide direct protection for these plants; thus, these categories are not official.

Source: Achuff, P. L., 1991 (modified)

TABLE 3.6 THREATENED, ENDANGERED OR CANDIDATE PLANT SPECIES, SOUTH DAKOTA RESOURCE AREA

Botanical Name	Common Name	Status Federal	Status State
Astragalus barrii	Barr's Milkvetch	C2*	—
Eriogonum visheri	Dakota Buckwheat	C2	—
Platanthera praeclara	Western Prairie Fringe Orchid	LT	—

EXPLANATION OF KEY CODES

LT Federal Threatened
C2 Candidate for Federal Listing

*List includes Federal candidate (C2) species which do not receive legal protection under the Federal Endangered Species Act. However, some of these species may receive protection under other state or Federal statutes.

Source: Ode, D. J., 1991 (modified)

Livestock Grazing

In the planning area covered in this amendment, a total of 1,556 allotments covers 1,744,031 acres of Federal lands. These allotments are used to graze cattle, sheep and horses. The main class of livestock using public lands is cattle.

Authorized livestock use on the grazing allotments totals 350,143 Animal Unit Months which include active-use, non-use, and exchange-of-use options. Most allotments involve only one permittee; however, there are several multi-permittee allotments. The permittee leases only the privilege to graze livestock on the allotment. There are no other rights or control of public lands granted by issuance of a grazing permit.

The length of grazing periods varies from seasonal to yearlong use. Most ranch operators using the allotments are cow-calf operations. The majority of allotments include a mix of private and public lands. Most allotments are predominantly private lands with scattered 40-80 acre tracts of Federal lands. Occasionally a few larger blocks of 640 acres or more of Federal lands are encountered.

Most allotments have several range improvements such as fences, stock ponds, pipelines, springs, windmills, seedings, wells, and access roads for better control of livestock for management purposes.

Cropland

Semidesert: This semidesert region includes the northern Bighorn Basin in southcentral Montana and includes approximately 10 percent of the planning area. More than half of this area is Federally owned. The remainder is farms and ranches. Most of the land is used for grazing. The range consists of desert shrubs and short grasses. About five percent of the area is irrigated where soils are conducive to irrigation. Most of the acreage is planted to alfalfa and other feed crops, but dry beans, malt barleys, sugar beets, and corn are important cash crops. Much of the area also provides habitat for some wildlife species.

Prairie plains: This region known as the prairie plains represents approximately 40 percent of the planning area. Most of the soils, combined with the predominantly smooth topography of the northcentral part of South Dakota, western North Dakota and northeastern and northcentral Montana, are favorable for agriculture. This area is dominated by farms and ranches. Many of the areas along the rivers and major tributaries are irrigated for feed grains, corn, silage, alfalfa and grass hay, sugar beets and tame pasture. Some of the upland areas are dry farmed to small grains while most of the sloping upland areas are used for livestock grazing. Much of this terrain also provides habitat for various wildlife species.

Rolling Uplands: This region also represents approximately 40 percent of the planning area. The central and southeastern portions of Montana, along with the western half of South Dakota, are rolling uplands and prairie with some rugged, dissected areas as well. Farms and ranches are predominant. Some of the land adjacent to the rivers and major tributaries is irrigated for wheat, feed grains, alfalfa, grass hay, sugar beets and tame pasture. However, the majority of the area is used for grazing livestock. The higher elevations provide wildlife habitat, recreation, watershed, some timber harvesting, and some mining activity.

Mountains and Foothills: The Beartooth and Pryor Mountains are the dominant feature of this region, but there are some broad valleys and remnants of high plateaus. This region represents approximately 10 percent of the planning area. A large portion of this area also is Federally owned. Some of the privately owned land is controlled by timber companies and some by cattle ranches and farms. All of the forested areas are used as wildlife habitat, for recreation and watershed, and for timber production. Meadows on the upper mountain slopes and crests above timberline provide summer grazing for livestock and big game animals. Some forage, grain, and peas are grown in the higher valleys.

In the lower foothills, half or more of the area is range land used for grazing because it has short and mid grasses and some shrubs. Many of these lower valleys are irrigated. Grain and forage for livestock are the main crops, but potatoes, sugar beets, and peas grow in the warmer valleys. Some of the area is used for dry land wheat farming.

Split Estate

Nearly two-thirds of the Federal oil and gas lands in the planning area are part of the split estate land pattern. These are lands where the surface ownership is different from the mineral ownership (Table 1.2). Management of Federal oil and gas resources on these lands is somewhat different from management on lands where both surface and mineral ownership are Federal. On split estate lands where the surface ownership is private, the BLM places necessary restrictions and requirements on permitted activities and works in cooperation with the surface owner. The BLM has established policies for the management of Federal oil and gas resources under the following statutes:

- The Federal Land Policy and Management Act (FLPMA)
- The National Environmental Policy Act (NEPA)
- The National Historic Preservation Act (NHPA)
- The Endangered Species Act (ESA)

The BLM does not have the legal authority to regulate how private surface is managed by the surface owner. BLM does have the statutory authority to require measures by its lessees to avoid or minimize adverse impacts that may result from Federally-authorized mineral lease activities. These measures, in the form of lease stipulations or permit conditions of approval, are intended to protect or preserve the privately-owned resources and prevent adverse impacts to adjoining lands, not to dictate management to the surface owner.

The term split estate also refers to lands where the surface ownership is Federal and the mineral ownership is private. In this situation, the BLM is the surface owner and works in cooperation with the applicant and the state regulatory agency approving fee mineral applications. The BLM has responsibilities in this situation under its statutes; however, it does not have the authority to approve or disapprove the mineral owner's actions. Through either a reserved or an outstanding right contained in the deed, the mineral estate owner usually has the right to enter the land and use the amount of surface area that is necessary and reasonable for mineral development.

The four statutes listed above provide BLM with the authority and responsibility to impose constraints on Federal oil and gas lessees and operators. The constraints are lease stipulations, lease terms, and conditions of approval which are in accordance with Federal laws and regulations. Use of these mitigating measures allows for the management of Federal oil and gas resources while protecting other resources and land uses.

Pryor Mountain Wild Horse Range

The Pryor Mountain Wild Horse Range (PMWHR) is located in the southeastern portion of Carbon County, Montana, and extends into the northern portion of Big Horn County, Wyoming (USDI BLM, 1984a). The horse range is bordered on the west by the Custer National Forest and the Crooked Creek Natural Area, on the north by private lands, and on the east by the Bighorn Canyon National Recreation Area. The city of Lovell, Wyoming, is approximately 13 miles due south. The horse range is in the Billings Resource Area.

The horse range varies in elevation from 3,900 feet to 8,000 feet. The area is characterized by deep, steep-walled canyons, isolated grassy plateaus, and foothills (USDI BLM, 1984a). Vegetation is varied in density and composition. Changes in elevation and topography which influence soil development and the availability of water produce a variety of vegetative associations. Most of the horse range has young fragile soils which are susceptible to erosion. High intensity summer storms have caused considerable erosion in the lower elevations of the horse range. Water is available from two permanent streams, three springs, and several manmade catchments and reservoirs.

The horse range is currently managed for 121 head of wild horses. The number varies with the carrying capacity of the range. The horses may have Spanish bloodlines. It is an isolated herd which draws a great deal of attention from local and national groups interested in the preservation of wild horse herds. There is some competition for habitat with other large animals on the range.

Varieties of other resources exist within and adjacent to the boundaries of the horse range (USDI BLM, 1984a). Big game species, upland game birds, numerous small non-game mammals, birds, and reptiles share the diverse habitats found within the area. Cultural resource sites have been inventoried there. Recreation opportunities are available, with many users coming from the nearby BigHorn National Recreation Area.

Mineral materials and locatable minerals occur in the area. Sand and gravel are found in the ephemeral streams. Uranium and vanadium mineralization is mostly confined to the limestone caverns on Red Pryor Mountain and on Burnt Timber Ridge. There are no known leasable minerals on the horse range. Oil and gas occurrence and development potential are rated as low due to a lack of test wells within the horse range.

The PMWHR was created by Order of the Secretary of the Interior, Stewart L. Udall, on September 9, 1968. It was the first such designation in the United States. The area is administered primarily for the protection and management of wild horses, wildlife, recreation, watershed, and archeological and scenic values. Management of the wild horses is part of a balanced program which considers all public values without impairment to the productivity of the land. The 1984 Pryor Mountain Wild Horse Range Herd Management Area Plan sets management goals for the area.

The original 1968 designation included approximately 32,000 acres. At the present time, rangeland available for wild horse use consists of approximately 35,000 acres with more than 6,000 acres extending into Wyoming. An estimated 20,000 acres of the horse range lie within three WSAs: Burnt Timber Canyon, Pryor Mountain, and Big Horn Tack-on. All of these WSAs are recommended for wilderness designations.

Fort Meade Recreation Area

The Fort Meade Recreation Area contains 6,629 acres and is unique as well as notable for its place in western history. This high intensity use area is a mix of forest and midgrass prairie on the eastern foothills of the Black Hills, adjacent to Sturgis, South Dakota. The area's proximity to population centers makes it highly visible and accessible to a wide variety of users. The area currently is being intensively managed for wildlife, cultural resources, grazing, forestry and a variety of recreational uses under the multiple use management concept.

The area originated in December 1878, when approximately 7,000 acres were declared a Military Reservation and named after Major General George G. Meade. Fort Meade remained a Military Installation until 1944 when jurisdiction was transferred to the Veterans Administration.

In 1954 and 1955, 3,500 acres were transferred to the United States Department of the Interior, Bureau of Land Management. In 1960, Public Land Order 2112 transferred jurisdiction of an additional 3,200 acres to the Bureau of Land Management. In addition, this Land Order withdrew the acres and dedicated the land for the "conservation of natural resources, including wildlife and recreation resources and the protection of wildlife habitat".

In 1980, the Fort Meade Recreation Management Plan specifically set out the following guideline: "The Fort Meade Management Area will be managed to protect, preserve and enhance the values found within the unit. The cultural and wildlife values are recognized as the most important elements of the resource. Therefore, the management of the other resources and recreational activities will be carried out with minimal intrusions and impacts on these leading resource elements".

Meeteetse Spires Proposed ACEC

The proposed Meeteetse Spires Area of Critical Environmental Concern (ACEC) is located entirely on BLM land at the base of the eastern slopes of the Beartooth Mountains, approximately five miles south of the town of Red Lodge. It consists of approximately 960 acres and is located in the following sections:

T. 8 S., R. 20 E., MPM
Section 23, W1/2NE1/4, NE1/4NW1/4, N1/2SE1/4, SE1/4SE1/4
Section 26, N1/2, SE1/4
Section 35, E1/2NE1/4, SE1/4

In early 1989, The Nature Conservancy (TNC) approached the BLM concerning the possible establishment of a natural preserve south of Red Lodge, Montana. The area contains two rare plants, *Shoshonea pulvinata* and *Townsendia spathulata*. The BLM has agreed to participate with TNC in the designation and management of the Meeteetse Spires ACEC in order to protect these rare plants (Appendix E). The ACEC and the rare plants are located within the western boundary of the proposed TNC preserve.

Shoshonea pulvinata is a member of the carrot family. It is found only in Carbon County Montana and northwest Wyoming. It grows in open, windswept limestone outcrops, ridgetops, and canyon rims in thin rocky soils. Flowering is in late June and July. These Shoshonea populations do not appear to be threatened by livestock grazing at the present time. Grazing use will continue to be monitored.

Townsendia spathulata, a member of the sunflower family, is considered rare in Montana. Although it usually grows near the tops of pinnacles at the higher elevations, it also thrives in the open, rocky, limestone-derived soils on the slopes and ridgetops in the valley and foothills zones. It blooms in May and early June, and is locally common in the Big Horn Canyon, the Pryor Mountains, and the Beartooth Mountains.

There are two oil and gas leases throughout the three sections of the proposed ACEC. They are ten year leases and do not expire until 1995 and 1996. This area is considered to have moderate potential for oil and gas development.

No new oil and gas leases will be issued within the boundaries of the ACEC when the present leases expire. The BLM will take the initiative to work with the current oil and gas lease holders in an effort to preserve the esthetic values of the Meeteetse Spires.

The areas adjacent to the proposed ACEC do not qualify as a commercial forest and will not be harvested as such. Selective timber harvests may be necessary periodically to protect the areas's overall resource values. Recreational and Christmas tree cutting will be prohibited in the areas adjacent to and within the ACEC.

Weatherman Draw Proposed ACEC

The Weatherman Draw Rock Art Complex is on the divide with Jack Creek to the north and Cottonwood Creek to the south. The area is characterized by rugged exposures of Eagle Formation Sandstone. Rock art panels composing the complex are closely associated with the intermittent Weatherman Draw drainage (Appendix E).

The surface geology of the area consists of Eagle sandstone, other sandstones, and shales. The formations dip to the southwest and a fault bisects Weatherman Draw itself. Erosion of the area has produced canyon topography with numerous vertical sandstone exposures.

Energy minerals include coal and the potential for oil and gas. The area is the southernmost extension of the Bridger coal beds. A four-foot seam with gypsum inclusions in the area was developed as a marginal mine, but this mine does not appear to have been worked since World War II. Oil and gas exploration in the area was conducted using shallow wells during the 1930s and 1940s. Current interest in industrial minerals exists in this area.

Most of the affected environment exhibits rapid runoff and severe erosion. This is enhanced in the Weatherman Draw area by the precipitation pattern. Also of significance was the use of the area for sheep grazing until 1962. Erosion is prevalent over the entire area and is quite severe in many places due to sparseness of vegetation, unstable soils, and steep slopes. Active head-cutting and bank sloughing are present in all drainages.

The primary drainage, Cottonwood Creek, is intermittent as is Weatherman Draw. A spring located outside the proposed ACEC is the only live water supply. It is used primarily for grazing and wildlife purposes. Some guzzler type range developments are planned to enhance natural water sources for livestock and wildlife species. No true wetlands are present. The floodplain of Cottonwood Creek occupies an extremely small area. No threatened and endangered plants are known to exist within the proposed ACEC.

The principal use of the area is for grazing. It occupies a portion of Pasture 3 of the Cottonwood Allotment (#5213). Grazing management is on a rest rotation schedule during which time cattle graze from May to late July of the first year, late July to the end of October of the second year, and no grazing takes place on the third year.

The only big game animal within the proposed ACEC is the mule deer. Upland game birds present include sage grouse, chukar, and Hungarian partridge. The area receives moderate hunting pressure, and wildlife water developments are planned to enhance the game bird population. Fur-bearers present include bobcat and lynx. The area has excellent potential habitat for mountain lion. Trapping and hunting of these species do occur. The Weatherman Draw area has no waterfowl habitat or fisheries.

Raptors within the Weatherman Draw area include red-tailed hawks and prairie falcon. Great horned owls may nest in the area. A large dove population nesting along cliffs offers a potential for peregrine falcon habitat. This habitat potential is unrealized because of the low amount of standing water in the area. An inventory for threatened and endangered animal species is on-going, but currently there are none known.

The knowledge of cultural resource properties and their distribution within the Weatherman Draw area has slowly accumulated over the last two decades. Through 1986 a total of ten sites had been recorded in the area, nine by avocational archeologists. The unknown potential for additional sites led to a 1987 inventory implemented through cooperative agreement with the University of North Dakota. A total of 1,320 acres in the immediate Weatherman Draw area was closely examined and a total of 44 new sites recorded, 23 of them rock art sites.

Among the sites recorded in 1987 was the Valley of the Shields site complex, 24YL1094. More than 50 individual panel areas are present within the complex and nearly the full range of artistic styles of the region is represented. The primary artistic style represented, however, consists of variations on the shield-bearing warrior motif. The use of abrasion to prepare a surface, followed by painting of detailed shield designs, is a site characteristic. Test excavations below one half-buried panel revealed two abrading stones, one which retained paint, associated with a buried hearth. Radio-carbon dating has proven earlier estimates as to the age of this art to be incorrect; the art dates to approximately A.D. 1105, two centuries earlier than previously thought. The excavations also yielded horse dung, dated A.D. 1650, eighty years previous to the earlier hypothesis. Other sites recorded in 1987 have similar information potential.

In order to assess the spacial distribution of the Weatherman Draw Rock Art Complex, a Class II sample inventory was conducted under service contract in 1988. A grid of 40 and 80 acre sample tracts was placed over the area of maximum sandstone exposure. Both public domain and split estate lands with Federal minerals were used to define the 1,320 acre sample area. Twenty-two new cultural properties were recorded, 19 of which had rock art present. The survey demonstrated that the Weatherman Draw Complex was closely associated with the drainage, and identified a second, smaller complex on split estate lands to the north.

Additional inventory has been conducted in the area for compliance with section 106 of the National Historic Preservation Act for proposed range and wildlife improvements. Through such examinations, a total of 260 acres in the Weatherman Draw vicinity has been made and six sites recorded. One rock art site was recorded as part of this set of inventories.

Consequently, the present inventory base of the Weatherman Draw area is 2,800 acres. A total of 72 cultural properties have been recorded. Of these, 46 sites consist of rock art. A satellite area of rock art sites exists on largely split estate lands near the mouth of Castle Coulee to the north, but 40 rock art sites, 14 open occupation sites, a rock shelter, and a vision quest site can be described within a spatially bounded area. Within this general area, some lands have been examined which yielded no significant properties. Other areas have not been inventoried, but share environmental attributes similar to those lands which yielded important cultural properties. The two sets together comprise the area proposed for ACEC designation.

WILDLIFE HABITAT

Public lands are a major source of wildlife habitat in the planning area. These lands, which are usually in a natural or semi-natural state, provide a wide diversity of habitat essential to wildlife for food and cover.

Several major vegetative habitat types on public lands support a wide variety of wildlife species. These habitat types include grassland, shrub-grassland, sagebrush, conifer overstory, woodland, upland shrub, and riparian-wetlands. A variety of subtypes develops where the major types grade into each other. Additionally, special habitat features such as cliffs, snags, springs, natural potholes, reservoirs, lakes, and islands are present in the planning area. Maintenance of these habitat features is critical to the continued existence of diverse, viable wildlife populations. Agricultural land often provides a significant additional habitat type that does not occur to any great extent on public lands, but is often adjacent to them. Grassland habitat is found primarily on the flats, on gently rolling hills above drainages, and in open areas within pine forests and sagebrush stands. Some of the most common grasses that occur in this habitat type include western wheatgrass, blue grama, needleandthread, and green needlegrass.

Shrub-grassland habitat is transitional between grassland and sagebrush types. It usually consists of open or patchy shrub stands with grass dominating the open spaces. Plant species are typical of both grassland and sagebrush types.

Sagebrush habitat consists of areas where sagebrush species comprise most of the canopy cover. The two major sagebrush species in the planning area are big sagebrush and silver sagebrush. Big sagebrush occurs mainly on upland benches, while silver sagebrush occurs mainly in mesic bottoms.

Upland shrub habitat is characterized by a variety of shrubs. Rose, snowberry, skunkbush sumac, greasewood, plum, chokecherry, and buffaloberry are some of the dominant shrubs in this habitat type. The most common landform association for upland shrubs is the drier drainage bottoms, usually in the upper reaches of watersheds.

Conifer overstory habitat consists of areas where the canopy ranges from thick forest to extremely sparse savannah-like coverage. The most common landforms for this habitat type include moderately steep north and northwest slopes and the breaks topography along the edges of plateaus.

Riparian-wetland habitat in Montana is characterized by the presence of one or more species of cottonwood, willow, boxelder, or green ash. A variety of other woody shrubs, grasses, and forbs species is associated with these trees. This habitat type is usually found along creeks and rivers and along shores of small lakes and reservoirs.

In South Dakota riparian-wetland habitat is characterized by the presence of one or more species of hardwood trees. Commonly found trees include cottonwood, American elm, green ash, willows, and bur oak and associated woody shrub species. In most instances, riparian-wetland habitat types are found in conjunction with stream or river bottoms.

Big Game Species

Elk: A small, isolated elk herd occurs in the Bull Mountains. Herds located in the Snowy and Beartooth Mountains sometimes winter and calve on public lands. Approximately 160,000 acres of elk winter range, of which 1,500 acres is BLM surface have been identified in the Billings Resource Area. In extreme winters elk move down from their historic winter range in the Beartooth Mountains near Red Lodge onto public lands located southwest of Belfry, Montana. There are also several small herds located in the Powder River Resource Area.

Mule Deer: This is the most widely distributed and abundant big game species in the planning area, and occupies the greatest variety of habitat types. In the spring mule deer feed extensively on succulent green grasses until forbs become available. They use forbs, supplemented by some browse, throughout the summer. In the fall, winter, and early spring, browse is utilized heavily. To maintain mule deer populations, protective cover is important. During severe winters, private agricultural lands play an important role in the maintenance of certain populations. Although mule deer occur throughout the planning area they are more abundant in the open shrub-grassland habitats adjacent to timbered or broken terrain. Habitat such as riparian bottoms, agricultural areas, and forests are utilized as well, either year long or seasonally.

White-tailed Deer: These deer are most abundant along the bottomlands of major waterways in the planning area. Whitetails also are found in riparian-wetland zones along lesser drainages and have moved into some of the timbered breaks and mountainous areas. Whitetails appear to be more dependent on sources of water than are mule deer (USDA SCS, 1973), frequently drinking from ponds, streams, springs, and reservoirs. An isolated population is found in the Long Pines area of southeastern Montana. Winter concentration areas occur almost exclusively in riparian-wetland habitats and in dense pine (Youmans, 1982). White-tailed deer tend to remain in one particular area and do not migrate in the winter (Hamlin, 1978).

Rocky Mountain Bighorn Sheep: Two locations within the planning area have Rocky Mountain Bighorn Sheep: the Pryor Mountains south of Billings, Montana, and the Powder River Herd near Miles City, Montana. The Pryor Mountain herd is estimated at 100 individuals (BLM Observation Reports). Grasses and forbs provide the major portion of their yearlong diet which is supplemented with browse types such as curlleaf mountain mahogany and sagebrush (USDI FWS, 1978). Little information is currently available on the migratory routes of this herd.

The Powder River Herd consists of approximately 65 bighorn sheep. Bighorns use forbs, shrubs, and grasses during all seasons. They are vulnerable to competition from elk, deer, and livestock (Couey and Schallenberger, 1971) where their ranges overlap. There is also little information about the migratory routes of this herd.

Antelope: These are abundant throughout most of the open, rolling grassland and sagebrush habitat found in eastern Montana and western South Dakota. Browse, primarily sagebrush, constitutes a very large portion of yearlong forage but is used most heavily during the fall and winter seasons. Seasonal forbs are used through the summer and early fall (USDI FWS, 1978). Crucial winter habitat includes sagebrush and shrubs 12 to 24 inches high, especially during periods of heavy snow cover. Vegetative cover is also necessary for fawning as it protects the young from predators and late winter storms (Autenrieth, 1978). Habitat with 20 percent sagebrush canopy cover, generally located in a basinal topography, adequately meets this particular need (USDI FWS, 1978).

Upland Game Birds

Sharp-tailed grouse: They are widely distributed in the planning area and are generally found in the grassland, shrub-grassland, and woodland vegetation areas. The breeding and nesting period from March to June is the most critical period in the life cycle of sharptails. The breeding male grouse attracts females to traditional breeding grounds, or leks, and performs a magnificent display of dancing and calling. Females nest and raise their broods in the grassy uplands, usually within 1 mile of mating grounds.

Sharptail habitat includes hills, benchlands, and other areas of rolling topography which have good stands of residual cover composed chiefly of grasses for roosting, feeding, and nesting. Dancing grounds, or leks, are usually flat areas on elevated knolls or benches. The dancing or mating sites are nearly bare of vegetation, although brushy cover is nearby for feeding and escape.

Limiting factors for sharptails are intensive and extensive farming and heavy grazing. Studies in southwestern North Dakota have shown that more than 90 percent of the nest sites were in residual vegetation over 6 inches high, and 70 percent of brood locations were in vegetation over 9 inches high (Kohn, 1976). Habitat preferences in this planning area are similar.

Sage Grouse: They are the most widely distributed and abundant game bird species on public lands. Their primary habitat is sagebrush communities in shrub-grassland and shrub vegetation types. Food and cover are provided in areas having at least 15 percent canopy of sagebrush.

Sage grouse are extremely specific in their habitat requirements, depending primarily on sagebrush for their diet. They eat only soft material because of their lack of a muscular gizzard (Patterson, 1952). The winter diet of sage grouse is almost exclusively sagebrush. They move in winter to occupy high density sagebrush areas.

Similar to the sharptails, sage grouse move to traditional breeding grounds in the spring. Several areas with high concentrations of strutting grounds are located in portions of the planning area. Nesting habitat is located under sagebrush, usually within 2 miles of mating grounds (Wallestad and Pyrah, 1974; Martin, 1970; Gill, 1965).

Raptors

Many of the raptors occurring in the planning area have been identified by the States of Montana and South Dakota as species of "special interest or concern" (Flath, 1991 and Houtcooper and others, 1985). Those listed by the states include the ferruginous hawk, osprey, Cooper's hawk, northern goshawk, golden eagle, merlin, prairie falcon, burrowing owl, flammulated owl, great grey owl, and Boreal owl. The endangered bald eagle and peregrine falcon, also listed by Montana, are discussed in the section on threatened and endangered species. The states are concerned about many species within this group because of their vulnerability to outside influence (USDI, BLM, 1987a).

Waterfowl

The planning area is within the Central Flyway which has important migration corridors that pass through it. Lands in the planning area also fall within the Prairie Pothole Joint Venture (PPJV) established through the North American Waterfowl Management Plan. The PPJV is thought to contain the most important duck breeding habitat in North America. Many spring runoff ponds in the planning area provide important habitat for nesting waterfowl. The major rivers and stockponds provide important habitat for resident ducks and nesting areas for migrants. A large variety of ducks, geese, and shorebirds use riparian-wetland habitats within the planning area for both nesting and migration stopovers. Common species include the mallard, pintail, gadwall, blue-winged teal, common merganser, Canada goose, killdeer, and avocet. Species identified as being of "special interest or concern" by Montana (Flath, 1991) are the mountain plover, American golden plover, ruddy turnstone, knot, dunlin, short-billed dowitcher, semipalmated sandpiper, western sandpiper, sanderling, and black-necked stilt. The whooping crane is discussed in the section on threatened and endangered species.

The Yellowstone and Clarks Fork drainages are used heavily for nesting by Canada geese and some species of ducks. Nesting occurs mostly on established islands and brushy riparian-wetland areas where abundant cover provides protection from predators.

Fisheries

Fisheries within the area include rivers, lakes, stock ponds, and streams. The primary game fish found in the major drainages are rainbow trout, brown trout, mountain whitefish, sauger, ling, walleye, channel catfish, black crappie, small-mouthed bass, white crappie, yellow perch, northern pike, and sturgeon. The smaller, cool water tributaries support populations of brook and cutthroat trout. Several stockponds and reservoirs throughout the planning area have been stocked with northern pike, largemouth bass, perch, walleye, bluegills, and trout. The most abundant nongame fish include longnose dace, mountain sucker, longnose sucker, mottled sculpin, stonecat, short-headed redhorse, river carpsucker, flathead chub, black bullhead, goldeye, smallmouth buffalo, carp, lake chub, plains minnow, silvery minnow, and fathead minnow (Brown, 1971).

Threatened And Endangered Species

The planning area has historical and potential habitat for several species of wildlife that are classified as threatened or endangered by the USFWS. The black-footed ferret, bald eagle, peregrine falcon, interior least tern, piping plover, whooping crane, Eskimo curlew, and pallid sturgeon are on the Federal Threatened and Endangered Wildlife Species list (Tables 3.7 and 3.8).

TABLE 3.7 THREATENED, ENDANGERED OR CANDIDATE ANIMAL SPECIES, BILLINGS AND POWDER RIVER RESOURCE AREAS

Scientific Name	Common Name	Status	
		Federal	State
Buteo regalis	Ferruginous hawk	C2	C2
B. swainsoni	Swainson's hawk	3C	3C
Charadrius melodus	Piping plover	T	T
C. montanus	Mountain plover	C2	C2
Falco peregrinus	Peregrine falcon	E	E
Grus americana	Whooping crane	E	E
Haliaeetus leucocephalus	Bald eagle	E	E
Numenius americanus	Long-billed curlew	C2	C2
Sterna antillarum athalassos	Interior least tern	E	E
Euderma maculatum	Spotted bat	C2	C2
Felis lynx canadensis	North American lynx	C2	C2
Gulo gulo luscus	North American wolverine	C2	C2
Mustela nigripes	Black-footed ferret	E	E
Sorex preblei	Preble's shrew	C2	C2
Ursus horribilis	Grizzly bear	T	T
Vulpes velox	Swift fox	C2	C2
Cycleptus elongatus	Blue sucker	C2	C2
Hybopsis gelida	Sturgeon chub	C2	C2
Polyodon spathula	Paddlefish	C2	3C
Scaphirhynchus albus	Pallid sturgeon	E	E

EXPLANATION OF KEY CODES

C2 Notice of review, Category 2, (some evidence of vulnerability, but not enough data to support listing at this time)
3C Taxa that have proven more abundant or widespread than previously believed, or those not subject to any identifiable threat

E Endangered
T Threatened

Source: USF&WS, 1989, Internal report: Helena, Montana (modified)

TABLE 3.8 THREATENED, ENDANGERED OR CANDIDATE ANIMAL SPECIES, SOUTH DAKOTA RESOURCE AREA

Scientific Name	Common Name	Status	
		Federal	State
Buteo regalis	Ferruginous hawk	C2	—
Charadrius melodus	Piping plover	LT	ST
C. montanus	Mountain plover	C2	—
Falco peregrinus	Peregrine falcon	LE	SE
Grus americana	Whooping crane	LE	SE
Haliaeetus leucocephalus	Bald eagle	LE	SE
Lanius ludovicianus migrans	Migrant loggerhead shrike	C2	—
Numenius americanus	Long-billed curlew	C2	—
N. borealis	Eskimo curlew	LE	—
Pandion haliaetus	Osprey	—	ST
Plegadis chichi	White-faced ibis	C2	—
Sterna antillarum athalassos	Interior least tern	LE	SE
Felis concolor	Mountain lion	—	ST
F. lynx canadensis	North American Lynx	C2	—
Lutra canadensis	River otter	—	ST
Mustela nigripes	Black-footed ferret	LE	SE
Ursus americanus	Black bear	—	ST
Vulpes velox	Swift fox	C2	ST
Acipenser fulvescens	Lake sturgeon	C2	—
Catostomus catostomus	Longnose sucker	—	ST
Cycleptus elongatus	Blue sucker	C2	—
Fundulus diaphanus	Banded killifish	—	SE
F. sciadicus	Plains topminnow	—	ST
Hybopsis gelida	Sturgeon chub	C2	ST
H. meeki	Sicklefin chub	C2	ST
Percopsis omiscomaycus	Trout-perch	—	ST
Phoxinus eos	Northern redbelly dace	—	ST
P. neogaeus	Finescale dace	—	ST
Polyodon spathula	Paddlefish	C2	—
Scaphirhynchus albus	Pallid sturgeon	LE	SE
Semotilus margarita	Pearl dace	—	SE
Umbra limi	Central mudminnow	—	SE
Emydoidea blandingii	Blanding's turtle	—	ST
Graptemys pseudogeographica	False map turtle	—	ST
Heterodon platirhinos	Eastern hognose snake	—	ST
Storeria occipitomaculata o.	Northern redbelly snake	—	ST
Tropidoclonion lineatum	Lined snake	—	ST

EXPLANATION OF KEY CODES

LE Federal Endangered
LT Federal Threatened
C2 Candidate for Federal Listing
SE State Endangered
ST State Threatened

Source: Ode, D. J., 1991 (modified)

BLACK-FOOTED FERRET

Black-footed ferrets have not been observed since periodic searches were begun in recent years. Ferrets are essentially obligate species in that their existence is closely tied to the occurrence of prairie dog colonies. Prairie dogs play an important role in the grassland ecosystem by creating islands of unique habitat. They provide a source of food for numerous predators and their burrows provide homes for a variety of species including burrowing owls and black-footed ferrets. The prairie dog colonies that occur in the area could provide habitat for ferrets. The BLM is participating in the USFWS's Black-Footed Ferret Recovery Program. Several potential reintroduction sites have been identified for black-footed ferret in the Powder River Resource Area.

BALD EAGLE

Bald eagles migrate through the area and winter along the Yellowstone, Clarks Fork, Tongue, Little Missouri, Belle Fourche, Cheyenne, Missouri, and Bad Rivers, Redwater Reservoir, and Bear Butte Creek where nesting habitat exists. Bald Eagles nesting along the rivers in the planning area have increased in number over the past 10 years (USDI, BLM, 1986b).

PEREGRINE FALCON

Historic peregrine falcon nest sites occur on public land but no active nesting sites have been located to date. Recent sightings have identified the peregrine falcon only as a migrant. The abundance of rocky cliffs and outcrops used for roosting and nesting in proximity to the large expanses of open grassland and shrub-grassland vegetation types offer excellent potential habitat for prey species. The BLM is continuing to monitor and evaluate potential reintroduction sites to support the peregrine falcon recovery plan (USDI, USFWS, 1984).

PIPING PLOVER

Piping plovers are migratory shorebirds that spend approximately 3 to 4 months on breeding sites in the northern United States and southern Canada (Haig and Oring, 1985). They are Federally listed as threatened in Montana and South Dakota. Breeding pairs are known to occur on islands along the lower Missouri River and in riparian-wetlands. They commonly nest in close proximity to colonies of least terns. There is habitat for plovers along the Yellowstone River, but no colonies have been identified on public land in the planning area.

INTERIOR LEAST TERN

The interior least tern is a Federally listed endangered species. They are migratory and travel in small, loose flocks. They nest on beaches along river banks and reservoirs. Currently colonies are known to nest on sandbars and islands along the lower Yellowstone River.

WHOOPING CRANES

Whooping cranes migrate through South Dakota and eastern Montana and occasionally are seen on stock reservoirs.

ESKIMO CURLEW

Potential habitat for the Eskimo curlew exists throughout the prairie in South Dakota.

Fish Species Of Special Concern

Potential habitat occurs in the rivers and creeks for the following species of fish: sturgeon chub, sicklefin chub, northern redbelly dace, finescale dace, longnose sucker, and plains topminnow. There is the possibility that the finescale dace and longnose sucker are in drainages of the Black Hills. The sturgeon chub, sicklefin chub, and northern redbelly dace are more likely to be found in the larger rivers.

PALLID STURGEON

The pallid sturgeon is a large fish known to occur only in the Missouri River, the Mississippi River downstream of the Missouri River, and the Yellowstone River. The species is threatened through habitat modification, apparent lack of natural reproduction, commercial harvest, and hybridization in parts of its range.

CULTURAL RESOURCES

Approximately 9 percent of the planning area has been surveyed for cultural resources, resulting in a total of more than 1,856 tests, related projects, and cultural resource surveys. This has resulted in the identification and recording of 4,150 cultural resource properties. Most of the inventoried Federal land of approximately 426,500 acres has been surveyed at the Class III level of intensity. The BLM's Miles City District Cultural Resources Class I Overview (Deaver and Deaver, 1988) estimates a site density of 3.51 acres per 1,000 acres, assuming an equal

distribution of sites, or one site per 285 acres of Federal land in the Montana portion of the planning area. Taking into account the most recent information, these site density figures have increased to 9.73 sites per 1,000 acres, or one site for approximately every 100 acres.

Of those 4,150 cultural resource properties presently recorded in the planning area, some 312 have been determined eligible or are considered eligible for listing on the National Register of Historic Places. Consultation with the Montana and South Dakota State Historic Preservation Offices (SHPO) has determined that these 312 properties meet the National Register criteria, while some 1,364 sites are ineligible for the National Register. The National Register eligibility status of the remaining 2,474 properties is uncertain, undetermined or not available.

Cultural resources in the planning area represent human occupation throughout two broad periods: the prehistoric and the historic. The prehistoric period began when the first humans occupied this area 12,000 years ago and lasted until the late 1700s or early 1800s. Cultural resource properties of this period generally are characterized by lithic scatters, stone circles, habitation, petroglyphs, game drive lines, animal kill and processing sites, hearths, lithic material quarries, medicine wheels, and religious sites. Properties of this period contain nonperishable artifacts and other remains, including stone tools, pottery, bone, and charcoal. Many of these sites contain features and artifacts in buried deposits.

The historic period began with the arrival of explorers and well organized fur trading expeditions in the region during the early 1800s. Cultural resources in the planning area that date from this historic period include mining operations and settlements, emigrant trails and stage roads, fur trading posts, Indian war period battle sites, railroad installations, ranch developments, coal mines, and oil and gas fields. Approximately 2,187 acres of the Fort Meade Recreation Area have been placed on the National Register of Historic Places.

The BLM administers a few scattered parcels of public lands along the Yellowstone River adjacent to the Lewis and Clark National Historic Trail. Management of these lands within the trail corridor is guided by the Lewis and Clark National Historic Trail Comprehensive Plan for Management and Use (USDI NPS, 1982). Although these public lands were not identified as initial protection components in the plan, management of these lands will consider impacts to the trail.

The following is a list of cultural resource sites that have been allocated to conservation or sociocultural use. Site areas include small buffer zones for protection. Acreages are limited to those portions of the site areas overlying the Federal oil and gas estate that would be affected by oil and gas actions. All sites have been allocated to conservation use unless otherwise stated.

TABLE 3.9 CULTURAL SITES ALLOCATED TO CONSERVATION OR SOCIOCULTURAL USE

Site	Acres
POWDER RIVER RESOURCE AREA	
Rosebud Battlefield	897
Powers-Yonkee Site	229
Battle Butte/Wolf Mountain Site	521
Reynolds Battlefield	3,113
Mill Iron Site	2,505
BILLINGS RESOURCE AREA	
Steamboat Butte Site	520
Bruder-Janich Site	320
Paul Duke Rock Art Site	40
Petroglyph Canyon National Register Site	240
Demi-John Flat Site	200
Castle Butte Site	280
Stark Bison Kill Site	479
Youngs Point	498
Bighorn Mouth North Cliffs Rock Art Site	212
Gyp springs Site	320
Dryhead Overlook Site (sociocultural use)	480
Weatherman Draw National Register Site	2,250
Bandit National Register Site	520
Sykes Spring Site	200
SOUTH DAKOTA RESOURCE AREA	
Ft. Meade Historic Site	6,629
Total Acres	20,453

Due to the sensitivity of these and all archeological and historic sites, their specific locations will not be revealed. Locational data of archeological and historic sites is considered proprietary information. If locations are divulged, sites could be subject to vandalism and looting. Prospective lessees may be informed of the percentage and acres of lands subject to cultural resource stipulations. Lease holders would be informed of the exact location of sites within their lease area.

PALEONTOLOGICAL RESOURCES

Fossil bearing rocks underlie the entire planning area. Although fossils are rare in most rock layers, there are seven geologic rock formations in the planning area that contain significant fossil material that is noted worldwide. Included

in this group are the Tullock and Ludlow Members of the Fort Union, the Judith River, Hell Creek, Morrison and Cloverly Formations, Lakota sandstone, and the White River Group. A detailed stratigraphic correlation chart for the planning area is in Appendix C.

The Morrison, Cloverly and Lakota sandstone formations are known for their dinosaur fossils. The Judith River Formation preserves ancient environments including shallow oceans, deltas, rivers, freshwater swamps and lakes. In addition to plant remains, many animal species are found in this formation. Mollusks, fish, amphibians, lizards, dinosaurs, other reptiles, and small mammals are represented in the fossil record.

Areas of low plains interrupted by broad swampy river bottoms and delta areas are preserved in the Hell Creek Formation. The fossil record indicates a tropical to subtropical climate. A wide diversity of plants is evident, especially in the moist areas. Mollusks, fish, amphibians, reptiles, dinosaurs (*Triceratops, Anatosaurus, Tyrannosaurus*), birds, and small mammals are abundant in the Hell Creek fossil record. The plant and animal communities varied between the low moist areas and the drier, upland plains.

An important time event is represented at the contact of the Hell Creek Formation and The Tullock Member of the Fort Union Formation. This contact represents a time of worldwide extinction of many life forms, most notably the dinosaurs, and the beginning of rapid mammal evolution.

Varieties of plant fossils are found throughout the Fort Union Formation and indicate streamside swamps, bottomlands, and riparian communities along well-established river courses. Channel fills in the formation contain an abundance of fresh water clams and snails. The most significant fossils are found primarily in the Tullock Member which contains turtle, fish, reptile, and mammal fossils.

The White River Group is an important source of middle Tertiary age mammals. Other formations such as a portion of the Pierre Shale Formation in South Dakota are known for *Placenticeras* ammonites and marine reptiles. Plant fossils are commonly found in the Lakota sandstone, the Fuson shale, and the Fort Union Formation.

The planning area contains some of the richest paleontological resources in the world. The Hell Creek Formation contains the best example of the Age of Dinosaurs. This formation, in association with the Tullock Member, exhibits an uninterrupted sequence of the last of the dinosaurs, their extinction, and the subsequent beginnings of the Age of Mammals.

Three areas have been shown to contain important paleontological values and have the potential to continue producing significant information. These areas are the Cycad locality in South Dakota (40 acres), the Bridger Fossil Area - *Deinonychus* Quarry location (160 acres),in Montana and the Crooked Creed Fossil Area (280 acres) located in the southern Pryor Mountains in Wyoming.

WILDERNESS

The planning area contains six Wilderness Study Areas (WSA). Detailed discussions on the existing environment and wilderness values for each WSA can be found in the respective Final Wilderness Environmental Impact Statements (EIS). The preliminary wilderness recommendations for these WSAs and their fluid mineral development potential are summarized below in Table 3.10.

TABLE 3.10 PRELIMINARY WILDERNESS RECOMMENDATIONS AND FLUID MINERAL DEVELOPMENT POTENTIAL

WSA	Acres Recommended for Wilderness	Acres Not Recommended for Wilderness	Fluid Mineral Development Potential
BILLINGS RESOURCE AREA			
Big Horn Tack-on	3,308	0	Low
Burnt Timber Canyon	3,430	0	Low
Pryor Mountain	13,397	0	Low
Twin Coulee	0	6,870	Low
POWDER RIVER RESOURCE AREA			
Buffalo Creek	0	5,650	Moderate
Zook Creek	0	8,438	Moderate
Subtotals	20,135	20,958	
Grand Total		41,093	

Sources: Long and others, 1989
USDI, BLM, 1988 and 1989

All activities related to oil and gas leasing in WSAs will continue to be managed using BLM Manual H-8550-1, Interim Management Policy and Guidelines for Lands under Wilderness Review, until Congress determines whether or not the lands are wilderness. Lands released by Congress for uses other than wilderness are to be managed in accordance with the current land use plans.

Within the WSAs there are no pre-FLPMA fluid minerals leases issued prior to October 21, 1976, with valid existing rights. In 1984, an appropriations act established a moratorium on oil and gas leasing in WSAs. Since then, no new leases have been issued in WSAs. The only WSA in the planning area with post-FLPMA oil and gas leases is the Buffalo Creek WSA which contains 5,012 acres under lease. Any on-the-ground activity on these post-FLPMA leases is subject to meeting the nonimpairment standard. This requires activities to be reclaimed to a condition of being substantially unnoticeable in the WSA as a whole before the Secretary of the Interior is scheduled to send his recommendations to the President. The Secretary was scheduled to send his Montana BLM recommendations to the President in September 1991. The deadline in Montana for authorizing activities requiring reclamation was September 30, 1990. After this date, only actions that do not require reclamation can be authorized.

RECREATION

Hunting, fishing, and sightseeing are the primary recreation uses of public lands in the planning area. Other recreation uses include hiking, camping, picnicking, ORV use, rock hounding, photography, spelunking, horseback riding, boating, cross-country skiing, snowshoeing, and sledding. Generally, about half the public lands in the planning area are accessible to the public either through legal access or because private land owners have not denied access.

The BLM places public lands in one of two categories for managing recreation use: Special Recreation Management Areas (SRMA) and Extensive Recreation Management Areas (ERMA). SRMAs are normally small areas which require intensive management to protect natural resources. They often contain campgrounds or other major BLM investments. However, the majority of public lands in the planning area are managed as ERMAs. These lands contain few or no BLM facilities, recreation use is primarily dispersed, and information on visitor use is generally lacking.

There are nine SRMAs in the planning area: Pryor Mountains, four walk-in hunting areas, South Hills, Shepherd Ah-Nei, Moorhead, and Fort Meade. SRMAs and other specific recreation resources are discussed below for each resource area.

Billings Resource Area

Seven of the nine SRMAs are in the Billings Resource Area: Pryor Mountains, four walk-in hunting areas, South Hills, and Shepherd Ah-Nei.

The Pryor Mountains SRMA is located about 70 miles south of Billings. The area offers opportunities for hunting, fishing, camping, snowmobiling, spelunking, sightseeing, picnicking, and viewing wild horses with major attractions being wild horse viewing and big game hunting. The Pryor Mountain Wild Horse Range (PMWHR) is a unique attraction, one of only two such designated wild horse ranges in existence. Big game hunting is primarily for mule deer although there are also bird hunting and permit hunting for Bighorn sheep and bear. Use of motorized vehicles in the Pryor Mountains SRMA is limited to designated roads and trails on 52,000 acres, while 40,000 acres are designated as open to ORV use. Penn's cabin located on top of East Pryor Mountain is open to the general public on an availability basis. The East Pryor Mountains Area has three Wilderness Study Areas (WSAs): Burnt Timber Canyon, Pryor Mountain, and Big Horn Tack-on. Within the East Pryor Mountains, facilities consist of one cabin, three historical horse traps, an administrative site at Britton Springs (cabin and corrals), and Skyes Spring corrals.

There are four walk-in hunting areas in the resource area: Pole Creek, Gage Dome, Tilstra, and Grove Creek. These areas are blocks of mixed private and public lands managed cooperatively between the BLM and private landowners to provide hunters a non-motorized setting during the hunting season. Vehicle travel within the walk-in areas is limited to designated roads during the hunting seasons. Pole Creek, located ten miles northwest of Roundup, Montana, was established for antelope hunting and encompasses 32,000 acres. Gage Dome, another antelope hunting area located five miles northeast of Roundup, encompasses approximately 5,300 acres. Tilstra and Grove Creek were established for deer and upland game bird walk-in hunting. The Tilstra walk-in hunting area is located six miles southeast of Bridger, Montana and encompasses 3,100 acres. The Grove Creek Ranch walk-in area is located south of Red Lodge, Montana, and encompasses approximately 38,000 acres.

Another form of recreation is off-road vehicle (ORV) use. A popular area for this is the South Hills SRMA located two miles south of downtown Billings, Montana. These 1,200 acres of public lands were established primarily for use by motorcycles and ATVs to reduce indiscriminate ORV use near the community of Billings. The area provides excellent hill climbing opportunities with many 40-50 percent slopes. The area is comprised of two tracts of public lands separated by private land owned by the Billings Motorcycle Club (BMC) which allows the general public access across their land. A 70 acre portion of the public lands between the South Hills SRMA and an adjoining subdivision is designated as closed to all motorized vehicles to reduce conflicts with adjacent landowners.

Another popular ORV area is within the Shepherd Ah-Nei SRMA where 512 acres are designated as open to ORV travel. The terrain is less rugged than the South Hills and is popular for family riding and beginners. There are also snowmobiling opportunities when snow cover is adequate.

The Shepherd Ah-Nei SRMA is a 4,016 acre area established for environmental education purposes. It is located approximately 20 miles northeast of Billings and is popular with the local schools. The SRMA contains two developed recreation sites. Motorized vehicle use is limited to designated roads and trails on 3,090 acres, limited to authorized uses on 460 acres, and open to ORV travel on 512 acres. The SRMA also provides opportunities for hiking, horseback riding, cross country skiing and snowmobiling when snow cover is adequate, hunting, wildlife viewing, and photography.

The Acton area is also managed for general recreational use. It is located 13 miles northwest of Billings and consists of approximately 3,800 acres of public lands. Motorized vehicles are limited to existing roads and trails and authorized use.

Powder River Resource Area

The Moorhead SRMA is an undeveloped recreation site located on the Powder River near the Montana-Wyoming border approximately 30 miles south of Broadus, Montana. The area receives a significant amount of overnight use in the fall by hunters and commercial outfitters. Camping is encouraged at this site to reduce impacts from indiscriminate camping in the nearby Buffalo Creek WSA during hunting season. While hunting is the main attraction, the area is used for hiking and sightseeing as well.

The Tongue River Reservoir, located in the southwest section of the resource area, is a major recreation site for fishing and boating. The reservoir provides an important warm water fishery for southeastern Montana. Public lands in and around the reservoir are scattered but several parcels provide access to the reservoir.

Dean S. Reservoir is a 2-acre reservoir approximately 10 miles from Miles City, Montana. The area is stocked with trout by the State of Montana and provides an important opportunity for fishing close to home. The site includes picnic tables and grills. Turkey hunting is also popular in the area.

Tusler is a small tract of public land along the Yellowstone River near Miles City. One of the management objectives for this area is handicap-access fishing. Development of the project is a cooperative effort between BLM and the Good Sam Club. Plans include a trail, parking area, restroom, and picnic sites.

Howrey's Island on the Yellowstone River is an island with high recreation use as well as wildlife values. It is one of the few tracts of public lands along the Yellowstone River in the entire planning area. Encompassing approximately 600 acres, it provides excellent opportunities for fishing, hunting, hiking, camping, picnicking, and sightseeing.

South Dakota Resource Area

Throughout this resource area, hunting and fishing are very popular. Hunting is primarily big game and upland game birds, with limited waterfowl hunting. Portions of 11 South Dakota rivers are identified in the Nationwide Rivers Inventory. Two of these rivers, the Belle Fourche and the Cheyenne, are adjacent to public lands.

The greatest concentration of public land in South Dakota lies within the 13 counties west of the Missouri River. Included are: the Black Hills National Forest, Custer National Forest, grasslands of the Nebraska National Forest, Badlands National Park, Wind Cave National Park,

Custer State Park, several ski areas, the historic town of Deadwood, three major rivers, and five reservoirs. These areas offer a variety of dispersed recreational opportunities including fishing, photography, boating, hiking, rock collecting, sightseeing, hunting, and ORV use. The Center of the Nation Recreation Area near Belle Fourche is recognized as a geographic center of the United States and offers excellent scenic viewing.

The Fort Meade SRMA, with a variety of recreational opportunities, encompasses 6,629 acres on the northeastern flank of the Black Hills in western South Dakota. It is located between two population centers. Sturgis (5,330) is one half mile to the west, and Rapid City (54,520) is 25 miles southeast. The Black Hills National Cemetery borders the area on the south. Due to the number of historic and prehistoric sites, approximately one third of the recreation area has been placed on the National Register of Historic Places.

The area is accessible by Interstate 90 and State Highway 34. The SRMA contains a developed campground with 25 family picnic units, three group picnic units, toilets, drinking water, a campground for horseback riders, and a nature trail. In addition to the winter sports of sledding, skating, and cross country skiing, the area is used for fishing, hunting, hiking, horseback riding, bicycling, jogging, sightseeing, picnicking, camping, and bird watching. Additional recreation opportunities include a muzzle-loading rifle shooting range and eleven miles of the multi-agency Centennial Trail.

VISUAL RESOURCES

Landscapes in the planning area are varied. Included are badlands, forested breaks, forests, buttes, woody draws, riparian zones, flood plains, prairie, and scabland. The physical features within these landscapes are the visual resources. Physical features by definition are the landform, water, vegetation, structures, animals and other manmade or natural features; they combine to form the visual resources.

The art of managing change in a landscape so that the change is in harmony with the physical features of the landscape is visual resource management (VRM). The same level of management for all visual resources is neither practical nor desirable; consequently, a systematic process is used to evaluate visual resources. This evaluation considers three factors: scenic quality or visual appeal; sensitivity or public concern for that scenic quality; and the distance of the landscape from the observer. Based on these three factors, the public lands are placed into one of three visual resource inventory classes: Class I and II have the most value; Class III has a moderate value; and Class IV has the least value. These inventory classes are considered along with other resource values in land use planning to establish VRM management objectives.

VRM objectives have been established for the Powder River Resource Area, but they have not yet been defined for the South Dakota and Billings Resource Areas. Where these objectives are not yet established, the visual resources are managed on a project-by-project basis. However, visual resource inventories are planned for these two resource areas, and the RMPs will be amended based on those inventories.

Of the 1,080,000 acres of public lands where VRM objectives have been established, 400,000 acres are in VRM Class II and 680,000 acres in VRM Class III. Currently, there are no public lands in the planning area being managed as VRM Class I or Class IV. In addition, public lands without established VRM objectives contain areas where the management of visual resources is a concern. Included in this group are: the Pryor Mountains; the Pole Creek, Gage Dome, Tilstra, and Grove Creek walk-in hunting areas; the Lewis and Clark National Historic Trail; the Shepherd Ah-Nei and Acton environmental education areas; the Musselshell River, the Yellowstone Valley, Moorhead Campground, the Fort Meade Recreation Area; the Center of the Nation Recreation Area, and the Belle Fourche and Cheyenne Rivers.

SOCIAL AND ECONOMIC CONDITIONS

The planning area covers all or most of 13 counties in eastern Montana and all of the state of South Dakota. They create a large geographic area that includes an abundance of natural resources. The economy of the area is based on the exploration, production, and utilization of these natural resources. The resources include the land which is used for crops and livestock production; minerals including oil and gas; water and wildlife which offer outdoor recreation opportunities; and natural features which stimulate tourism.

Approximately 176,459 people lived in the 13 Montana counties in the two resource areas in 1990. This represented an increase of 2.5 percent over the 1980 population of 172,165 (Table 3.11).

TABLE 3.11 POPULATION OF THE PLANNING AREA

Resource Area	Population 1980	1990	% Change
Powder River	28,308	26,669	-5.8%
Billings	143,857	149,790	4.1%
So. Dakota	205,283	211,591	3.1%
Total	377,448	388,050	2.8%

Sources: Montana Dept. of Commerce, 1990
South Dakota Dept. of Labor, 1990

The 1990 population of Billings, the largest city in the planning area, was 81,151. In that year Yellowstone County, where Billings is located, contained 64.3 percent of the population of the two Montana resource areas' total populations. The other major communities in the resource areas include Miles City, Laurel, Forsyth, Colstrip and Hardin, all with 1990 populations between 4,800 and 8,500. Numerous smaller communities also exist in the two RAs in Montana.

The 1990 population of the 22 counties west of the Missouri River in South Dakota was 211,591, a decrease of 3.1 percent from the 1980 population (Table 3.11). Five counties are composed of Indian reservations and are not included in the analysis. The 1990 population of Rapid City, the largest city in western South Dakota, was 54,523. Other major communities in western South Dakota include Belle Fourche, Spearfish, Hot Springs, and Sturgis, all with 1990 populations between 4,300 and 6,900. Numerous smaller communities also exist in western South Dakota.

Oil and natural gas were produced in 10 counties in Montana and four counties in western South Dakota in 1987. All 13 counties in Montana and nearly all of the counties west of the Missouri River in South Dakota have had oil and gas exploration activity in the past.

Oil and gas exploration and development have occurred in the planning area since oil was discovered in the Bighorn Basin in 1915. During the past 15 years, all three of the resource areas have had some level of drilling activity. The majority of the wells were drilled in the Billings Resource Area: 1,208 wells or 50 percent; the South Dakota Resource Area, 647 wells or 27 percent; and the Powder River Resource Area, 572 wells or 23 percent.

Short-term jobs during oil and gas exploration and well development create most of the direct and indirect wage and salary employment and income. The activity tends to be cyclical and dispersed over a region rather than being concentrated in one area. In Montana the oil and gas industry pays state severance taxes, local property taxes on drilling and production equipment, and a state net proceeds tax based on the value of oil and gas produced (replaced in 1989 by a local government severance tax). The taxes and royalties assessed on oil and gas development and production are significant sources of local and state government revenues in Montana (MBOGC Tech. Appendix, 1989, p. 217). The oil and gas net proceeds taxes accounted for approximately 5.4 percent of the total taxable value in the Montana portion of the planning area in 1988.

The state of South Dakota levies an Energy Minerals Severance Tax at a rate of 4.5 percent of the market value defined as the first point of sale. Half of the money collected goes to the State's Energy Development Impact Fund and the General Fund. The other half is returned to the producing counties. Total revenues are currently around $1.8 million. The South Dakota state sales tax applies to the receipts resulting from oil and gas field services at a base rate of two percent.

The states also receive 50 percent of the annual rents and royalties collected from lessees of Federal lands. Montana's share of these revenues was $2 million in fiscal year (FY) 1988 and $1.6 million in FY 1989. South Dakota received $775,000 in FY 1988 and $654,000 in FY 1989 (Table 3.12).

TABLE 3.12 FEDERAL RENTS AND ROYALTIES

Resource Area	Federal Rents & Royalties State Share FY88	FY89
Powder River	1,033,280	839,288
Billings	954,698	787,794
South Dakota	774,624	654,492
Total	$2,762,602	$2,281,574
88-89 AVE:		$2,522,088

Sources: USDI, MMS, 1989 & 1990

Powder River Resource Area

The economy of this resource area has been based historically on agriculture. During the past 20 years, the construction and subsequent operation of the coal-fired electrical powerplants and mines at Colstrip in Rosebud County have created hundreds of new jobs. Oil and gas exploration and development have played a relatively small part in the economy of the resource area as a whole.

The major geologic feature in the Powder River Resource Area (PRRA) is the Powder River Basin, a structural trough covering the western two-thirds of the resource area. Active oil and gas fields are in the Powder River Basin and on the western flank of the Black Hills Uplift in Carter County. During 1988 two gas fields and four oil fields were active. The southwest end of the Central Montana Uplift, which produces in the Billings and Big Dry Resource Areas, is present in northwestern PRRA, but production has not yet been established.

The 1990 population of the Powder River Resource Area was 26,669, a decrease of 5.8 percent from the 1980 population. Counties most likely to be affected by future oil and gas development, Carter and Powder River, had a combined 1990 population of 3,593. This figure represents a 16.8 percent decrease from 1980. The major communities in these counties are Ekalaka in Carter County with a 1990 population of 439, and Broadus in Powder River County with a 1990 population of 572. Both of these communities lost population during the period 1980 to 1990 with Ekalaka losing 29.2 percent and Broadus 19.7 percent. The establishment of the Bell Creek oil field in Powder River County created a small population boom in Broadus in the late 1960s and early 1970s. The impacts from oil and gas development were minor and short term. Revenues from the oil field have enabled the county to provide adequate services.

EMPLOYMENT AND INCOME

The most important wage and salary employment sectors in 1988 were government, services, retail trade, transportation, and public utilities. Oil and gas extraction data was not available for the counties in the region for 1988, but the industry accounted for less than one percent of the total wage and salary employment in 1987. It did not change significantly in 1988 as the total wage and salary employment was nearly the same.

Custer and Rosebud Counties accounted for 90 percent of the total wage and salary employment in 1988. Miles City in Custer County is a regional trade center, and Colstrip in Rosebud County is the location of electrical powerplants and coal mines. The oil and gas extraction industry's wage and salary income data was not available for 1988, but the industry accounted for approximately one-tenth of one percent in 1987 (Table 3.13).

PRODUCTION

Oil production totaled nearly 1.1 million barrels in 1987 (latest year county totals were available), while Federal production was 444,000 barrels of oil or 41.6 percent. Natural gas production was 138,000 MCF and Federal production was nearly 30,000 MCF of gas or 21.2 percent (Table 3.14).

TABLE 3.13 EMPLOYMENT AND INCOME

Resource Area	1988 Wage and Salary Employment			1988 Wage and Salary Income		
	Oil & Gas	Total	% Oil & Gas	Oil & Gas	Total	% Oil & Gas
Powder River	0	8,771	0.0%	$0	$160,871,533	0.0%
Billings	347	54,245	0.6%	$10,201,000	$963,221,254	1.1%
So. Dakota	111	66,007	0.2%	$2,620,199	$1,013,188,017	0.3%
Total	458	129,023	0.4%	$12,821,199	$2,137,280,804	0.6%

Sources: Montana Dept. of Labor & Industry, 1989; South Dakota Dept. of Labor, 1989

TABLE 3.14 OIL AND GAS PRODUCTION FOR THE PLANNING AREA

Resource Area	1987 Production					
	Oil (bbls)			Gas (MCF)		
	Total	Federal	% Federal	Total	Federal	% Federal
Powder River	1,067,572	444,313	41.6%	138,454	29,284	21.2%
Billings	1,654,174	735,836	44.5%	3,566,508	231,540	6.5%
South Dakota	1,644,200	490,952	29.9%	3,682,364	369,722	10.0%
Total	4,365,946	1,671,101	38.3%	7,387,326	630,546	8.5%

Sources: Montana Dept. of Revenue, 1989; USDI MMS, 1989; South Dakota Dept. of Water and Natural Resources, 1990

FISCAL

Property taxes levied on the net proceeds and royalty value of oil and gas production are an important revenue source for local government. The oil and gas net proceeds taxes accounted for approximately 6.1 percent of the total taxable value in the PRRA in 1988. The proportion of oil and gas production taxes to total taxable value ranged from less than one percent in Treasure County to 63 percent in Powder River County (Table 3.15).

TABLE 3.15 TAXABLE VALUES FOR THE PLANNING AREA

Resource Area	1988 Amount Taxable (000's $'s) Oil & Gas	Total	% Oil & Gas
Powder River	$15,736	$256,352	6.1%
Billings	$19,163	$392,392	4.9%
So. Dakota			
Total	$34,899	$648,744	5.4%

Source: Montana Dept. of Revenue, 1989

The state receives 50 percent of the annual rents and royalties collected from lessees of Federal lands. From the Powder River Resource Area, Montana's share of revenue was $1 million in FY 1988, and $839,000 in FY 1989 (Table 3.12).

Billings Resource Area

The Billings Resource Area includes Billings, Montana's largest city and major regional trade center. Historically, the key industries in the area has included services, retail trade, and government followed by agriculture and manufacturing on a smaller scale. Oil and gas exploration and development in the Billings Resource Area (BRA) has occurred in two principal provinces, the Bighorn Basin in south central Montana and the Central Montana Uplift. The first producing oil well in Montana was drilled in the Bighorn Basin in 1915, an extension of the Elk Basin Field in Wyoming. Other fields are located in the Lake Basin fault zone, along the Nye-Bowler lineament, or scattered across the resource area where structural features or stratigraphic conditions have caused the accumulation of hydrocarbons. During 1988 the resource area had 41 active oil and gas fields.

The 1990 population of the BRA was 149,790, an increase of 4.1 percent from the 1980 population. The counties most likely to be affected by future oil and gas development are Carbon and Musselshell. Carbon County's 1990 population of 8,080 was a 0.2 percent decrease from 1980, although Red Lodge, its principal community, showed a 3.3 percent increase in population from the 1980 census to 1,958 in the 1990 census. Musselshell County's 1990 population of 4,106 shows a 7.3 percent decrease over 1980. Its principal community of Roundup experienced a 14.7 percent decrease in population from 1980 to 1990. Roundup's 1990 population is 1,808.

Oil and gas production in Yellowstone County probably would not be affected by decisions made in this plan. However, Billings does play a role as Montana's service hub for the oil and gas industry. Red Lodge has experienced some minor effects from oil and gas exploration in the recent past. Oil development has affected Roundup since oil was discovered in the area in 1919. Production peaked in the Roundup area in the 1960s and has declined steadily since.

EMPLOYMENT AND INCOME

Eighty-five percent of the total wage and salary employment is concentrated in Yellowstone County which includes Billings. The oil and gas extraction industry generates only six-tenths of 1 percent of the wage and salary jobs in the area. However, more than 8 percent of the jobs in Musselshell County are oil and gas related (Table 3.13).

Although oil and gas employment generates only 0.6 percent of the total number of jobs, total wage and salary income is higher because of the higher average annual wages in the oil and gas industry generally. The industry accounted for 13 percent of the total wage and salary income in Musselshell County in 1988 (Table 3.13).

PRODUCTION

Oil production in the BRA totaled nearly 1.65 million barrels in 1987 (latest year county totals were available), while Federal production was 736,000 barrels of oil, or 44.5 percent. Natural gas production was 3.6 million MCF and Federal production was 232,000 MCF, or 6.5 percent (Table 3.14).

FISCAL

The royalties and rents derived from the leasing and production of Federal oil and gas are important revenue sources for the state and local governments. The state receives 50 percent of the annual rents and royalties collected from lessees of Federal lands. From the Billings Resource Area, Montana's share of these revenues was $955,000 in FY 1988, and $788,000 in FY 1989 (Table 3.12).

Property taxes levied on the net proceeds and royalty value of oil and gas production are also an important source of funding for the local government. The oil and gas net proceeds taxes accounted for approximately 4.9 percent of the total taxable value in the BRA in 1988. The proportion of oil and gas production taxes to total taxable value ranged from less than one percent in Sweetgrass and Wheatland Counties to 50 percent in Musselshell County (Table 3.15).

South Dakota Resource Area

The most likely region for further oil and gas exploration and development activity in South Dakota is that covering the 22 counties west of the Missouri River. The region includes Rapid City, the largest city and a major trade center for the western portion of the state, and the Black Hills, a recreation and tourism area of national importance.

The existing oil and gas production is located in Harding, Custer and Fall River Counties. Production in Dewey County is on the Cheyenne River Indian Reservation and is not subject to this amendment. However, oil and gas exploration activities have occurred throughout the region and are expected to continue during the study period. Producing fields in Harding County and noncommercial accumulations in Butte County are part of the southern reach of the Williston Basin. In the southwestern corner of the state, fields have been discovered in Custer and Fall River Counties.

The counties most likely to be affected by future oil and gas development in the region are Harding and Butte in northwest South Dakota, and Custer and Fall River in southwest South Dakota. Harding and Butte Counties had a total population of 9,583 in 1990, a 4.9 percent decrease from 1980. Custer and Fall River Counties had a total population of 13,532 in 1990. Between 1980 and 1990, the population decreased 13 percent in Fall River County and increased 3 percent in Custer County. The major communities in these counties are Hot Springs, in Fall River County, with a 1990 population of 4,325; Belle Fourche, in Butte County, with a 1990 population of 4,335; Custer, in Custer County, with a 1990 population of 1,741; Edgemont, in Fall River County, with a 1990 population of 906; and Buffalo, in Harding County, with a 1990 population of 488. All of these communities lost population between 1980 and 1990, with Edgemont losing the most at 38.2 percent. Social impacts from oil and gas activity in South Dakota have been minimal to date, because production has been limited.

EMPLOYMENT AND INCOME

The study area generated approximately one-quarter of the statewide total wage and salary employment in 1988. Pennington County, which includes Rapid City, generated 56 percent of the study area employment in 1988. However, the study area accounted for nearly all of the statewide employment in the oil and gas industry. The industry generated only two-tenths of 1 percent of the wage and salary employment in 1988 (Table 3.13).

The oil and gas industry's average earnings were 53 percent higher than the statewide average; as a result, the industry accounted for three-tenths of 1 percent of the total wage and salary income for the area. Oil and gas exploration and development activity is expected to continue and grow in some areas, but not to the extent that it will have other than short term local impacts (Table 3.13).

PRODUCTION

Oil production totaled more than 1.6 million barrels in 1987 (latest year county totals were available), while Federal production was 490,952 barrels of oil or 29.9 percent. Natural gas production was 3.7 million MCF and Federal production was 370 thousand MCF of gas or 10 percent (Table 3.14).

FISCAL

The royalties and rents derived from the leasing and production of Federal oil and gas are important revenue sources for the state and local governments. The state receives 50 percent of the annual rents and royalties collected from lessees of Federal lands. South Dakota's share of these revenues generated from the counties in the study area was $775,000 in FY 1988 and $654,000 in FY 1989 (Table 3.12).

Attitudes Toward Oil And Gas Development

Recent information on national attitudes toward oil and gas development is not available. Regional information consisting of a 1985 survey of 624 Montana adults is reported in "Natural Resource Development in Montana", (Wallwork and Johnson, 1986). The following information is summarized from this document.

Nearly two-thirds of the respondents indicated natural resource development, in general, to be very essential to Montana's future economic health. Nearly half indicated the pace of development was about right; approximately one-third indicated the pace was too slow. The primary benefits associated with natural resource development are construed to be jobs and income, help to state and local economy, tax revenues, and providing needed products. The respondents indicated that the primary costs or disadvantages associated with natural resource development

would be environmental impacts, pollution, poor reclamation, population growth, boomtown, and boom and bust cycles. About three-fifths of the respondents saw little or no conflict between natural resource development and outdoor recreation while one-quarter felt the two activities did conflict.

Respondents were asked what activities should be allowed on government lands other than areas adjacent to national parks and wilderness areas. The type of government, Federal, state, or local, was not specified in the question. Most respondents felt the following activities should be allowed on government lands: timber cutting (85 percent approval), oil and gas extraction (83 percent), coal mining (78 percent), and hardrock mining (79 percent). Some respondents felt the following activities should be prohibited on government lands: timber cutting (11 percent disapproval), oil and gas extraction (12 percent), coal mining (17 percent), and hardrock mining (15 percent).

The above survey also asked specific questions about oil and gas leasing and development. About half of the respondents felt oil and gas development to be very essential to Montana's future economic health; a higher percentage of respondents in eastern Montana answered in the affirmative. Another third of the respondents indicated oil and gas development to be fairly essential. Responses to the pace of development were evenly split with nearly 40 percent responding that it was about right, and 40 percent feeling it was too slow. Nearly half of the respondents indicated that the state of the industry was static, one-fifth said it was thriving and successful, and another fifth said it was unhealthy and declining.

Nearly three-fourths of the respondents said they had a favorable impression of the industry. About two-fifths of the eastern Montana respondents rated the industry excellent or pretty good in its behavior as a responsible citizen of the state. Another two-fifths of these respondents rated the industry as only fair or poor in its behavior as a responsible state citizen.

INTRODUCTION

This chapter analyzes the impacts of oil and gas leasing and development on each resource for all alternatives. The environmental effects of oil and gas development are essentially the same for all of the alternatives. Only the number of acres which are protected by stipulations or No Lease decisions varies among the alternatives. The projected number of wells and associated acres of disturbance are presented in Table 4.1. The impact analysis was completed using the assumptions listed below.

ASSUMPTIONS

The Reasonably Foreseeable Development (RFD) scenario contains projections for the number of wells and acres disturbed in each producing region. The disturbance for each well is based on the typical depth of wells for an area. Shallow wells generally disturb fewer acres. Tables 4.1 through 4.4 show totals for the planning area and each resource area.

(1) Unconstrained number of wells comes from the RFD scenario.

(2) Constrained number of wells is derived from the resource analysis for wells foregone in No Surface Occupancy areas.

(3) Average acreage figure (total acres/total wells) for the resource area was used to estimate Federal acres disturbed.

(4) The RFD Projections have a 15 year life.

A more detailed description of information for the assumptions is contained in Chapter 4, under Social Economic Conditions, and in Appendix C.

TABLE 4.1 TOTAL DISTURBANCE PROJECTED FOR THE PLANNING AREA

Unconstrained Well Development	
Total wells	1,765
Total Federal wells	633
Total acres disturbed	6,817
Total Federal acres	2,460

Constrained Well Development

Category	Alt A	Alt B	Alt C	Alt D
Federal wells forgone	3	35	3	3
Total Federal wells	630	598	630	630
Federal acres disturbed	2,447	2,322	2,447	2,447

TABLE 4.2 TOTAL DISTURBANCE PROJECTED FOR SOUTH DAKOTA RESOURCE AREA

Unconstrained Well Development	
Total wells	472
Percent Federal lands	49%
Total Federal wells	231
Total acres disturbed	2,266
Percent Federal lands	49%
Federal acres disturbed	1,110

Constrained Well Development

Category	Alt A	Alt B	Alt C	Alt D
Federal wells forgone	1	2	1	1
Total Federal wells	230	229	230	230
Federal acres disturbed	1,105	1,100	1,105	1,105

TABLE 4.3 TOTAL DISTURBANCE PROJECTED FOR POWDER RIVER RESOURCE AREA

Unconstrained Well Development	
Total wells	298
Percent Federal lands	31%
Total Federal wells	92
Total acres disturbed	1,364
Percent Federal lands	31%
Federal acres disturbed	361

Constrained Well Development

Category	Alt A	Alt B	Alt C	Alt D
Federal wells forgone	1	30	1	1
Total Federal wells	91	62	91	91
Federal acres disturbed	355	242	355	355

TABLE 4.4 TOTAL DISTURBANCE PROJECTED FOR BILLINGS RESOURCE AREA

Unconstrained Well Development	
Total wells	995
Percent Federal lands	31%
Total Federal wells	310
Total acres disturbed	3,187
Percent Federal lands	31%
Federal acres disturbed	989

Constrained Well Development

Category	Alt A	Alt B	Alt C	Alt D
Wells forgone	1	3	1	1
Total Federal wells	309	307	309	309
Federal acres disturbed	987	980	987	987

STIPULATION TABLES BY ALTERNATIVE

Tables 4.5 through 4.8 show totals for individual stipulations by alternative. In each table, only acres available for lease with stipulations are shown. For example, in Table 4.6, areas which are evaluated as "No Lease" are not included in the totals for Alternative B. Totals are grouped by the three kinds of stipulations, No Surface Occupancy, Timing, and Controlled Surface Use. A net total for stipulated acres was calculated to account for overlap where two or more stipulations cover the same area. Also included at the end of each table are the No Lease discretionary closures for each alternative.

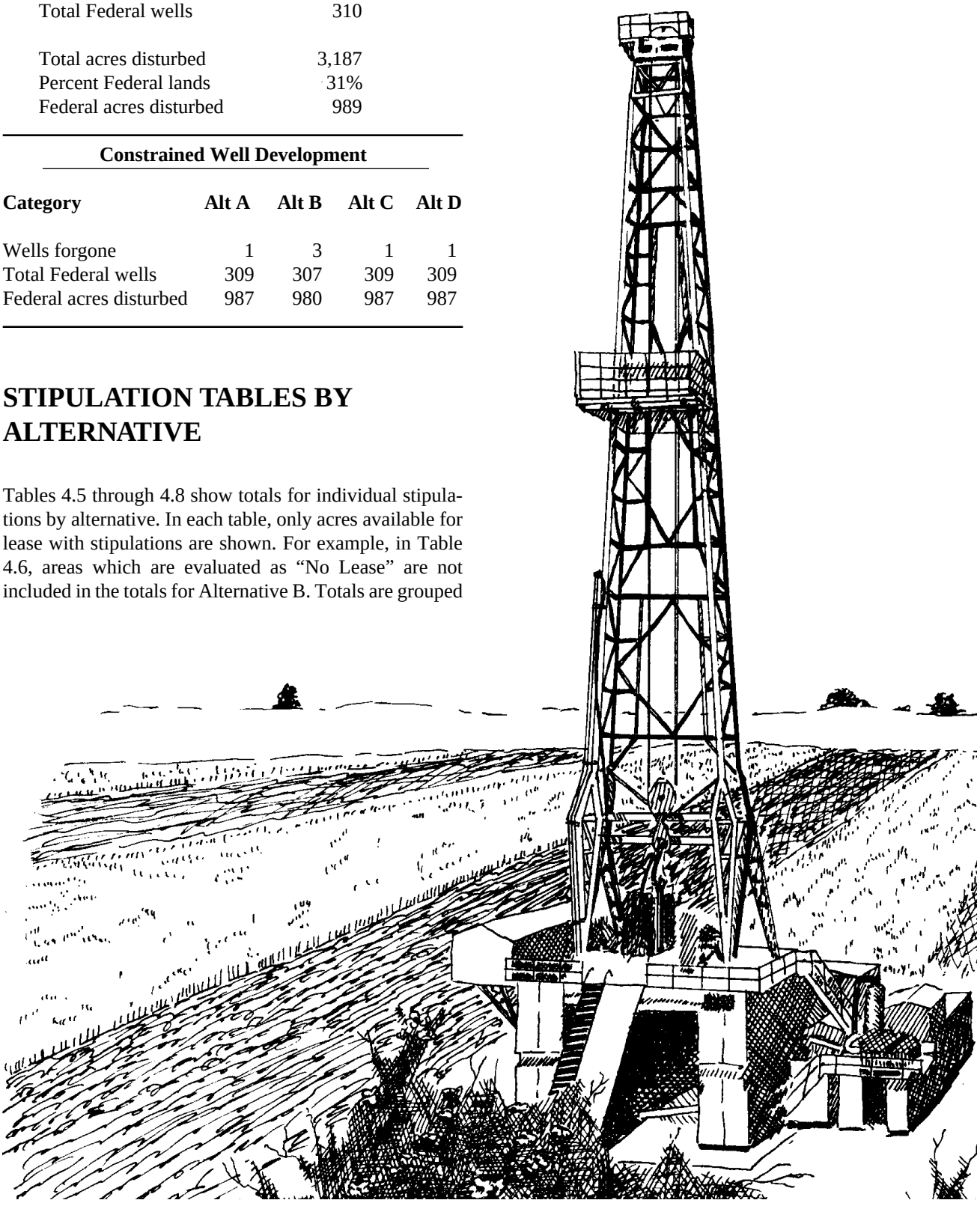


TABLE 4.5 STIPULATED ACRES FOR ALTERNATIVE A, NO ACTION

	Development Potential			
	High	**Moderate**	**Low**	**Total Acres**
MAJOR STIPULATIONS				
No Surface Occupancy				
Coal	0	18,865	0	18,865
Riparian/Hydrology	4,332	23,007	1,329	28,668
Soils*	*	*	*	*
Grouse Leks	0	370	0	370
Raptor Nests*	113	14,887	0	15,000
Fisheries	0	350	0	350
Black-footed Ferret Reintroduction Areas*	1,589	134,924	0	136,513
Potential Black-footed Ferret Habitat*	*	*	*	*
Bald Eagle Nest Sites	9	616	0	625
Peregrine Falcon	0	60	0	60
Ferruginous Hawk	418	2,382	0	2,800
Piping Plover	0	0	0	0
Interior Least Tern	0	0	0	0
Cultural Resources	165	11,699	1,960	13,824
Paleontological Resources	0	480	0	480
Recreation	480	14,106	0	14,586
Pryor Mountain Wild Horse Range*	0	0	11,500	11,500
Fort Meade Recreation Area*	0	2,139	4,490	6,629
Meeteetse Spires Proposed ACEC	*	*	*	*
Powder River Breaks Bighorn Sheep Range*	0	13,626	0	13,626
Major Stipulations Totals	7,106	237,511	19,279	263,896
MINOR STIPULATIONS				
Timing				
Crucial Winter Range	56,267	159,138	26,876	242,281
Elk Spring Calving Range	1,612	2,244	0	3,856
Grouse Nesting Zones	1,552	48,448	0	50,000
Powder River Breaks Bighorn Sheep Range*	*	*	*	*
Raptor Nests*	*	*	*	*
Subtotals	59,431	209,830	26,876	296,137
Controlled Surface Use				
Visual Resource Management	19,006	304,626	1,280	324,912
Black-footed Ferret Reintroduction Areas*	*	*	*	*
Potential Black-footed Ferret Habitat*	1,856	11,290	440	13,586
Soils*	117,721	1,151,823	30,048	1,299,592
Subtotals	138,583	1,467,739	31,768	1,638,090
Minor Stipulation Totals	198,014	1,677,569	58,644	1,934,227
GRAND TOTAL	205,120	1,915,080	77,923	2,198,123
Net Total of overlapping stipulations				1,758,000
Total Federal oil and gas estate				4,670,219
Approximate percentage of acres stipulated				38%
NO LEASE (Discretionary closures)				
Pryor Mountain Wild Horse Range	*	*	*	*
Fort Meade Recreation Area	*	*	*	*
Rosebud Battlefield	*	*	*	*
Dryhead Overlook	*	*	*	*
Powder River Breaks Bighorn Sheep Range	*	*	*	*
Meeteetse Spires Proposed ACEC	*	*	*	*
Totals	*	*	*	*

*Stipulation changes category in some alternatives.

TABLE 4.6 STIPULATED ACRES FOR ALTERNATIVE B

	Development Potential			
	High	**Moderate**	**Low**	**Total Acres**
MAJOR STIPULATIONS				
No Surface Occupancy				
Coal	0	18,865	0	18,865
Riparian/Hydrology	4,332	23,007	1,329	28,668
Soils*	117,721	1,151,823	30,048	1,299,592
Grouse Leks	0	2,581	0	2,581
Raptor Nests*	430	56,434	0	56,864
Fisheries	0	1,844	0	1,844
Black-footed Ferret Reintroduction Areas*	1,589	134,924	0	136,513
Potential Black-footed Ferret Habitat*	1,856	11,290	440	13,586
Bald Eagle Nest Sites	36	2,437	0	2,473
Peregrine Falcon	0	661	0	661
Ferruginous Hawk	1,614	9,189	0	10,803
Piping Plover	0	0	0	0
Interior Least Tern	0	0	0	0
Cultural Resources	165	10,802	1,480	12,447
Paleontological Resources	0	480	0	480
Recreation	480	14,106	0	14,586
Pryor Mountain Wild Horse Range*	*	*	*	*
Fort Meade Recreation Area*	*	*	*	*
Meeteetse Spires Proposed ACEC*	*	*	*	*
Powder River Breaks Bighorn Sheep Range*	*	*	*	*
Major Stipulation Totals	128,223	1,438,443	33,297	1,599,963
MINOR STIPULATIONS				
Timing				
Crucial Winter Range	56,267	159,138	26,876	242,281
Elk Spring Calving Range	1,612	2,244	0	3,856
Grouse Nesting Zones	5,667	176,921	0	182,588
Powder River Breaks Bighorn Sheep Range*	*	*	*	*
Raptor Nests*	*	*	*	*
Subtotals	63,546	338,303	26,876	428,725
Controlled Surface Use				
Visual Resource Management	19,006	304,626	1,280	324,912
Black-footed Ferret Reintroduction Areas*	*	*	*	*
Potential Black-footed Ferret Habitat*	*	*	*	*
Soils*	*	*	*	*
Subtotals	19,006	304,626	1,280	324,912
Minor Stipulation Totals	82,552	642,929	28,156	753,637
GRAND TOTAL	210,775	2,081,372	61,453	2,353,600
Net Total of overlapping stipulations				1,860,370
Total Federal oil and gas estate				4,670,219
Approximate percentage of acres stipulated				40%
NO LEASE (Discretionary closures)				
Pryor Mountain Wild Horse Range	0	0	11,500	11,500
Fort Meade Recreation Area	0	2,139	4,490	6,629
Rosebud Battlefield	0	897	0	897
Dryhead Overlook	0	0	480	480
Powder River Breaks Bighorn Sheep Range	0	13,626	0	13,626
Meeteetse Spires Proposed ACEC	0	960	0	960
Totals	0	17,622	16,470	34,092

*Stipulation changes category in some alternatives.

TABLE 4.7 STIPULATED ACRES FOR ALTERNATIVE C

	Development Potential			
	High	**Moderate**	**Low**	**Total Acres**
MAJOR STIPULATIONS				
No Surface Occupancy				
Coal	0	18,865	0	18,865
Riparian/Hydrology	0	23,007	1,329	24,336
Soils*	*	*	*	*
Grouse Leks	0	2,581	0	2,581
Raptor Nests*	*	*	*	*
Fisheries	0	1,844	0	1,844
Black-footed Ferret Reintroduction Areas*	*	*	*	*
Potential Black-footed Ferret Habitat*	*	*	*	*
Bald Eagle Nest Sites	36	2,437	0	2,473
Peregrine Falcon	0	661	0	661
Ferruginous Hawk	1,614	9,189	0	10,803
Piping Plover	0	0	0	0
Interior Least Tern	0	0	0	0
Cultural Resources	165	11,699	1,960	13,824
Paleontological Resources	0	480	0	480
Recreation	0	14,106	0	14,106
Pryor Mountain Wild Horse Range*	0	0	11,500	11,500
Fort Meade Recreation Area*	0	2,139	4,490	6,629
Meeteetse Spires Proposed ACEC*	0	960	0	960
Powder River Breaks Bighorn Sheep Range*	*	*	*	*
Major Stipulation Totals	1,815	87,968	19,279	109,062
MINOR STIPULATIONS				
Timing				
Crucial Winter Range	0	159,138	26,876	186,014
Elk Spring Calving Range	0	2,244	0	2,244
Grouse Nesting Zones	0	176,921	0	176,921
Powder River Breaks Bighorn Sheep Range*	0	13,626	0	13,626
Raptor Nests*	0	56,434	0	56,434
Subtotals	0	408,363	26,876	435,239
Controlled Surface Use				
Visual Resource Management	0	304,626	1,280	305,906
Black-footed Ferret Reintroduction Areas*	1,589	134,924	0	136,513
Potential Black-footed Ferret Habitat*	1,856	11,290	440	13,586
Soils*	*	*	*	*
Subtotal	3,445	450,840	1,720	456,005
Minor Stipulation Totals	3,445	859,203	28,596	891,244
GRAND TOTAL	5,260	947,171	47,875	1,000,306
Net Total of overlapping stipulations				861,000
Total Federal oil and gas estate				4,670,219
Approximate percentage of acres stipulated				18%
NO LEASE (Discretionary closures)				
Pryor Mountain Wild Horse Range	*	*	*	*
Fort Meade Recreation Area	*	*	*	*
Rosebud Battlefield	*	*	*	*
Dryhead Overlook	*	*	*	*
Powder River Breaks Bighorn Sheep Range	*	*	*	*
Meeteetse Spires Proposed ACEC	*	*	*	*
Totals	*	*	*	*

*Stipulation changes category in some alternatives.

TABLE 4.8 STIPULATED ACRES FOR ALTERNATIVE D, THE PREFERRED

	Development Potential			
	High	**Moderate**	**Low**	**Total Acres**
MAJOR STIPULATIONS				
No Surface Occupancy				
Coal	0	18,865	0	18,865
Riparian/Hydrology	4,332	23,007	1,329	28,668
Soils*	*	*	*	*
Grouse Leks	0	2,581	0	2,581
Raptor Nests*	*	*	*	*
Fisheries	0	1,844	0	1,844
Black-footed Ferret Reintroduction Areas*	*	*	*	*
Potential Black-footed Ferret Habitat*	*	*	*	*
Bald Eagle Nest Sites	36	2,437	0	2,473
Peregrine Falcon	0	661	0	661
Ferruginous Hawk	1,614	9,189	0	10,803
Piping Plover	0	0	0	0
Interior Least Tern	0	0	0	0
Cultural Resources	165	11,699	1,960	13,824
Paleontological Resources	0	480	0	480
Recreation	480	14,106	0	14,586
Pryor Mountain Wild Horse Range*	*	*	*	*
Fort Meade Recreation Area*	*	*	*	*
Meeteetse Spires Proposed ACEC*	*	*	*	*
Powder River Breaks Bighorn Sheep Range*	0	13,626	0	13,626
Major Stipulation Totals	6,627	98,495	3,289	108,411
MINOR STIPULATIONS				
Timing				
Crucial Winter Range	56,267	159,138	26,876	242,281
Elk Spring Calving Range	1,612	2,244	0	3,856
Grouse Nesting Zones	5,667	176,921	0	182,588
Powder River Breaks Bighorn Sheep Range*	*	*	*	*
Raptor Nests*	430	56,434	0	56,864
Subtotals	63,976	394,737	26,876	485,589
Controlled Surface Use				
Visual Resource Management	513	304,626	1,280	306,419
Black-footed Ferret Reintroduction Areas*	1,589	134,924	0	136,513
Potential Black-footed Ferret Habitat*	1,856	11,290	440	13,586
Soils*	38,811	1,151,823	30,048	1,220,682
Subtotals	42,769	1,602,663	31,768	1,677,200
Minor Stipulation Totals	106,745	1,997,400	58,644	2,162,789
GRAND TOTAL	113,372	2,095,895	61,933	2,271,200
Net Total of overlapping stipulations				1,769,760
Total Federal oil and gas estate				4,670,219
Approximate percentage of acres stipulated				38%
NO LEASE (Discretionary closures)				
Pryor Mountain Wild Horse Range	0	0	11,500	11,500
Fort Meade Recreation Area	0	2,139	4,490	6,629
Rosebud Battlefield	*	*	*	*
Dryhead Overlook	*	*	*	*
Powder River Breaks Bighorn Sheep Range	*	*	*	*
Meeteetse Spires Proposed ACEC	0	960	0	960
Totals	0	3,099	15,990	19,089

*Stipulation changes category in some alternatives.

AIR QUALITY

Oil and gas activities affecting air quality are primarily short-term in nature and very localized. They include geophysical prospecting, construction of access roads and well pads, well drilling and workovers, blowouts, gas line ruptures, flaring and venting of associated gas, well maintenance, and routine production operations. These activities in this planning area occur within Prevention of Significant Deterioration (PSD) Class III areas and unclassified areas. No significant degradation of air quality in PSD Class I areas is anticipated from Federal oil and gas operations. A more detailed discussion of air quality impacts is presented in Appendix D.

ALTERNATIVE A

Well Pad and Access Road Construction

Primary exhaust emissions are carbon monoxide, carbon dioxide, particulate matter, volatile compounds (VOCs), sulfur dioxide and nitrogen oxides. These pollutants are expected to be transient in nature and will not exceed Federal, Montana, and South Dakota ambient air quality standards.

Approximately 630 Federal wells would be drilled, of which 246 may be producers and 384 may be dry holes. These wells would cause approximately 2,447 acres of surface disturbance. Average fugitive (airborne) dust associated with well pad and access road construction is predicted to be approximately 1.2 tons per well. This is well below the State of Montana threshold which is 25 tons/year per well (USDI BLM, 1990b and USDI-USDA, 1983a).

Drilling

Exhaust emissions from drilling and workover operations are not expected to exceed Montana and Federal point source air quality permit levels (25 and 40 tons/year respectively). Appendix D, Illustration D-5 lists the ranges of emissions anticipated from drilling engines and associated equipment based on duration of drilling and horsepower of engines used.

Blowouts and Gas Line Ruptures

Records for the State of Montana indicate that the probability of a blowout is extremely small (MBOGC, 1989a). Should a blowout happen, short term emissions of hydrogen sulfide and natural gas might occur. Gas line ruptures would be shut off within minutes to hours. If hydrogen sulfide gas were to be released during the blowout, the well would be ignited, oxidizing the gas to non-flammable sulfur dioxide (API, 1987b). Although extremely hazardous conditions might exist in the immediate area, these conditions would be of short duration. No serious impacts to air quality are expected.

Venting and Flaring

The State of Montana requires all non-recoverable gas containing more than 20 parts per million hydrogen sulfide to be flared. Venting of sweet gas is estimated to be in relatively small volumes (2 to 5 MCF per day) and will result in only a slight degradation of air quality in the immediate area of the vent stack. South Dakota allows no venting of natural gas without flaring.

BLM forecasts 4 additional producing/gas flaring wells in the next 15 years averaging approximately 2 tons/year per well of sulfur dioxide produced. There is a high probability that none of these wells will exceed state air quality permit levels. No wells are expected to exceed Federal air quality permit levels for point sources (40 tons/year sulfur dioxide). Within the planning area, there are currently 11 existing hydrogen sulfide producing wells (all in the South Dakota Resource Area) which produce a combined total of approximately 22 tons/year of sulfur dioxide from flaring. BLM predicts that 2 of these wells will be abandoned in the next 15 years (average loss of 2 tons/year per well of sulfur dioxide). Therefore, a total net increase of 4 tons/year of sulfur dioxide from flaring is estimated for the planning area over the next 15 years. It is probable that virtually all of the hydrogen sulfide wells which will be drilled over the next 15 years will be located in the South Dakota Resource Area.

Production Operations

The volume of air pollution generated over the life of an oil or gas well depends on the physical and chemical properties of the product and the production practices used. Oil and gas wells that produce hydrogen sulfide are termed “sour wells”; wells that do not are classified as “sweet wells”. Appendix D, Illustration D-6, lists common air pollutants and sources for wells that produce oil, gas, or both.

Combustion of small volumes of natural gas/propane in heater/treaters associated with production operations will slightly degrade air quality at that specific location.

Emissions are not expected to exceed Federal and state standards for individual wells (Appendix D, Illustration D-1).

Cumulative Air Quality Impacts

Current oil and gas activity, combined with projected development over the next 15 years, will result in cumulative impacts to air quality in small, localized areas. This projection is based on results from the Williston Basin Regional Air Quality Study. This study addresses air quality impacts in the North Dakota portion of the Williston Basin, but is sufficiently close to the hydrogen sulfide wells in the planning area.

Cumulative air quality impacts from other oil and gas related activities are not to exceed Federal and state standards.

ALTERNATIVE B

Impacts to air quality should be slightly less than in Alternative A. There are 598 Federal wells projected to be drilled over 15 years. This amounts to 32 fewer wells than shown in Alternative A over a 15 year period.

ALTERNATIVE C

The impacts in Alternative C are the same as A.

ALTERNATIVE D

The impacts in Alternative D are the same as A.

CONCLUSION

Air quality effects within the planning area are projected to be very consistent for the four alternatives. No significant air quality degradation is expected from any of the alternatives. There are 630 drilled wells projected for Alternatives A, C and D compared to 598 wells for Alternative B. These projections represent an area-wide variation of fewer than two wells per year. Based on potential air quality impacts, the four alternatives are essentially equal.

GEOLOGY AND MINERALS

Oil and Gas

Activities associated with oil and gas leases include exploration, development, production and abandonment operations. A description of each of these specific operations is contained in Appendix A. In contrast to these oil and gas activities, geophysical operations may be conducted with or without an oil and gas lease.

Leases are issued with restrictions to lease operations in the form of terms of the lease or additional stipulations. The restrictions can dictate the location, timing, or design of lease operations to reduce conflicts with the other resources or land uses.

ALTERNATIVE A

This alternative makes available for leasing 4,629,126 acres of Federal oil and gas estate in the planning area. All Federal acreage is available for potential exploration and development, and protection from drainage by offlease wells except in WSAs. In Alternative A, oil and gas leases in the planning area are issued with standard stipulations and additional special stipulations when necessary. The lease stipulations provide protection to other resources and land uses by modification to siting or design of facilities, or timing of operations. Special stipulations must conform to leasing decisions in an existing land use plan. In areas inaccessible to drilling, any oil and gas resources would remain in place, and geologic information normally obtained by drilling would not be available.

In this alternative, 630 Federal wells are projected for drilling in the next 15 years, and a total of 2,447 acres would be disturbed by construction of access roads, well pads and production facilities.

In the short term, a producing oil or gas well removes a portion of the oil and gas reserves. With current technology, an oil well is capable of removing approximately 30 percent of the reserves and a gas well is capable of removing approximately 80 percent of the reserves.

In the long term, production of oil and gas can be extended or increased by enhanced recovery methods. With current technology, enhanced recovery methods can increase production to recover approximately 65 percent of oil reserves and 90 percent of gas reserves.

Production or drainage of the oil and gas results in the irreversible and irretrievable loss of these resources. Produced water associated with oil and gas production may or may not be an irreversible or irretrievable loss. The produced water may be used for beneficial purposes or used in an enhanced recovery method. Most, if not all, surface disturbance and use will be restored through proper reclamation techniques.

ALTERNATIVE B

This alternative offers 4,595,034 acres of Federal oil and gas estate for lease and excludes leasing on 75,185 acres of no leasing. The coal resource, under approved mining plans, covers 18,865 acres with a No Surface Occupancy

stipulation. An additional 1,841,505 acres are covered by other resource stipulations. This leaves approximately 2,734,664 acres available for leasing with the application of lease terms.

In areas inaccessible to drilling, any oil and gas resources would remain in place and geologic information normally obtained by drilling would not be available. Closing areas to oil and gas leasing would prohibit the identification, exploration and development of oil and gas resources. Knowledge gained by drilling would be foregone and Federal revenues would be lost. Areas without a lease could not be protected from drainage, but the Federal government could be reimbursed if a Compensatory Royalty Agreement could be reached with the offending lessee. Areas closed to leasing could hinder orderly field development.

In this alternative 598 Federal wells are projected for drilling during the next 15 years which would disturb a total of 2,322 acres. Areas disturbed include acres for access roads, well pads, and production facilities.

The impacts in the short and long term, and for production or drainage, are the same as Alternative A.

ALTERNATIVE C

This alternative makes leasing available on 4,629,126 acres in the planning area with 41,093 acres closed to leasing; 861,000 acres leased with No Surface Occupancy, Timing, and Controlled Surface Use stipulations. Approximately 3,768,126 acres would be leased with only lease terms and no stipulations. Impacts from wells drilled, access roads, well pads and production facilities are the same as A.

The impacts in the short and long term, and for production or drainage, are the same as Alternative A.

ALTERNATIVE D

This alternative makes available for leasing 4,610,037 acres in the planning area with 60,182 acres closed to leasing. There are approximately 1,769,760 acres with No Surface Occupancy, Timing, and Controlled Surface Use stipulations. This leaves approximately 2,840,277 acres leased with lease terms only and no stipulations applied. Impacts from wells drilled, access roads, well pads and production facilities are the same as A.

The impacts in the short and long term, and for production or drainage, are the same as Alternative A.

CONCLUSION

Leases issued with lease terms only would provide the fewest restrictions to lease operations and the best opportunities for protection of Federal leases from drainage by offlease wells. Leases issued with stipulations would provide the most restrictions to lease operations, and less protection of Federal leases from drainage by offlease wells. In comparison, lease stipulations could decrease the value of the lease because of more, or greater, restrictions which could result in higher operating costs.

Areas closed to leasing or areas closed to lease operations because of contiguous No Surface Occupancy stipulations would preclude any oil and gas activities, but would not provide the opportunity for protection of drainage; however, reimbursement could occur by execution of a Compensatory Agreement. These same areas also would limit the opportunity to gain subsurface knowledge from drilling.

Coalbed Methane

Anticipated low levels of coalbed methane exploration and development fall within the number of total oil and gas wells projected for the area in the RFD analysis. No significant impacts would occur under any of the four alternatives.

Coal

A No Surface Occupancy stipulation on lands with existing coal leases and approved mine plans requires agreement between affected parties before oil and gas operations can occur. Enforcement of this stipulation would prevent impacts to coal operations until they are completed. No significant impacts would occur under any of the four alternatives.

Other Minerals

Mineral materials and locatable mineral deposits sometimes occur on the same lands as Federally-owned oil and gas. Provisions of the Multiple Mineral Development Act, P.L. 83-585, establish the priority for developing these resources. The enforcement of this statute would eliminate or mitigate any potential impacts from oil and gas development on mineral materials or locatable minerals. Therefore, no significant impacts would occur under any of the four alternatives.

HYDROLOGY

Water resources can be affected by drilling operations or construction activities. If the wells are developed, pipelines may be installed or roads upgraded for oil haul trucks. Storage tanks, utility stations, and maintenance facilities may be required. Injection wells may be drilled for waste water disposal. Areas disturbed for site construction may add to sediment loads in runoff and change infiltration rates and water quality. These effects could continue for the life of the well site. Once wells are abandoned, they are plugged with cement to prevent fluid movement up and down the casing. Improvements and roads are removed and the area is reseeded.

The EPA requires protection of Underground Sources of Drinking Water (USDWs) which have less than 10,000 TDS and could be used for human consumption.

The drilling program is designed to protect useable USDWs from contamination by drilling operations. The States of Montana and South Dakota both require the use of fresh water muds while drilling the portion of the well through the USDWs. Both states also require setting surface casing past the deepest USDW into a competent clay formation. The surface casing is then cemented in place. A cement bond log may be required to verify the integrity of the cement.

The plugging program is designed to secure the well bore and prevent contamination to mineral or water bearing formations. Cement is pumped into the well bore to seal any perforations. Cement is also pumped into the well bore at certain formations to act as plugs to prevent migration of any fluids that might enter the well bore.

In many alluvial areas, woody vegetation helps to maintain a ground water level that prevents migration of salts upward from shallow water tables. Removal of woody vegetation reduces this effect and increases the likelihood of saline seeps. Removal of woody vegetation and alteration of the soil surface in or near stream channels can change channel stability. This would result in stream channel erosion and movement. Saline seeps and stream channel changes are long term effects. There is a potential for contamination of alluvial aquifers from the accidental release of fluids from reserve pits, storage pits, tanks, pipelines, and wells.

Stipulations among various alternatives offer some protection from the possibility of ruptured flow lines. The planning area averages approximately 10 ruptured flow lines per month with most occurring in the Bell Creek field. Approximately 95 percent of these ruptures result in minor spills with the loss of less than 100 barrels of fluid per spill.

Fluids from flow line ruptures are usually controlled and contained within 4 to 12 hours after the rupture occurs. Fluids rarely reach groundwater because of the depth of the groundwater and the overlying geologic formation. If spilled fluids are not quickly contained they could reach surface waters, but this rarely happens due to the natural surface features and the distance of flow lines to surface waters. The natural surface features act as barriers or artificial barriers used in control and clean up procedures.

There are no National Wild and Scenic Rivers in the planning area. The following rivers/streams in the planning area are listed in the Natural Rivers Inventory (The Nationwide Rivers Inventory, NPS, USDI, January, 1982) as potential wild and scenic river candidates: James, Little Minnesota, North Fork Whetstone, Big Sioux, Belle Fourche, Cheyenne, Missouri, White, French and Little Spearfish.

ALTERNATIVE A

This alternative offers protection to the water resources. The number of acres unprotected is reduced because each lease can be evaluated against the known locations of the water resources within the planning area and sites can be moved to give a buffer for protection of the resource.

These restrictions prevent site development near major streams and in areas along the smaller streams or near other bodies of water. This alternative does not protect the complete width of the alluvium of some of the larger rivers. An estimated 10,000 acres of land having unconfined water tables associated with alluvium are not protected by the hydrologic restrictions of the current Oil and Gas Lease Stipulations, MT-3109-1. Water resources on 41,093 acres of land within WSAs are protected from surface disturbance by a No Leasing decision.

ALTERNATIVE B

The No Surface Occupancy stipulation for riparian areas, 100 year floodplains, and water bodies affects 28,668 acres of land along the major drainages. It also allows movement of the site to protect upland drainages. A No Leasing decision on 75,185 acres of land in WSAs, the Pryor Mountains Wild Horse Range, the Meeteetse Spires area, the Fort Meade Military Reservation, and the Powder River Breaks Big Horn Sheep Range benefits water resources. An additional 1,831,702 acres of land, mostly in the uplands, are stipulated for No Surface Occupancy to protect other resources; this also benefits the water resources.

ALTERNATIVE C

The No Surface Occupancy stipulation for riparian areas, 100 year floodplains, and water bodies in moderate and low oil and gas potential areas affects 24,336 acres of land. A No

Lease decision on 41,093 acres of land in WSAs benefits water resources.

ALTERNATIVE D

The No Surface Occupancy stipulation for riparian areas, 100 year floodplains, and water bodies affects 28,668 acres of land. There are also 1,741,092 acres of No Surface Occupancy, Timing, and Controlled Surface Use stipulations for other resources which would benefit water resources.

A No Leasing decision on 60,182 acres of land in WSAs, the Pryor Mountain Wild Horse Range, the Meeteetse Spires area, and the Fort Meade Military Reservation benefits water resources by preventing surface disturbance from oil and gas operations.

CONCLUSION

None of the alternatives prevent the construction of flow lines. They are a potential source of pollution to the water resource. Flow lines are monitored and most ruptures are detected and controlled within 4 to 12 hours. Approximately 95 percent of these ruptures are considered minor with a loss of fewer than 100 barrels of produced water or petroleum products. Impacts from major ruptures are infrequent and scattered, thus causing significant localized impacts to both surface and ground water. These impacts are short term.

There would be no impacts to potential wild and scenic river candidates. They would be protected from oil and gas development activities under the No Surface Occupancy stipulation for Riparian/Hydrology in Alternatives B, C, and D and by Lease Form 3100-11, Section 6 under Alternative A. Occupancy and use would be prohibited within riparian areas, 100-year flood plains of major rivers and on water bodies and streams.

HAZARDOUS MATERIALS

Occasional spills or releases of hazardous materials from flow lines, reserve pits, or storage areas may degrade surface or ground water or soils. The potential for surface water degradation is greatest immediately adjacent to the water body, whereas the ground water degradation is greatest where water tables are high, typically over alluvial aquifers adjacent to streams. The potential for spills and releases is equal under all alternatives.

Reserve pits in Montana may be required to be lined based upon site conditions; however, it is not a BLM or state requirement to line each reserve pit. The State of South Dakota requires reserve pits to be lined with a plastic liner unless the requirement is waived by the State. A leak detection or monitoring system may be required for pits.

SOILS

Impacts to soils from oil and gas activities generally occur in several ways: soil compaction, soil disturbance and erosion, and spilling of fluids. These impacts to the soils resource occur throughout exploration, development and production.

Soils disturbed by the building of access roads, drill pads, and pipelines are prone to accelerated erosion because of the removal of protective vegetation and litter cover during construction activities. This protective cover binds the soil, provides desirable surface texture for infiltration of water and air, and protects the surface from compaction by raindrops and wind erosion. Wind and water erosion on bare soil surfaces cause more sedimentation offsite, creating additional soil cover damage and further increasing erosion. The total effect on erosion rates is significant where surface disturbances occur on slopes greater than 30 percent and in areas of nonproductive soils. However, adverse impacts could be moderate overall. Soil losses would be more severe if the topsoil were not stockpiled during construction for later use. Impacts would be greatest on shallow soils of low productivity and on soils on moderately sloping to steep landscapes.

The use of off-road vehicles and heavy equipment will cause soil compaction which will lead to increased surface runoff and subsequent erosion. Effects will be most severe when off-road vehicles and heavy equipment are used during moist and wet soils conditions.

Impacts to soils also may occur from oil spills and from the discharge of salt water from wells, flow lines, storage tanks and treaters. These fluids can affect the soils severely in a relatively localized area. Toxic and saline concentrations from the spilled fluids are capable of sterilizing the soil.

Other impacts include improperly lined or unlined reserve pits or improper reclamation of these pits after the drilling phase. Some of the drilling fluids that are expended into the reserve pits are high in sodium salts. These brine solutions could reduce the productivity of the soils around the reserve pit and within the profile of the reserve pit itself after reclamation. The brine solution affects the soil by migrating vertically and horizontally through the soil profile adjacent to the reserve pit. Contamination of the soil and possible contamination of shallow ground-water aquifers can be minimized by utilizing a liner in all pits, by pumping and

drying the fluids, by using newer forms of pit reclamation (solidification), and by proper backfilling of the pit.

ALTERNATIVE A

Oil and Gas Lease Stipulations under this alternative affect 1,299,592 acres. There are two main stipulations.

Erosion control: This stipulation can prohibit surface disturbing activities during muddy or wet soil periods. By prohibiting surface disturbance activities when the soils are wet or muddy, soil compaction and erosion are minimized. This can have a direct bearing on the eventual success of the reclamation plan as severely eroded or compacted soils can be difficult to reclaim. Soil erosion also can affect offsite and downstream areas through sedimentation.

Controlled or Limited Surface Use stipulation: This stipulation allows for controlled or limited surface use including exclusion of surface use or occupancy. Specifically for soils, this targets slopes exceeding 30 percent, or 20 percent on extremely erodible or slumping soils.

Drill site development which includes drill pad, reserve pit, earthen pit, roads, surface facilities, pipelines, powerlines, herbicide use, and all other miscellaneous items results in a disturbance of 2,447 acres from drill site development of 630 wells. This results in an increase in soil erosion and compaction on this acreage while these wells and roads are active. These impacts may persist, at least in the short term.

For the most part, these standard stipulations, combined with a well developed and approved surface use plan, will mitigate most soil disturbances and related erosion within 25 years. Exceptions may be sites with severe characteristics (slope, physical and chemical nature of the soils) or sites where massive oil or salt water spills have occurred. Salt water has a more persistent and detrimental effect on soil productivity, especially when immediate mitigative measures are not followed for cleanup. There may be some irretrievable loss of soil through erosion as a result of surface disturbance, but this can be minimized with a well developed and approved surface use plan.

ALTERNATIVE B

The No Surface Occupancy stipulation for soils under this alternative would apply to 1,299,592 acres on slopes greater than 30 percent. Stipulations for other resources and the No Lease decision in this alternative would protect soils on an additional 635,963 acres from disturbance due to oil and gas activity.

Drill site development which includes drill pad, reserve pit, earthen pit, roads, surface facilities, pipelines, powerlines, herbicide use, and all other miscellaneous items results in a disturbance of 2,322 acres from drill site development of 598 wells. This results in an increase in soil erosion and compaction on this acreage while these wells and roads are active. These impacts may persist, at least in the short term, after the roads are no longer active and until fully successful rehabilitation is attained.

In the short and long term, with the No Surface Occupancy stipulation for steep slopes, there may be no accelerated soil erosion, compaction or sedimentation occurring as a result of using heavy equipment through all phases of oil and gas development. Areas other than the steep slopes may suffer some erosion, however, and there would be some irretrievable loss of soil.

ALTERNATIVE C

The application of Lease Terms applies to 3,768,126 acres and provides minimal protection for the soils resource from oil and gas development activities. No Surface Occupancy, No Lease, Timing and Controlled Surface Use restrictions provide protection to the soils resource from oil and gas activity on 861,000 acres. Impacts on drillsite development of 630 wells are the same as shown in Alternative A.

In the short and long term, Lease Terms provide for minimal protection of the soils resource from oil and gas activities for a defined area on the ground. There may be some irretrievable loss of soil through erosion as long as surface disturbing activities are taking place.

ALTERNATIVE D

The Controlled Surface Use stipulation for soils would cover approximately 1,220,682 acres, with an additional 549,078 being protected by other resource stipulations. Impacts on drill site development of 630 wells are the same as Alternative A.

In the short and long term, the Controlled Surface Use stipulation provides for mitigation of most of the impacts to the soils resource.

CONCLUSION

Increased soil disturbance, erosion, compaction and sedimentation will occur primarily in the short term (less than 25 years) and decline naturally due to stabilization and revegetation. Soil productivity should recover, also, within a similar timeframe. Some of the steep areas, densely

compacted soils, low productivity soils and soils affected by fluid spills will require more extensive and aggressive reclamation techniques and a longer time period to restore the soil productivity.

Most long term impacts to the soils resource result from incomplete onsite analysis and reclamation plan development prior to oil and gas activities. Even with a thoroughly developed reclamation plan, there will be some irretrievable loss of soil through erosion. Oil spills have negative short term impacts on soils and vegetation, but biodegrade naturally with time so do not result in serious long term soil problems. Saltwater spills can have more serious negative, long term effects because of the chemical nature of salt water and its effects on plant growth and soils. There is a possibility of localized, severe erosion due to loss of vegetation by oil or saltwater spills. These spills may flow downslope into drainages and affect areas offsite from the spill. Long term impacts to soil can result from unlined and improperly reclaimed reserve pits. New techniques are currently being applied that result in more effective reclamation of these pits.

Prime Farmland

If prime farmland exists on Federal surface where an oil and gas development is proposed, the same type of reclamation plan is developed for it as with all such proposals. A difference would be that more topsoil probably would be available for reclamation purposes on a prime farmland site and would be identified in the reclamation plan prior to development.

If the site proposed for development is private surface, then the reclamation plan would be developed in consultation with and according to the wishes of the private land owner. Most likely, the reclamation plan on Federal versus private surface would be very similar.

There are no prime farmlands known to exist on the Federal surface. Privately-owned prime farmlands over Federal oil and gas acres that are impacted by roads or site development would be reclaimed in accordance with consultation with the private surface owner. This situation would be same for all alternatives.

VEGETATION

ALTERNATIVE A

Impacts to vegetation include a loss of that vegetation as a result of drill-site development which includes pad, reserve pit, earthen pit, roads, surface facilities, pipelines, powerlines, and herbicide use. It would result in disturbance of 2,447 acres.

Conditions of Approval for the APD state that “It is the responsibility of the operator to control noxious weeds on lands disturbed in association with oil and gas lease operations. Lease-associated weed control strategies, when required by the Bureau of Land Management (BLM), are to be coordinated with any involved surface owners and local weed control boards. A pesticide-use proposal must be prepared, and then be reviewed and approved by the BLM, prior to any herbicide application on lands disturbed by federal oil and gas lease operations. A pesticide application record must be completed within 24 hours after completion of application of herbicides.”

Noxious weed species are highly competitive and dominate plant communities very rapidly. The spread of noxious weeds would have a negative impact upon vegetative composition. This negative impact could be both short and long term depending upon the effectiveness and timing of control measures. Certified seed, free of noxious weed seed, would be required for reclamation.

Threatened and Endangered Plants and Species of Special Concern

Under all alternatives, leased lands would be examined prior to surface disturbing activities to determine the effects upon plant species protected by the Endangered Species Act of 1973. The findings of this examination may result in some restrictions to the operator’s plan or even disallow use and occupancy that would be in violation of the ESA.

ALTERNATIVE B

The impacts in Alternative B are the same as A, except 2,322 acres would be disturbed.

ALTERNATIVE C

The impacts in Alternative C are the same as A.

ALTERNATIVE D

The impacts in Alternative D are the same as A.

CONCLUSION

The overall impacts to vegetation are insignificant for all alternatives.

LANDS AND LAND USES

Land Use Authorizations are established by the provisions of a variety of regulations and laws. These uses include rights-of-way, leases, permits, conservation easements, and Recreation and Public Purpose leases and patents.

No impacts are expected to facilities, improvements or tracts of land permitted through Land Use Authorizations in the planning area. A Lease Notice placed on all oil and gas leases which have Land Use Authorizations would avoid potential conflicts between authorized land uses and other resource uses. The Lease Notice gives the lessee additional information so that operations can be planned to avoid the areas where destruction of or interference with authorized surface uses may occur. This situation is applicable to all alternatives.

Livestock Grazing

ALTERNATIVE A

Impacts to livestock grazing would include a loss of forage as a result of drill-site development which includes pad, reserve pit, earthen pit, roads, surface facilities, pipelines, powerlines, and herbicide use. It would result in a disturbance of 2,447 acres and a temporary loss of 490 AUMs in a worst case situation. While roads, trails, and well pads may block traditional cattle trails, this road network provides livestock producers with improved access to remote livestock facilities and grazing areas. The short term loss of 490 AUMs occurring from oil and gas activities would be considered a minor impact to grazing management.

ALTERNATIVE B

Impacts to livestock grazing would include a loss of forage as a result of drill-site development which includes pad, reserve pit, earthen pit, roads, surface facilities, pipelines, powerlines, and herbicide use. It would disturb 2,322 acres and there would be a temporary loss of 464 AUMs in a worst case situation. The short term loss of 464 AUMs occurring from oil and gas activities would be considered a minor impact to grazing management.

ALTERNATIVE C

The impacts in Alternative C are the same as A.

ALTERNATIVE D

The impacts in Alternative D are the same as A.

CONCLUSION

The overall impacts of the oil and gas program would be insignificant to livestock grazing.

Cropland

There are no significant impacts to croplands for all alternatives.

Special Land Use Areas

Pryor Mountain Wild Horse Range

There are no oil and gas leases in the Pryor Mountain Wild Horse Range. Approximately 20,135 acres of the Pryor Mountain Wild Horse Range are covered by the No Lease decision for the three WSAs. Approximately 11,500 acres are covered by the No Surface Occupancy stipulation for Alternatives A and C. These 11,500 acres are protected by the No Lease decision for Alternatives B and D. Therefore, no significant impacts are anticipated for any alternative for the Pryor Mountain Wild Horse Range.

Fort Meade Recreation Area

There are no oil and gas leases on Fort Meade. Under Alternatives A and C, it is protected by No Surface Occupancy stipulations. Under Alternatives B and D, it is covered by the No Lease decision. Therefore, there are no anticipated impacts from oil and gas leasing, for all alternatives, on the Fort Meade Recreation Area.

Meeteetse Spires Proposed ACEC

The Meeteetse Spires Area is currently leased. Both of these leases will expire by 1996 unless extended by production or agreement. Under all alternatives, drilling could occur on the 960 acres until leases expire; however, all Threatened and Endangered plant species would be protected by a survey prior to drilling as would be required in the approval of an APD. Scenic values could be impacted while current leases are in effect. If the ACEC is approved, the area would not be leased after current lease expiration for Alternatives B and D. For Alternative C, the area would be available for leasing, after current lease expiration, with a No Surface Occupancy stipulation.

Weatherman Draw Proposed ACEC

Approximately 1,890 acres of the 2,250 acres in Weatherman Draw are currently leased. Under all alternatives, drilling could occur. However, under the Archeological Resources Protection Act (ARPA) all cultural resources would be protected by requiring use of the No Surface Occupancy stipulation during the APD approval process. Therefore, no significant impacts are anticipated on this proposed ACEC.

WILDLIFE

The BLM has coordinated with the U.S. Fish and Wildlife Service (USFWS) in the preparation of protective measures for Threatened and Endangered Species as required by the Endangered Species Act (ESA). Based on this consultation, a biological assessment was prepared by the BLM for the project and is included in the document as Appendix F. The Biological Opinion issued by the USFWS assessing the effects on the Threatened and Endangered Species in the planning area is also found in Appendix F.

ALTERNATIVE A

Threatened and Endangered Animals and Species of Special Concern

This alternative protects approximately 153,584 acres of identified, occupied or potential habitat for the black-footed ferret, interior least tern, piping plover, peregrine falcon, bald eagle, and a candidate species, the ferruginous hawk, primarily through No Surface Occupancy restrictions. No Surface Occupancy would be allowed within one quarter of a mile of identified essential habitat of state and Federally identified sensitive species. Under this alternative, unstipulated leased land would be examined prior to surface disturbing activities to determine effects upon plant and animal species protected by the Endangered Species Act of 1973. The black-footed ferret habitat (prairie dog towns) of 80 acres or more in size is subject to a Controlled Surface Use stipulation. This stipulation requires a black-footed ferret survey before the identified area can be cleared for any type of oil and gas activities. This stipulation is in conformance with guidelines established in the "Draft Guidelines for Oil and Gas Activities in Prairie Dog Ecosystems Managed for Black-footed Ferret Recovery" by the U.S. Fish and Wildlife Service (1990) for the management of potential black-footed ferret habitat. As a result of this alternative the affected species would experience minimal stress in key habitats. This would enhance reproduction and survival of the species.

Under all alternatives, leased land would be examined prior to surface disturbing activities to determine the effects upon animal species protected by the ESA. The findings of this examination may result in some restrictions to the operator's plan or even disallow use and occupancy that would be in violation of the ESA.

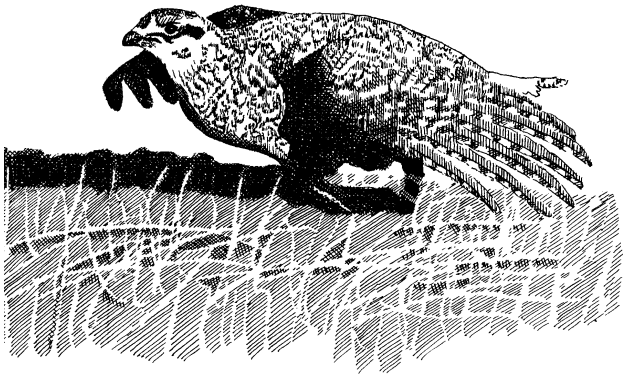
Raptors

A number of raptors of special concern that are not discussed under Threatened and Endangered Species have their nesting habitats protected under this alternative. Approximately 15,000 acres would be protected.

Big Game And Upland Birds

Identified big game and crucial winter ranges on approximately 242,281 acres are protected by a Timing stipulation that precludes surface occupancy from December 1 through May 15 annually. Elk calving areas of approximately 3,856 acres are protected from May 1 through June 30 annually.

Sharp-tailed grouse and sage grouse leks are protected by an NSO stipulation that precludes surface occupancy within 500 feet of the lek. Important nesting areas are protected from March 1 to June 30 (Timing stipulation). These stipulations would cover approximately 50,370 acres of grouse lek or nesting habitat.



The critical bighorn sheep habitat of approximately 13,626 acres identified in the Powder River Resource Area is protected by an NSO stipulation as identified in a management decision in the Powder River RMP (USDI BLM, 1984b).

Waterfowl

Waterfowl habitat can be protected through the application of lease terms or by using the riparian/hydrology stipulation that provides for NSO on all water bodies.

Surface Disturbance of Habitat

Drill site development which includes pad, reserve pit, earthen pit, roads, surface facilities, pipelines, powerlines, and herbicide use would result in the loss of vegetative food and cover on 2,447 acres.

Fisheries

The fisheries reservoirs, on approximately 350 acres, which are on developed recreational areas or in areas receiving concentrated public use are protected under this alternative by an NSO stipulation that precludes surface occupancy within 500 feet of the reservoirs.

ALTERNATIVE B

Threatened and Endangered Animals and Species of Special Concern

Impacts under Alternative B are the same as A except for potential black-footed ferret habitat. The NSO stipulation in Alternative B was considered to give greater protection than the guidelines established in the "Draft Guidelines for Oil and Gas Activities in Prairie Dog Ecosystems Managed for Black-footed Ferret Recovery" by the U.S. Fish and Wildlife Service (1990). The guidelines by the U.S. Fish and Wildlife Service provide for CSU for black-footed ferret habitat.

Raptors

The habitat of approximately 56,864 acres for raptors of special concern is protected by an NSO stipulation that precludes surface occupancy within one half mile of identified nests. The results of this alternative would enhance reproduction and survival of the affected raptor species.

Big Game and Upland Birds

Impacts under Alternative B are the same as A except for sharp-tailed grouse and sage grouse leks which are protected by an NSO stipulation in this alternative that precludes surface occupancy within one quarter mile of the lek. Nesting areas within 2 miles of a lek are protected from March 1 to June 15 (Timing stipulation). This stipulation protects approximately 185,169 acres.

The critical bighorn sheep habitat identified in the Powder River Resource Area is protected by a No Leasing decision affecting 13,626 acres.

Waterfowl

Impacts under Alternative B are the same as A.

Surface Disturbance of Habitat

Drill-site development could result in disturbance of approximately 2,322 acres of wildlife habitat.

Fisheries

The protection provided for fisheries under this alternative covers approximately 1,844 acres.

ALTERNATIVE C

Threatened and Endangered Animals and Species of Special Concern

Impacts under Alternative C are the same as A.

Raptors

The habitat of approximately 56,434 acres for raptors of special concern is protected by a Timing stipulation that prevents access during the breeding season. This would enhance reproduction and survival of the affected raptor species.

Big Game and Upland Birds

Identified big game crucial winter range of approximately 186,014 acres in the planning area is protected by a stipulation that precludes surface occupancy on these areas from December 1 through March 31 annually. Additionally, identified elk calving areas of about 2,244 acres are protected from occupancy from April 1 through June 15

annually. Under the crucial winter range and elk calving stipulations (Timing), 188,258 acres of big game habitat are protected.

Under this alternative sharp-tailed grouse and sage grouse leks on 2,581 acres are protected by an NSO stipulation that precludes surface occupancy within one quarter mile of the lek. Nesting areas within 2 miles of a lek on 176,921 acres are protected from March 1 to June 15 by a Timing stipulation. These stipulations protect a total of 179,502 acres of grouse leks and nesting areas.

The bighorn sheep habitat covering 13,626 acres also is protected by a Timing stipulation from December 1 through June 30.

Waterfowl

Impacts under Alternative C are the same as A.

Surface Disturbance of Habitat

Impacts under Alternative C are the same as A.

Fisheries

Impacts under Alternative C are the same as B.

ALTERNATIVE D

Threatened and Endangered Animals and Species of Special Concern

Impacts under Alternative D are the same as A.

Raptors

Impacts under Alternative D are the same as C, except that 56,864 acres would be subject to the Timing stipulation.

Big Game and Upland Birds

Impacts under Alternative D are the same as A except for sharp-tailed grouse and sage grouse leks on 2,581 acres which are protected by an NSO stipulation that precludes surface occupancy within one quarter mile of the lek. Nesting areas within 2 miles of a lek on 182,588 acres are protected from March 1 to June 15 by a Timing stipulation. As a result of the above stipulations, key breeding and nesting areas of approximately 185,169 acres are protected.

Waterfowl

Impacts under Alternative D are the same as A.

Surface Disturbance of Habitat

Impacts under Alternative D are the same as A.

Fisheries

Impacts under Alternative D are the same as B.

CONCLUSION

All alternatives adequately protect Threatened and Endangered and sensitive species habitat.

Raptors are adequately protected by all alternatives except A. This is because the distance is increased to one half mile in the stipulation protecting raptors in Alternatives B, C, and D.

Crucial winter range is the same for all alternatives except Alternative C which is reduced by approximately 56,267 acres. Elk calving areas also are reduced under Alternative C by 1,612 acres. The reductions are due to the elimination of all high potential development areas except for T&E and sensitive species habitat.

Alternative B offers the most protection for sharp-tail and sage grouse leks and nesting areas.

Important bighorn sheep habitat is adequately protected by all alternatives.

Waterfowl are adequately protected by all alternatives.

There are no significant impacts from surface disturbance for any alternative.

Fisheries are adequately protected in all alternatives except Alternative A.

There are no irretrievable or irreversible impacts to the wildlife resource.

In the short term the above impacts would occur; however, there are no significant impacts to the wildlife resource in the long term.

CULTURAL RESOURCES

Cultural resources are protected by a combination of laws, regulations, policies, procedures, management practices, and stipulations. The principal authorities are the National Historic Preservation Act of 1966 (NHPA) and the Archaeological Resources Protection Act of 1979 (ARPA). The NHPA establishes procedures for addressing impacts to cultural resources resulting from Federal undertakings, while ARPA establishes definitions, permit requirements, and penalties for unauthorized use. These laws are implemented through regulations at 36 CFR Part 800 and 43 CFR Part 7 which serve as the principal authority for NTL-MSO-85-1. This Notice to Lessee establishes procedures to be followed by the lessee in conducting oil and gas operations and complying with cultural resource obligation under all alternatives.

The effects of BLM decisions on American Indian religious rights and practices must also be considered as mandated by the American Indian Religious Freedom Act of 1978 (AIRFA), the Archeological Resources Protection Act, and the Native American Grave Protection and Repatriation Act of 1990 (NAGPRA).

Under All Alternatives, adherence to the NTL and cultural resource laws and regulations, in most instances, will minimize most anticipated impacts. In all alternatives the combination of Lease Stipulations, Lease Terms, and Lease Notices provide information about the requirements to identify and protect cultural resources and mitigate impacts to them.

ALTERNATIVE A

The application of cultural resource NSO stipulations, in Alternative A, would result in the protection of 20 cultural resource sites on 13,824 acres from surface disturbance due to oil and gas development with 165 of these acres occurring in a high development potential area. The remaining 13,659 acres occur in moderate and low development potential areas. The application of Lease Terms and cultural resource Lease Stipulations, NSO Stipulations and Lease Notices, along with law, regulations, management practices and procedures would also protect cultural sites on all 2,447 acres proposed for disturbance by the 630 wells under this Alternative.

ALTERNATIVE B

Under Alternative B, three cultural resource sites would be considered for No Lease. These include the Rosebud Battlefield (897 acres), Dryhead Overlook site (480 acres) (a site with Native American religious concerns) and Ft. Meade (6,629 acres). A total of 8,006 acres of Federal oil and gas estate would be removed from oil and gas leasing to protect significant cultural resources under this Alterative. None of these areas would be in high development potential zones and impacts to cultural resources are not anticipated in these areas.

The application of cultural resource NSO stipulations would also result in the protection of an additional 17 cultural resource sites on 12,447 acres from surface disturbance due to oil and gas development with 165 of these acres occurring in high development potential areas. The remaining 12,282 acres would be in moderate and low development area. The application of No Lease, Lease Terms, cultural resource NSO Stipulations and Lease Notices, as well as law, regulations, management practices and procedures would protect cultural sites on all 2,322 acres proposed for disturbance by the 598 wells.

ALTERNATIVE C

Impacts under Alternative C are the same as A.

ALTERNATIVE D

Under Alternative D, the application of NSO stipulations and Lease Notices for cultural resources would still be applied in all potential development areas. One cultural resource site, Ft. Meade (6,629 acres), would be considered for No Lease. Fort Meade is not in a high development potential area.

The application of cultural resource NSO stipulations would also result in the protection of an additional 19 cultural resource sites on 13,824 acres form surface disturbance due to oil and gas development with 165 of these acres occurring in high development potential areas. The remaining 13,659 acres would be in moderate and low development areas.

Some sites are important because of their setting or feeling; for instance, the battlefield sites and sites with religious values. These sites derive some of their importance from the setting which plays an important role in the significance of these properties. In these instances, if there were development around the edges of these properties there could be a loss of the values that make these sites significant. Mitigation may not be sufficient to offset impacts from oil and gas development. Consequently, there would be residual impacts from off-site development on the edges of these sites causing disturbance of the site's setting and feeling.

The use of cultural resource lease stipulations and NSO stipulations could concentrate oil and gas activities on unstipulated and non-federal fee mineral areas where cul-

tural resources have little or no protection. This concentration of activities could result in impacts to unprotected cultural resources. Moving oil and gas operations offlease would reduce costs to the operator as concern for cultural resource protection would no longer be required. Moving operations offlease also protects the Federal cultural resources from oil and gas actions by not impacting them.

CONCLUSION

It is anticipated that all lease actions that would affect cultural resources would be mitigated by implementation of Section 6 of the Lease Terms and the combination of laws, regulations, procedures, management practices and stipulations placed on the lessee. The practice of applying archeological mitigation measures to affected significant cultural resources offsets some of the impacts caused by oil and gas development activities. However, residual impacts still would occur. For example, oil and gas activities can impact, disturb, or destroy undiscovered buried cultural resource sites, resulting in the irretrievable loss of those values. Some data may be lost through excavations. Other impacts could occur to cultural resource properties or areas which are significant for the topographic setting and religious values which could not be mitigated.

Under all alternatives, it is projected that not more than 24 sites throughout the planning area would be encountered by all proposed oil and gas development activities on the 2,447 acres projected for disturbance during the life of this plan. On the average, one site in seven to ten is found to be eligible for the National Register. Therefore, it is projected that between two and four sites could be encountered that would be considered eligible requiring possible project relocation or mitigation.

Lease Stipulations and Lease Notices which may require inventory and mitigation measures can benefit cultural resources by providing additional data. Significant cultural sites that could not be avoided through project relocation or application of lease stipulations could be mitigated through data recovery or excavation. Although mitigation by excavation recovers valuable data, the process of archeological excavation using the most current methods and technology still results in the destruction of sites and loss of some data. Sites which have religious values, like the Dryhead Overlook site, cannot be mitigated through standard mechanical or archival means, and there exist types of sites that cannot be mitigated at all. However, given the number of acres (2,447) that are likely to be disturbed by all anticipated lease development over the life of the plan, it is unlikely that it would be necessary to mitigate sites or cultural properties through data recovery. In almost all situations cultural properties could be avoided by project redesign or relocation.

No significant impacts to the cultural resources on Federal lands are likely to occur as a result of oil and gas leasing and development under any of the alternatives.

PALEONTOLOGICAL RESOURCES

Impacts to the paleontological resources are mitigated by Section 6 of the lease terms, Conduct of Operations.

Under all alternatives, the combination of Lease Stipulations and Lease Terms would mitigate impacts to the paleontological resources. NSO stipulations for paleontological resources would be applied on 480 acres under all alternatives.

At any time, the operator has the prerogative of relocating oil and gas activities to avoid the expense of mitigation or the delays associated with this process. If paleontological material is uncovered during construction, the operator is to immediately cease work that might further disturb such material, and contact the Authorized Officer (AO). The AO is responsible for all required recordation and stabilization of exposed materials. The operator is responsible for mitigation costs.

CONCLUSION

Paleontological resources on all 4,670,219 acres of the Federal oil and gas estate within the planning area would be protected by Section 6 of the lease terms. Since NSO stipulations for paleontological resources would be applied on 480 acres under all alternatives, there are no significant impacts to the paleontological resource.

WILDERNESS

There would be no impacts to wilderness values under any of the alternatives for several reasons. There are no pre-FLPMA leases with valid existing rights which could allow development which impairs wilderness values. Any activities proposed under the existing post-FLPMA leases in the Buffalo Creek WSA would be subject to meeting the nonimpairment standard regardless of the lease stipulations. Under the nonimpairment standard, activities requiring reclamation cannot be authorized after September 30, 1990. No new leasing has occurred since the 1984 appropriations act that prohibited leasing in lands under wilderness review. This situation is expected to continue until the WSAs are either designated or released as nonwilderness.

RECREATION

Recreation is expected to show few negative or positive direct impacts associated with oil and gas development. Hunting, fishing and sightseeing may be affected on small scattered parcels of the public lands, but the incidence of this occurring is anticipated to be low. Visitors are likely to use other public lands in their vicinity that offer the same or similar opportunities.

ALTERNATIVE A

Access to public lands for recreational purposes could be improved by the addition of approximately 630 miles of new roads constructed for oil and gas development. However, the benefits are not anticipated to be significant, because roads associated with access to oil and gas developments are usually short, dead-end roads leading only to the development.

Recreation sites that receive concentrated public use would benefit significantly because of the NSO stipulation. Surface disturbance within the sites would be precluded; this preserves the existing recreation setting.

Sights, sounds and smells from oil and gas activities conducted on lands adjacent to recreation sites could result in adverse impacts. However, the significance of these impacts depends upon the proximity, intensity and visibility of the operations. Visitors could use other recreation sites if available; where shifting visitor use causes crowding or other inconveniences, the impact of oil and gas on recreation may be significant.

ALTERNATIVE B

The impacts in Alternative B are the same as A.

ALTERNATIVE C

The impacts in Alternative C are the same as A.

ALTERNATIVE D

The impacts in Alternative D are the same as A.

CONCLUSION

Impacts to recreation are essentially the same for each alternative. Though Alternative C stipulates 480 fewer acres than the other alternatives, the impacts should be the same overall. The impacts to Fort Meade under the No Lease stipulation in Alternatives B and D are the same as those under the NSO stipulation in the other alternatives.

VISUAL RESOURCES

ALTERNATIVE A

Under this alternative, all lands classified as VRM Class I would be protected from surface occupancy, and visual resources would remain unchanged. Although there are currently no public lands in the planning area identified as VRM Class I, this stipulation would be necessary for future classifications such as wilderness or wild and scenic rivers where the objective is to preserve the existing landscape.

There would be no significant impacts on the 324,912 acres of VRM Class II public lands under the Controlled Surface Use stipulation. It is anticipated that there would be situations where relocation or other visual design techniques would not be adequate to meet VRM Class II objectives; however, these situations are not expected to be extensive nor to result in significant adverse impacts overall to VRM Class II lands.

VRM Class III and Class IV lands would also be subject to the Controlled Surface Use stipulation. This stipulation would be adequate to protect visual resources under these Class III and Class IV objectives.

ALTERNATIVE B

The impacts in Alternative B are the same as A.

ALTERNATIVE C

The impacts in Alternative C are the same as A.

ALTERNATIVE D

The impacts in Alternative D are the same as A.

CONCLUSION

With the exception of the number of acres protected, impacts are virtually the same under all of the alternatives.

SOCIAL AND ECONOMIC CONDITIONS

Introduction

Oil and gas exploration and development activities have occurred in the three resource areas since oil was discovered in the Bighorn Basin in 1915. The activity tends to be cyclical and is dispersed over a region rather than being concentrated in one area. Nearly all of the direct and indirect employment consists of short term jobs during exploration activities and well development. The economic impacts for each alternative are based on estimating the number of wells that could not be drilled on Federal lands. The impacts would include a loss of Federal lease rents and production royalties, and a decrease in drilling activity resulting in a short-term loss of jobs and earnings. There would be no change in Payment in Lieu of Taxes (PILT) receipts. There would be a loss of local government severance taxes (LGST) paid to the counties in proportion to the amount of production foregone. The impacts are defined as changes from current levels rather than baseline projections.

Federal lease rents and royalties could be lost for those tracts designated as No Lease areas. The loss of Federal lease rents was estimated for each alternative and was compared to the annual average rents paid for FY88 and FY89, the first two years under the new oil and gas leasing procedures.

The No Surface Occupancy (NSO) stipulations could result in the loss of Federal oil and gas production depending upon the regional geologic conditions and drilling techniques applicable to the area. NSO stipulated areas were mapped by 40 acre subdivisions. Directional drilling would allow the recovery of the oil and gas under most of the NSO areas. Those NSO areas that were inaccessible to drill rigs or could not be tapped by directional drilling were identified and those NSO areas were considered unavailable for exploration or development drilling.

The No Lease acres and the unavailable NSO acres were added together and were divided by the total acres in the resource area to determine the percentage of the resource area unavailable for exploration or development drilling. The number and general location of the wildcat and development wells were based on the drilling activity RFD (Appendix C). The drilling activity described in the RFD was unconstrained by stipulations for this analysis. The analysis measures the reduction in drilling activity from the RFD levels for each alternative. The number of wells that could not be drilled by alternative was the product of the number of wells projected for the resource area multiplied by the percentage of the resource area unavailable for exploration and development drilling.

The foregone oil and gas production was based on the number of production and development wells foregone multiplied by the economic ultimate recovery (EUR) in barrels or MCFs according to the typical well fact sheets. The estimated annual production losses were compared to 1987 totals, the latest production data for the Montana counties. The Federal royalties foregone would be 12.5 percent of the total dollar value of the lost production of oil and gas. (The total dollar value equals the lost production, in barrels or MCFs, multiplied by the average price in 1990 dollars.)

The estimated employment and earnings foregone were calculated for each alternative based on the earnings and employment multipliers developed by the Bureau of Economic Analysis in the Regional Input-Output Modeling System (RIMS II). The multipliers for the crude petroleum and natural gas sector were used in the analysis. The average annual employment and earnings foregone were compared to 1988 wage and salary employment and earnings for the planning area.

All of the dollar values were adjusted to their 1990 equivalent value using the annual average change in the Implicit Price Deflator for Gross National Product.

ALTERNATIVE A

Of the total acres in the three resource areas 68,259 acres or 1.4 percent would be unavailable for exploration and development drilling. As a result, approximately three wells would be foregone and $524,000 in earnings would be lost over the next 15 years. The wells would have produced an estimated 89,000 barrels of oil and 21 MMCF of gas. Federal lease rental and royalties totaling $1,128,000 would be lost. The cumulative impacts are summarized in Table 4.9.

TABLE 4.9 CUMULATIVE IMPACTS FOR ALTERNATIVE A BY RESOURCE AREA

	Billings	Powder River	South Dakota	Total
NSO Acres	1,694	0	13,583	15,277
No Lse Acres	27,005	14,088	0	41,093
Rent Forgone	$608,000	$317,000	$0	$925,000
Wells Forgone	1	1	1	3
Bbls Forgone	395	37,931	51,083	89,409
Royalty Forgone	$1,000	$84,000	$113,000	$198,000
MCF Forgone	17,818	0	3,365	21,183
Royalty Forgone	$4,000	$0	$1,000	$5,000
Earnings Forgone	$34,000	$202,000	$288,000	$524,000
Total Rents & Royalties				$1,128,000

On an average annual basis, less than one well, 6,000 barrels of oil, and 1.4 MMCF of gas would be lost. This is approximately 0.36 percent of the Federal oil and 0.22 percent of the Federal gas produced in the three resource areas in 1987 (Table 3.14). This would result in an estimated decrease of 3.0 percent in the annual Federal lease rental and royalties. The impacts on earnings and employment would be insignificant. Table 4.10 summarizes annual impacts.

TABLE 4.10 ANNUAL IMPACTS FOR ALTERNATIVE A IN THE STUDY AREA

	Average Annual Forgone	Current or Average Annual	Percent Forgone
Total Oil	5,961	5,108,095	0.12%
Federal Oil	5,961	1,671,101	0.36%
Total Gas	1,412	7,387,326	0.02%
Federal Gas	1,412	630,546	0.22%
Wells	0.20	117	0.17%
Employment	2	129,023	0.001%
Earnings	$35,000	$2,137,281,000	0.002%
Total Rents & Royalties	$75,000	$2,522,000	2.98%

Impacts to community social organization are unlikely under this alternative. However, there is potential for a decrease in local government severance tax revenues which could affect the services available locally. These effects could be significant if losses are concentrated in counties which are highly dependent on oil and gas severance tax revenues.

ALTERNATIVE B

Of the total acres in the three resource areas 473,434 acres or 10.1 percent would be unavailable for exploration and development drilling. As a result, approximately 35 wells would be foregone and $5,000,000 in earnings would be lost over the next 15 years. The wells would have produced an estimated 775,000 barrels of oil and 67 MMCF of gas. Federal lease rents and royalties totaling $3,422,000 would be lost. The cumulative impacts are summarized in Table 4.11.

TABLE 4.11 CUMULATIVE IMPACTS FOR ALTERNATIVE B BY RESOURCE AREA

	Billings	Powder River	South Dakota	Total
NSO Acres	10,904	277,705	124,255	412,864
No Lse Acres	39,945	28,611	6,609	75,185
Rent Forgone	$899,000	$644,000	$149,000	$1,692,000
Wells Forgone	3	30	2	35
Bbls Forgone	24,331	674,859	75,729	774,919
Royalty Forgone	$54,000	$1,494,000	$168,000	$1,716,000
MCF Forgone	33,530	24,725	9,349	67,604
Royalty Forgone	$7,000	$5,000	$2,000	$14,000
Earnings Forgone	$180,000	$4,366,000	$462,000	$5,008,000
Total Rents & Royalties				$3,422,100

On an average annual basis approximately two wells, 52,000 barrels of oil, and 4.5 MMCFs of gas would be lost. This is approximately 3 percent of the Federal oil and 0.7 percent of the Federal gas produced in the three resource areas in 1987 (Table 3.14). This would result in an estimated decrease of 9.0 percent in the annual Federal lease rents and royalties. The impacts on earnings and employment would be insignificant. Annual impacts are summarized in Table 4.12.

TABLE 4.12 ANNUAL IMPACTS FOR ALTERNATIVE B IN THE STUDY AREA

	Average Annual Forgone	Current or Average Annual	Percent Forgone
Total Oil	51,661	5,108,085	1.18%
Federal Oil	51,661	1,671,101	3.09%
Total Gas	4,507	7,387,326	0.06%
Federal Gas	4,507	630,546	0.71%
Wells	2	117	1.98%
Employment	16	129,023	0.013%
Earnings	$334,000	$2,137,281,000	0.016%
Total Rents & Royalties	$228,000	$2,522,000	9.04%

Impacts to community social organization and services are the same as in Alternative A.

ALTERNATIVE C

The impacts in Alternative C are the same as A.

ALTERNATIVE D

Of the total acres in the three resource areas 69,140 acres or 1.5 percent would be unavailable for exploration and development drilling. As a result, approximately three wells would be foregone and $513,000 in earnings would be lost over the next 15 years. The wells would have produced an estimated 91,000 barrels of oil and 21 MMCF of gas. Federal lease rents and royalties totaling $1,560,000 would be lost. The cumulative impacts are summarized in Table 4.13.

TABLE 4.13 CUMULATIVE IMPACTS FOR ALTERNATIVE D BY RESOURCE AREA

	Billings	Powder River	South Dakota	Total
NSO Acres	1,694	0	6,876	8,570
No Lse Acres	39,465	14,088	6,629	60,182
Rent Forgone	$888,000	$317,000	$149,000	$1,354,000
Wells Forgone	1	1	1	3
Bbls Forgone	1,593	37,931	51,083	90,607
Royalty Forgone	$4,000	$84,000	$113,000	$201,000
MCF Forgone	17,818	0	3,365	21,183
Royalty Forgone	$4,000	$0	$1,000	$5,000
Earnings Forgone	$40,000	$214,000	$259,000	$513,000
Total Rents & Royalties				$1,560,000

On an average annual basis less than one well, 6,000 barrels of oil, and 1.4 MMCF of gas would be lost. This is approximately 0.36 percent of the Federal oil and 0.22 percent of the Federal gas produced in the three resource areas in 1987 (Table 3.14). This would result in an estimated decrease of 4.1 percent in the annual Federal lease rents and royalties. The impacts on earnings and employment would be insignificant.

TABLE 4.14 ANNUAL IMPACTS FOR ALTERNATIVE D IN THE STUDY AREA

	Average Annual Forgone	Current or Average Annual	Percent Forgone
Total Oil	6,040	5,108,085	0.14%
Federal Oil	6,040	1,671,101	0.36%
Total Gas	1,412	7,387,326	0.02%
Federal Gas	1,412	630,546	0.22%
Wells	0.19	117	0.17%
Employment	2	129,023	0.001%
Earnings	$34,000	$2,137,281,000	0.002%
Total Rents & Royalties	$104,000	$2,522,000	4.12%

Impacts to community social organization and services are the same as in Alternative A.

CONCLUSION

The cumulative impacts of Alternatives A and C are the same, and do not significantly differ from Alternative D. The cumulative impacts of Alternative B are almost twice the amount of Alternatives A, C, and D. A similar trend is also found when looking at the impacts on an average annual basis. The impacts to community social organization and services are similar for all alternatives. They are insignificant unless revenue losses are concentrated in counties which are highly dependent on oil and gas severance tax revenues.

INTRODUCTION

The Resource Management Plan/Environmental Impact Statement Amendment was prepared by specialists from the Miles City District and the Billings, Powder River, and South Dakota Resource Areas, with assistance from the Montana State Office. The following disciplines used in the preparation of this final are: air quality, geology and minerals, hydrology, hazardous materials, soils, vegetation, lands and land uses, wild horses, wildlife habitat, fisheries, cultural resources, paleontological resources, wilderness, recreation, visual resources, sociology and economics, graphics, public affairs, typing, editing, and printing. Preparation of this amendment began with the public notice printed in the Federal Register, V. 53, No. 224, dated November 21, 1988.

PUBLIC INVOLVEMENT

Public participation and consultation during the preparation of the document began in 1988 with public scoping meetings in Miles City and Billings, Montana, and Belle Fourche, South Dakota. A brochure was mailed to approximately 500 addresses on November 18, 1988. It described the goals of this RMP/EIS and the area to be covered; it also included a response card for the return of comments related to the amendment. The major goal of the public participation process was to identify the issues that the public wanted considered in the amendment.

Individual contacts also were made with other government agencies, Native American tribes, and interest groups to gather input for this amendment. Consultation was conducted with other resource management agencies at the Federal and state level to identify common concerns for the planning effort. Consultation under Section 7 of the Endangered Species Act was initiated with the U.S. Fish and Wildlife Service (USFWS). The final RMP/EIS amendment contains the biological assessment and USFWS biological opinion on the impacts from the amendment to threatened and endangered species. A notice of availability for the final RMP/EIS amendment has been published in the Federal Register and in local newspapers.

When public contact was first made for the Oil and Gas Leasing Amendment, the scoping brochure was mailed to all concerned entities on the District's mailing list. The oil and gas analysis for the Big Dry Resource Area was removed from the leasing amendment and placed with the Big Dry RMP/EIS which is currently being written.

CONSISTENCY

The BLM's planning regulations require that resource management plans "be consistent with officially approved or adopted resource related plans, and the policies and programs contained therein, of other Federal agencies, State and local governments, and Indian tribes, so long as the guidance and resource management plans are also consistent with the purposes, policies, and programs of Federal laws, and regulations applicable to public lands...." (43 CFR 1610.3-2).

All Federal, state, and local agencies and Tribal councils have been requested to review this document for inconsistencies with their plans and to inform the BLM of them.

DISTRIBUTION LIST

The BLM requested comments from industry, business, and interest groups; from Federal, state, and local agencies; and from Native American tribes. This plan amendment has been distributed to the organizations, agencies, and individuals shown on the following list; it also is available at county libraries.

CONGRESSIONAL OFFICES

REPRESENTATIVE RON MARLENEE, MT
REPRESENTATIVE PAT WILLIAMS, MT
REPRESENTATIVE TIM JOHNSON, SD
SENATOR MAX BAUCUS, MT
SENATOR CONRAD BURNS, MT
SENATOR THOMAS DASCHLE, SD
SENATOR LARRY PRESSLER, SD

FEDERAL AGENCY

ADVISORY COUNCIL ON HISTORIC PRESERVATION
DEPT. OF ENERGY
DEPT. OF JUSTICE
DEPT. OF THE AIR FORCE
DEPT. OF THE INTERIOR
DEPT. OF TRANSPORTATION
ENVIRONMENTAL PROTECTION AGENCY
U.S. ARMY CORPS OF ENGRS.
USDA, ASCS STATE OFFICE
USDA, FOREST SERVICE
USDA, SOIL CONSERVATON SERVICE
USDA, SCS, ROOSEVELT CUSTER RC&D
USDI, BUREAU OF INDIAN AFFAIRS
USDI, BUREAU OF LAND MANAGEMENT
USDI, BUREAU OF MINES

USDI, BUREAU OF RECLAMATION
USDI, FISH AND WILDLIFE SERVICE
USDI, GEOLOGICAL SURVEY
USDI, MINERALS MANAGEMENT SERVICE
USDI, NATIONAL PARK SERVICE
USDI, OFFICE OF ENVIRONMENTAL PROJECT REVIEW
USDI, OFFICE OF THE FIELD SOLICITOR

INDIVIDUALS

ALLIUSON, GLEN
AMES, EDWIN H JR.
AMSLER, JERRY
ANDERSON, LLOYD
ARENSDORF, GENEVIEVE
ASKIN, BERDETTE
ASKIN, KERMIT
ATWOOD, NORMAN C
BAKER, GRACE ET AL
BAKER, ALAN
BALDUCKI, DAVID A & BENJAMIN A
BARCLAY, ALEX
BASSETT, AL
BEJOT, ARNOLD
BENTLEY, WALDO
BERGER, ROSIE PENSE
BERGER, PAUL M
BERGLEE, CLIFORD M & CLIFTON M
BERRY, WILSON SCOTT
BERRY, BONNIE
BERRY, DELBERT J
BIERY, RICHARD
BILLING, ROSS A
BILLING, THOMAS B
BILLINGS, MONTE
BIRTIC, FRANK
BLAKE, CLARKE
BLISS, KL
BOBACK, MICHAEL W
BOEHLER, KEVIN
BOESE, LAWRENCE J
BOHLE, HENRY & MAE
BOND, IRA & ETHEL
BONDELL, E B
BOONE, STANE
BOOTH, DWAYNE & NELLIE ET AL
BORG, MILO & KARSTEN
BORLA, SAM
BOUCHARD, ARTHUR & VERNA ET AL
BOULDING, RUSSELL
BOYSUN, STEVE
BROWN, J BURNS
BROWN, THOMINNA W
BROWNING, TED
BRUNNER, ELWYN
BUECHLER, RAYMOND
BUERKLE, FRED
BULDHAUPT, JANET A
BULDHAUPT, FRED
BURBACH, TERRY L
BURGESS, VIOLA & BRUCE
BUTTERFIELD, GALE E
BUXBAUM, WILMER
BUXCEL, GENE
CADWELL, MIKE
CALE, LOREN ET UX
CAMERON, COLIN E & JEAN
CANDEE, ALFRED
CARLSON, ERNEST
CARROLL, BOB
CARTER, WILLARD
CAYER, G J
CAYKO, JOHN
CEYNAR, GARY
CHAFFEE, DONALD BRUCE
CHAFFEE, DON H
CHAPMAN, LEE
CHILDERS, ROSS
CLARK, MR & MRS WALTER
COLDWELL, JERRY
COLDWELL, COLE
COLE, LEAH
COLE, HAROLD
COLE, RELAND & ELEANOR F
COOKE, BURHL
COOPER, ROD J
CORNELIA, VIRGIL
COULTER, ROD
CUNDIFF, BILL JR.
DEVLIN, TOD & RON
DSCHAAK, L
DUKART, DANIEL D
DVIRAAK, INGRID SENNER
EATON, ELMER
EBZERY, TOM
EHRET, LEONARD
ENSIGN, JOHN
ERLENBUSCH, HAROLD
FAHDL, JOHN
FEISTHAMEL, TONY
FERCH, JIM
FERGUSON, CHARLES
FISCHER, ERNEST E
FRIED, EMIL
GACKLE, ALVIN
GENTRY, ROY W
GILBERT, ROBERT
GILGE, CLARENCE & AUDREY
GLUECKERT, RAY
GRAY, ROBERT J GRAY
GREEN, LYLA
GREGERSON, EMMETT

GRIST, LORAINE,
HABER, DONALD
HAGEN, ARTHUR
HANSON, RANDY
HANSON, DUANE
HARRISON, SAM G
HEINLE, EDMUND E
HENRIKSEN, BOB
HENTGES, JIM
HEUER, VERA
HOCHHALTER, MILT & RUTH
HOEFLE, RICHARD C
HOFF, NEIL
HOFF, PAUL
HOPKINS, BILL
HORGAN, LEO J
HOSS, R L
HOTTER, DON
HOUSEHOLDER, LYNN & DORIS
HUBBELL, R P
HUBBLE, WALTER E
HUFFMAN, VIRGIL T
JACKSON, ALBERT
JANICH, NICK
JARVIS, MONTE
JOHNSON, FLOYD C
KASTEN, DAVID
KEELER, JERRY
KEITH, CLAUDE L
KELTNER, LAWRENCE & J KIM
KIPLINGER, GEORGE JR.
KIRKLAND, JAMES
KJELGAARD, RONALD
KNIPP, EVERETT L
KNUDSON, KIM
KOLDEN, JAMES E
KRUCKENBERG, CLINT
KUBESH, KENNETH
KUTZLER, CHARLES
LEDOUX, DONALD
LEDOUX, DENNIS
LEE, J R
LINN, DAVID A
LIVINGSTON, CHARLES
LORNSTON, CRAIG
LUCCA, MARION
MACIORASKI, CHESTER
MCCUTCHIN, JERRY JR.
MCGONIGAL, TOM
MCKEEVER, MIKE & NOREEN
MCKERLICK, JOHN
MCRAE, CHARLES
MEYER, HAROLD E
MORTIMER, GEORGE F
MULKEY, WAYNE
MURPHY, SHELDON
NEFSY, WILLIAM & LORENE
NELSON, MARGARET SCOTT
NELSON, ROBERT
NICKELS, RUSSELL
PEPLINSKI, PAUL
PETERMAN, ROBERT A
PETRUSKA, PAUL
PHIPPS, BOB
RATHERT, BILL
RICE, VELMA
RISING, RALPH
ROOS, JOHN P
ROSS, CLAIR L
ROUNTREE, CARL D
RUCHENBACH, WALTER
RUMMEL, DAVID L
SACKMAN, LYLE & VERA
SACKMAN, ISADOR
SAPP, BRUCE D
SAUNDERS, RICHARD
SCHREIBROGEL, KEN
SCHULEIN, ROBERT
SCHUMACHER, FRED E
SCHWARZ, JACK
SEVERSON, CHRIS
SHATTUCK, PAUL
SILBERNAGEL, DON
SINGLETON, DOUG
SLEHOFER, M D
SMALIS, JERRY
SMITH, FOSTER
SPARKS, THOMAS
STAFFORD, MARGARET
STEADMAN, CHARLES
STRAND, NEAL
STRAUSER, WILLIAM D
SUMMERS, NED
SWITZER, LARRY J
THIESSEN, DWIGHT E
THOENY, STEVE
THOMASON, DAN
TUNBY, MAURICE
TURNBULL, NEIL
TVETENE, ROBERT
UNGER, BRUCE
USSELMAN, FLOYD
VAN EPPS, CHARLES P
VARRIANO, ROCCO
VOGEL, P L
WALLER, GORDON H & HELEN M
WANG, DULANE & ANNAMAE
WENTWORTH, GORDON & JUDY
WHITESIDE, JIM
WILLIAMS, CLAYTON W
WISEMAN, JAMES JR.
WOLFF, JAMES
YOUNG, JAMES A
ZELLER, LEE

INDUSTRY AND BUSINESS

7-W RANCH
ABRAXAS PETROLEUM CORP.
ADOBE OIL & GAS CORP.
ADVANTAGE RESOURCE INC.
AESOP PARTNERSHIP
ALL-STATES PERMITTING
ALPAR RESOURCES INC.
AMAX COAL COMPANY
AMERADA HESS CORP.
AMERICAN EXPLORATION CO.
AMERICAN PETROFINA CO. OF TEXAS
AMOCO PRODUCTION CO.
ANADARKO PETROLEUM CORP.
ANCHOR BAY CORP.
ANDALEX RESOURCES
ANR PRODUCTION CO.
ANTELOPE OIL
APACHE CORP.
AQUARIUS OIL & GAS
ARCO OIL & GAS CO.
ARNSTON RANCH INC.
AVALON CORP.
B E G INC.
B MAC OIL
BAKER LVSTK. EXCH/KEYSTONE RANCH
BALCRON OIL CO.
BAN RANCH INC.
BAR BQ RANCH INC.
BASS ENT. PROD. CO.
BASSETT LAND & LIVESTOCK
BEARTOOTH OIL & GAS CO.
BECHTOLD RANCH INC.
BEECHER RANCH INC.
BERCO RESOURCES
BERENERGY CORP.
BETTY SHAWS 7C RANCH
BICKLE INC.
BIG TIMBER LIVESTOCK CO.
BILLINGSLEY RANCH OUTFITTER
BLACK RANCHES INC.
BLUEBONNET ENERGY CORP.
BOUCHER RANCH INC.
BOWERS OIL & GAS EXPLORATION INC.
BOX CREEK RANCH
BP EXPLORATION
BRECK OPERATING CORP.
BROSCHAT ENG. & MGT. SERVICES
BROWN & ROOT CONST. CO.
BROWN RANCH
BRUCE WRIGHT PINNACLE RANCH
BUTTE PIPELINE CO.
BWAB INC.
CANTERRA PETROLEUM INC.
CARTER OIL
CEJA CORP.
CENEX
CHERRY CREEK RANCH
CHRIS BRANGER OUTFITTER
CITATION OIL & GAS CORP.
CLINE PRODUCTION CO.
COASTAL OIL & GAS CORP.
COLUMBIA GAS DEVELOPMENT CORP.
COLUMBUS ENERGY CORP.
CONOCO INC.
COON CREEK RANCH CO.
COOPER PETROLEUM
COTTONWOOD RANCH INC.
COULTER RANCHES
CROWELLS JOYCE CORP.
DAMSON OIL CORP.
DAVIS OIL CO.
DEKALB ENERGY
DEVON ENERGY CORP.
DKM ENERGY INC.
DOUBLE H RANCH INC.
EASTERN AMERICAN ENERGY CORP.
ELENBURG EXPLORATION INC.
ELLIS CO.
ENSTAR PETROLEUM INC.
ENTERPRISE ENERGY INC.
ENVIRONMENTAL RESEARCH & TECHNOLOGY INC.
EQUITABLE RESOURCES ENERGY CO.
EQUITY OIL CO.
EVERETT DRILLING VENTURES INC.
EVERGREEN RESOURCES INC.
EXXON CO. USA
F & W ENTERPRISES
GARBER LAND & LIVESTOCK CO.
GARY-WILLIAMS ENERGY CORP.
GENERAL ATLANTIC ENERGY CORP.
GEO RESOURCES INC.
GMB INC.
GOLD CUP EXPLORATION INC.
GRAHAM ROYALTY LTD.
GRAY RANCH CO.
HALLIBURTON SERVICES
HANCOCK ENTERPRISES
HANSON OPERATING CO.
HARBAUGH RANCH CO.
HAY CREEK INC.
HEITZMAN DRILL SITE SERVICES
HELMERICH & PAYNE INC.
HERIGSTAD RANCH
HILLSIDE RANCH
HNG OIL CO.
HOMESTAKE MINING CO.
HONDO OIL & GAS CO.
HUNT OIL CO.
HYDRA INC.
INTEGRITY OIL & GAS CO.
IPAMS

JACK J GRYNBERG
J BURNS BROWN OPERATING CO.
JN EXPLORATION & PRODUCTION
JOE KEHL & ASSOC.
JORDAN INSURANCE SERVICE
KAISER-FRANCIS OIL CO.
KERR-MCKEE CORP.
KNIFE RIVER COAL MINING CO.
KOCH EXPLORATION CO.
L & B OIL CO. INC.
LADD PETROLEUM CORP.
LARIO OIL & GAS
LESTER OIL CO.
LL TUCK & ASSOC.
LUFF EXPLORATION CO.
M & K OIL CO. INC.
MAHLSTEDT RANCH INC.
MAIN ENERGY INC.
MAPCO OIL & GAS CO.
MARATHON OIL CO.
MARNELL RESOURCES LTD.
MATERI EXPLORATION INC.
MAXUS EXPLORATION CO.
MERIDIAN OIL INC.
MESA PETROLEUM CO.
M F ALLERDINGS INC.
MOBIL OIL CORP.
MONTANA DAKOTA UTILITIES
MONTANA PETROLEUM ASSOC.
MONTANA POWER CO.
MOSBACHER PRODUCTION CO.
MOUNTAIN STATES RESOURCES INC.
MURPHY OIL CORP.
NANCE PETROLEUM CORP.
NATURAL GAS CORP. OF CA
NEARBURG PRODUCING CO.
NRM PETROLEUM HDQTRS.
ORYX ENERGY CO.
P & M PETROLEUM MANAGEMENT
PEABODY DEVELOPMENT CO.
PENNZOIL EXPLORATION & PROD. CO.
PETER K ROOSEVELT
PETROLEUM CORP. OF TEXAS
PETROLEUM INC.
PETROLEUM INFORMATION
PIC TECHNOLOGIES INC.
PLACID OIL CO.
POULSON ODELL & PETERSON
POWERS ELEVATION
PRAIRIE COUNTY COOP.
PRONGHORN ENERGY SERVICES
PYRAMID ENERGY INC.
ROBERT HAWKINS INC.
ROCKY MOUNTAIN OIL & GAS ASSOC. INC.
RONAN INC.
ROUNDUP RESOURCES
S & L ENERGY INC.
SAGE ENERGY CO.
SANTA FE ENERGY RESOURCES INC.
SARATOGA PRODUCTION CO.
SD PETROLEUM COUNCIL
SHADCO
SHELL OIL CO.
SHELL WESTERN E & P INC.
SINCLAIR OIL CORP.
SOAP CREEK ASSOC. INC.
STOVALL OIL CO.
SUMMIT RESOURCES INC.
TBS RANCH
TERRETT RANCH INC.
TEXACO INC.
TEXAS INTERNATIONAL OIL CO. INC.
TIBBETTS CATTLE CO.
TIMBERLINE OIL & GAS CORP.
TIMBERLINE PETROLEUM
TOM BROWN INC.
TOMAHAWK OIL CO. INC.
TOTAL MINATOME CORP.
TRAVIS ENERGY GROUP
TRIGG DRILLING CO. INC.
TRUE OIL CO.
TURNER, SMITH & ASSOC.
TWITCHELL BROS. SNAP CREEK RANCH
U.S. ENERGY/CRESTED CORP.
UNION OIL CO. OF CA
UNION PACIFIC RESOURCES
UNION TEXAS PETRO CORP.
W & J WAGNER INC.
WBI
WESCO PIPELINE CO.
WESTERN ECONOMIC SERVICES
WESTERN PRODUCTION CO.
WHELESS INDUSTRIES INC.
WHITE & ASSOC.
WILLIAMS EXPLORATION CO.
WILLISTON BASIN INT. PIPELINE
WILLISTON INDUSTRIAL SUPPLY CORP.
WINCHESTER DEVELOPMENT CORP.
WN RANCH

INTEREST GROUPS

BELLE CREEK LANDOWNERS ASSN.
CARTER CO CHAMBER OF COMMERCE, MT
COLORADO ENVIRONMENTAL COALITION
FRIENDS OF THE EARTH
GREATER YELLOWSTONE ASSN. OF CONSERV. DIST.
HEADWATERS PADDLING ASSN.
MILES CITY AREA CHAMBER OF COMMERCE, MT
MINERALS EXPLORATION COALITION
MONTANA ASSN. OF PETROLEUM LANDMEN
MONTANA GEOLOGICAL SOCIETY
MONTANA PUBLIC LANDS COUNCIL

MONTANA WILDERNESS ASSN.
MT CHP. WILDLIFE SOCIETY
MT. INTERTRIBAL POLICY BOARD
NATIONAL AUDUBON SOCIETY
NATIONAL PETROLEUM COUNCIL
NATIONAL WILDLIFE FEDERATION
NATURAL RESOURCES DEFENSE COUNCIL
NORTHERN PLAINS RESOURCE COUNCIL
PEOPLE FOR ECONOMIC PROGRESS
POWDER RIVER BASIN RESOURCE COUNCIL
ROUGH RIDERS INC.
SE SPORTSMEN ASSN.
SIERRA CLUB
WILDERNESS SOCIETY
WILDLIFE MANAGEMENT INSTITUTE
YELLOWSTONE CO. CHAMBER OF COMMERCE, MT

LOCAL GOVERNMENT

AURORA COUNTY COMMISSIONERS, SD
BEADLE COUNTY COMMISSIONERS, SD
BENNETT COUNTY COMMISSIONERS, SD
BIG HORN COUNTY COMMISSIONERS, MT
BIG HORN COUNTY COMMISSIONERS, WY
BILLINGS COUNTY COMMISSIONERS, ND
BON HOMME COUNTY COMMISSIONERS, SD
BROOKINGS COUNTY COMMISSIONERS, SD
BROWN COUNTY COMMISSIONERS, SD
BRULE COUNTY COMMISSIONERS, SD
BUFFALO COUNTY COMMISSIONERS, SD
BUTTE COUNTY COMMISSIONERS, SD
CAMPBELL COUNTY COMMISSIONERS, SD
CARBON COUNTY COMMISSIONERS, MT
CARTER COUNTY COMMISSIONERS, MT
CARTER COUNTY PLANNING BOARD, MT
CHARLES MIX COUNTY COMMISSIONERS, SD
CITY OF BAKER, MT
CITY OF CIRCLE, MT
CITY OF EKALAKA, MT
CITY-COUNTY PLAN OFFICE,MILES CITY, MT
CLARK COUNTY COMMISSIONERS, SD
CLAY COUNTY COMMISSIONERS, SD
CODINGTON COUNTY COMMISSIONERS, SD
CORSON COUNTY COMMISSIONERS, SD
CUSTER COUNTY COMMISSIONERS, MT
CUSTER COUNTY COMMISSIONERS, SD
DAVISON COUNTY COMMISSIONERS, SD
DAY COUNTY COMMISSIONERS, SD
DEUEL COUNTY COMMISSIONERS, SD
DEWEY COUNTY COMMISSIONERS, SD
DOUGLAS COUNTY COMMISSIONERS, SD
EDMUNDS COUNTY COMMISSIONERS, SD
FALL RIVER COUNTY COMMISSIONERS, SD
FAULK COUNTY COMMISSIONERS, SD
GOLDEN VALLEY COUNTY COMMISSIONERS, MT
GRANT COUNTY COMMISSIONERS, SD
GREGORY COUNTY COMMISSIONERS, SD
HAAKON COUNTY COMMISSIONERS, SD
HAMLIN COUNTY COMMISSIONERS, SD
HAND COUNTY COMMISSIONERS, SD
HANSON COUNTY COMMISSIONERS, SD
HARDING COUNTY COMMISSIONERS, SD
HUGHES COUNTY COMMISSIONERS, SD
HUTCHINSON COUNTY COMMISSIONERS, SD
HYDE COUNTY COMMISSIONERS, SD
JACKSON COUNTY COMMISSIONERS, SD
JERAULD COUNTY COMMISSIONERS, SD
JONES COUNTY COMMISSIONERS, SD
KINGSBURY COUNTY COMMISSIONERS, SD
LAKE COUNTY COMMISSIONERS, SD
LAWRENCE COUNTY COMMISSIONERS, SD
LINCOLN COUNTY COMMISSIONERS, SD
LYMAN COUNTY COMMISSIONERS, SD
MARSHALL COUNTY COMMISSIONERS, SD
MCCOOK COUNTY COMMISSIONERS, SD
MCPHERSON COUNTY COMMISSIONERS, SD
MEADE COUNTY COMMISSIONERS, SD
MELLETTE COUNTY COMMISSIONERS, SD
MINER COUNTY COMMISSIONERS, SD
MINNEHAHA COUNTY COMMISSIONERS, SD
MOODY COUNTY COMMISSIONERS, SD
MUSSELSHELL COUNTY COMMISSIONERS, MT
PARK COUNTY COMMISSIONERS, WY
PENNINGTON COUNTY COMMISSIONERS, SD
PERKINS COUNTY COMMISSIONERS, SD
POTTER COUNTY COMMISSIONERS, SD
POWDER RIVER COUNTY COMMISSIONERS, MT
ROBERTS COUNTY COMMISSIONERS, SD
ROSEBUD COUNTY COMMISSIONERS, MT
SANBORN COUNTY COMMISSIONERS, SD
SHANNON COUNTY COMMISSIONERS, SD
SPINK COUNTY COMMISSIONERS, SD
STANLEY COUNTY COMMISSIONERS, SD
STILLWATER COUNTY COMMISSIONERS, MT
SULLY COUNTY COMMISSIONERS, SD
SWEETGRASS COUNTY COMMISSIONERS, MT
TODD COUNTY COMMISSIONERS, SD
TREASURE COUNTY COMMISSIONERS, MT
TREASURE COUNTY PLANNING BOARD, MT
TRIPP COUNTY COMMISSIONERS, SD
TURNER COUNTY COMMISSIONERS, SD
UNION COUNTY COMMISSIONERS, SD
WALWORTH COUNTY COMMISSIONERS, SD
WHEATLAND COUNTY COMMISSIONERS, MT
YANKTON COUNTY COMMISSIONERS, SD
YELLOWSTONE COUNTY COMMISSIONERS, MT
ZIEBACH COUNTY COMMISSIONERS, SD

STATE GOVERNMENT

BUREAU OF INTERGOVERNMENTAL REL., SD
CUSTER COUNTY CONSERVATION DIST., MT
DEPT. OF STATE LANDS, MT

GOVERNOR OF SOUTH DAKOTA
GOVERNOR OF MONTANA
INTERGOVERNMENTAL REL., MT
LITTLE BEAVER CONSERVATION DIST., MT
MCCONE COUNTY CONSERVATION DIST., MT
MT ASSN. OF CONSERVATION DISTS.
MT ASSN. OF STATE GRAZING DISTS.
MT BUREAU OF MINES AND GEOLOGY
MT DEPT. OF FISH-WILDLIFE & PARKS
MT ST. BOARD OF OIL & GAS CONSERVATION
MT ST. DEPT. OF NAT. RES. & CONS.
MT ST. HISTORIC PRESERVATION OFFICE
ND ENG. DEV. IMPACT OFFICE, ND
POWDER RIVER COUNTY CONSERVATION DIST.
RED BUTTE COOP. STATE GRAZING DIST.
ROSEBUD COUNTY CONSERVATION DIST., MT
SD ASSN. OF CONSERVATION DISTRICTS, SD
SOUTH DAKOTA GEOLOGICAL SURVEY
SD ST. HISTORIC PREERVATION OFFICE
SMITH CREEK GRAZING ASSN., MT
ST REPRESENTATIVE BETTY LOU KASTEN, MT
ST REPRESENTATIVE BOB GILBERT, MT
ST REPRESENTATIVE DOROTHY CODY, MT
ST REPRESENTATIVE TOM ZOOK, MT
ST REPRESENTATIVE VERNON KELLER, MT
ST SENATOR AL BISHOP, MT
ST SENATOR CECIL WEEDING, MT
ST SENATOR GERRY DEVLIN, MT
WY OIL & GAS CONSERVATION COMM., WY
WYOMING STATE CLEARINGHOUSE

TRIBAL GOVERNMENT

CHEYENNE RIVER SIOUX TRIBAL COUNCIL
CROW CREEK SIOUX TRIBAL COUNCIL
CROW TRIBAL COUNCIL
LOWER BRULE SIOUX TRIBAL COUNCIL
NORTHERN CHEYENNE TRIBAL COUNCIL
OGLALA SIOUX TRIBAL COUNCIL
ROSEBUD SIOUX TRIBAL COUNCIL
STANDING ROCK SIOUX TRIBAL COUNCIL
YANKTON SIOUX TRIBAL COUNCIL

LIST OF PREPARERS

Lloyd F. Emmons: Project Manager, Planning and Environmental Coordinator, Miles City District Office, B.S., Agronomy, Oklahoma State University, B.A., Anthropology, Fort Lewis College. Graduate study, University of Nevada, Range Management/Botany. 33 years with the Bureau of Land Management.

Mary Alice Spencer: Project Manager February 1989 - November 1991, Supervisory Land Use Specialist, Miles City District Office. B.A., Social Studies Education, State University of New York at Albany. M.S., Geology, University of Kansas. 17 years with the U.S. Geological Survey, Minerals Management Service, and Bureau of Land Management. Currently Powder River Resource Area Manager.

Lloyd A. Fusselman: Technical Coordinator, Land Use Specialist, Miles City District Office, B.S., Range Conservation, Utah State University. 19 year with the Bureau of Land Management. Retired.

Mary M. Garrow: Editorial Assistant, Miles City District Office. B.S., Earth and Planetary Sciences/Geology, University of Pittsburgh. 8 years industry, 1 year with the Bureau of Land Management.

Patricia J. Koch: Editorial Assistant, Miles City District Office. B.S., Secondary Education, English, Eastern Montana College. 16 years with the Bureau of Land Management. Currently employed at the Great Falls Resource Area, Montana.

Irene Tilleson: Editorial Assistant, Miles City District Office. Attended Eastern Montana College. 16 years with U.S. Geological Survey, Minerals Management Service, and Bureau of Land Management. Retired.

Kathryn D. Stevenson: Office Automation Clerk, Miles City District Office. Attended University of South Dakota, South Dakota State University, Black Hills State College, Classified Advertising Manager, daily newspaper. 3 years with the Bureau of Land Management.

James A. Albano: Minerals Resource Specialists, Powder River Resource Area. B.S., Range Science, Utah State University. 13 years with the Bureau of Land Management. Currently employed in the Montana State Office.

Charles A. Berdan: Realty Specialist, South Dakota Resource Area. Associate of Applied Science (AAS), Natural Resources, University of Minnesota Technical College, B.S., Wildlife Sciences, South Dakota State University. 14 years with the Bureau of Land Management.

Gary L. Berg: Geologist, Powder River Resource Area. B.A., Geology, University of Montana. 1 year industry, 19 years U.S. Forest Service, U.S. Geological Survey, Minerals Management Service, Bureau of Land Management.

J.L. Bloom: Natural Resource Specialist, Powder River Resource Area. B.S., Agricultural Production, Montana State University. 14 years with the Bureau of Land Management. Currently self-employed.

John Bown: Geologist, Miles City District Office. B.S., Millsaps College. M.S., University of Missouri, Rolla. 14 years with Bureau of Land Management. Currently employed at the Montana State Office.

David Breisch: Minerals Resource Specialist, Miles City District Office. B.S., Physical Geography, University of Wisconsin -LaCrosse. 15 years with the Bureau of Land Management.

Daniel A. Bricco: Wildlife Management Biologist, Miles City District Office. B.S., Wildlife Management/Range Management University of Arizona. 26 years with the Bureau of Land Management.

M. Craig Campbell: Geologist, Miles City District Office. B.A., History, University of Wyoming. B.S., Geology, University of Wyoming. 7 years industry, 7 years with the Bureau of Land Management.

Ladd Coates: Mineral Resource Specialist, Big Dry Resource Area. B.A., Sociology, University of California - Berkeley. M.S., Outdoor Recreation, Colorado State University. 16 years with the Bureau of Land Management.

Edmund J. Giebel: Supervisory Natural Resource Specialist, Miles City District Office. B.S., Agricultural Education, Montana State University. 32 years with the Bureau of Land Management. Retired.

Loren Glade: Realty Specialist, Billings Resource Area. B.S., Forestry, University of Montana. 21 years with the Bureau of Land Management.

Mark W. Gorges: Wildlife Management Biologist, Powder River Resource Area. B.S., Fish and Wildlife Management, Montana State University. 12 years with the Bureau of Land Management. Currently employed in the Wyoming State Office.

Martin Griffith: District Soil Scientist, Miles City District Office. A.S., Biology, Harper College, Illinois. B.S., Land Resources/Soil, Montana State University. 10 years with the Bureau of Land Management. Currently employed in the Wyoming State Office.

Kenneth Hanify: Natural Resource Specialist, Billings Resource Area. B.S., Science and Industrial Arts, South Dakota State University. M.A., Biology, Northern Arizona University. 17 years with the Bureau of Indian Affairs, 14 years with the Bureau of Land Management.

William B. Hansen: Minerals Resource Specialist, Montana State Office. B.A., Geology, Augustana College, Illinois. M.S., Mining Engineering, University of Wisconsin - Madison. 12 years with the Bureau of Land Management. Currently employed in the Great Falls Resource Area.

Dale Hanson: Computer Programmer/Analyst, Miles City District Office. B.S., Wildlife Science, New Mexico State University. Graduate study, paleontology, South Dakota School of Mines & Technology, Miles Community College. 15 years with the Bureau of Land Management. Currently employed with BLM in Oregon.

Dex Hight: Hydrologist, Miles City District Office. B.S., Hydrology, Colorado State University. 17 years with the Bureau of Land Management.

William S. Hubbell: Archeologist, Miles City District Office. B.A., Anthropology, University of Colorado. 15 years with the Bureau of Land Management.

Edward Hughes: Mineral Economist, Montana State Office. B.S., Mineral Economics, Pennsylvania State University. 7 years Private Industry, Bureau of Land Management 1974-1982 and 1989 to present.

David C. Jaynes: Supervisory Range Conservationist, Billings Resource Area. B.S., Range Management, Texas Tech University. M.S., Soil Science, Texas Tech University. 14 years with the Bureau of Land Management.

Sally Colony King: Realty Specialist, Miles City District Office. B.S., Physical Geography, University of Wyoming, BLM Lands & Minerals School. 1 year with Amoco Production Company, 2 years with Bureau of Reclamation and 9 years with the Bureau of Land Management.

Paul W. Kruger: Minerals Resource Specialist, Montana State Office. B.S., Atmospheric Sciences Engineering, University of Washington. 11 years with Bureau of Land Management. Currently employed by the Department of Energy, Operations Office, Richland, Washington.

Allen Kutt: Supervisory Land Use Specialist, Big Dry Resource Area, B.S., Forestry, University of Montana. 24 years with the Bureau of Land Management.

George Long: Geologist, Montana State Office. B.A., Geology, Colorado College, Colorado Springs, Colorado. 26 years experience as a geologist with a major oil company, 7 years with the Bureau of Land Management.

John McKay: Geologist, Montana State Office, B.A., Geology, University of Montana. 17 years with U.S. Forest Service, U. S. Geological Survey, Minerals Management Service, and Bureau of Land Management. Currently employed in the Butte District Office.

Robert A. Mitchell: Soil Scientist/Hydrologist, Miles City District Office. B.S., Geology, University of Wyoming; M.S., Soil Science, University of Wyoming. 2 years private industry; 5 years USDA-SCS; 1 year Bureau of Land Management.

Keith R. Mosbaugh: Outdoor Recreation Planner, Billings Resource Area. B.S., Forestry, University of Montana. 27 years with the Bureau of Land Management.

Jayson Parks: Wildlife Biologist, Billings Resource Area. B.S., Fish and Wildlife Management, Montana State University. 2 years Fish and Wildlife Service, 13 years with the Bureau of Land Management.

Patrick Roddy: Petroleum Engineer, Miles City District Office. B.S., Geological Engineering, University of Arizona. 14 years private industry, 4 years with the Bureau of Land Management. Currently employed at the San Jaun Resource Area, Colorado.

David Squires: Outdoor Recreation Planner, Miles City District Office. B.S., Wildlife Management, Texas Tech University. 1 year United States Forest Service, 3 years Bureau of Indian Affairs, 13 years with Bureau of Land Management.

John F. Taylor: Archeologist/Curator, Billings Resource Area. B.A., Anthropology, University of Pennsylvania. M.A., Anthropology, University of Montana. 12 years with the Bureau of Land Management.

Joan Trent: Sociologist, Montana State Office. B.A., Psychology, Miami (Ohio) University. M.A., Environmental Science, Miami (Ohio) University. 13 years with Bureau of Land Management.

Thomas C. Voss: Range Conservationist, Billings Resource Area. B.S., Range Management, Montana State University. 12 years with the Bureau of Land Management.

Fred Wambolt III: District Range Conservationist, Recreation and Planning and Environment Specialist, Miles City District Office. A.A., Miles Community College, B.S., Agriculture Production, Range Management Montana State University. 1 year with Soil Conservation Service. 14 years with the Bureau of Land Management.

Laura White: Wildlife Biologist, Billings Resource Area. B.S., Wildlife Science, New Mexico State University. 5 years with the Bureau of Land Management. Currently self-employed.

INTERDISCIPLINARY TEAM IMPACT ANALYSIS

David Breish, MCDO
Daniel Bricco, MCDO
Fred Wambolt III, MCDO
Dex A. Hight, MCDO
Pat Roddy
Ladd Coates, BDRA
William S. Hubbell, MCDO
Sally Colony King, MCDO
Edward Hughes, MSO

DISTRICT MANAGEMENT TEAM

Charles F. Frost, District Manager
Mathew N. Millenbach, District Manager, March 1986 - July 1991
Sandra E. Sacher, Associate District Manager
Arnold E. Dougan, Assistant District Manager, Division of Mineral Resources
Lloyd F. Emmons, Planning and Environmental Coordinator
Darrel G. Pistorius, Assistant District Manager, Division of Lands and Renewable Resources
Donald E. Nelson, Assistant District Manager, Division of Operations
David D. Swogger, Jr., Big Dry Resource Area Manager
Billy G. McIlvain, Billings Resource Area Manager
Gene A. Kolkman, Powder River Resource Area Manager, March 1988 - April 1991.
Mary Alice Spencer, Powder River Resource Area Manager
Mark Stiles, South Dakota Resource Area Manager

STEERING COMMITTEE

Charles F. Frost
Sandra E. Sacher
Arnold E. Dougan
Mary Alice Spencer
William Hansen
Mathew N. Millenbach
Lloyd F. Emmons
James Beaver
Lloyd Fusselman
Edmund Giebel

CONTRIBUTORS

Robert Allen
Kelly Lennick
Michele McGothlin
Alice Slagowski
Kathy Ives
Charles Sigafoos
Elaine Bartley
John Spencer

PUBLIC REVIEW OF THE DRAFT EIS

Availability of the Draft EIS was filed with the Environmental Protection Agency and announced in the Federal Register on January 10, 1992. Copies of the Draft EIS were mailed to Federal, state, and local governments, private groups and organizations, and individuals for review and comment. News releases provided information on how to obtain copies of the draft. Formal public meetings were held on March 10, 1992 in Belle Fourche, SD; March 11, 1992 in Miles City, MT; and March 12, 1992 in Billings, MT. A BLM official presided over each meeting and BLM representatives served on the panel. The meetings were recorded on tape. These tapes were later transcribed and are included in the final document. A total of 27 letters were received during the 120 day comment period. Responses to these comment letters and the public meetings are provided in this chapter.

COMMENT LETTERS

1.	Jack E. King	Hancock Enterprises, Billings, MT
2.	Eugene L. Lehr	U.S. Department of Transportation, Washington, D.C.
3.	Harold J. Wentland	Montana Department of Fish, Wildlife & Parks, Glasgow, MT
4.	Richard D. Gorton	U.S. Army Corps of Engineers, Omaha, NE
5.	Richard B. Grabowski	USDI Bureau of Mines, Denver, CO
6.	Don Taylor	County of Carbon, Red Lodge, MT
7.	Elza A. Plann	BLM Advisory Board, Terry, MT
8.	Brooks Study	Board of County Commissioners - Powder River County, Broadus, MT
9.	Elizabeth S. Bush	Arco Oil and Gas Company, Midland, TX
10.	Bart Koehler	Greater Yellowstone Coalition, Bozeman, MT
11.	Kirk Koepsil	Sierra Club, Sheridan, WY
12.	Richard Terra	Sierra Club, San Francisco, CA
13.	Sandy McIntyre	The Wilderness Society, Bozeman, MT
14.	John G. Wood	Fish and Wildlife Enhancement, Helena, MT
15.	James Phelps	Montana Audubon Council, Billings, MT
16.	John F. Wardell	U.S. Environmental Protection Agency, Helena, MT
17.	Bart Koehler	Greater Yellowstone Coalition, Bozeman, MT
18.	Rick Martin	Red Lodge Rod and Gun Club, Red Lodge, MT
19.	Claire Moseley	Rocky Mountain Oil and Gas Association, Denver, CO
20.	Michael D. Synder	USDI National Park Service, Denver, Co
21.	Alexander Woodruff	Independent Petroleum Association of Mountain States, Denver, CO
22.	E.C. Burrett	Texaco USA, Denver, CO
23.	Cedron Jones	Montana Wilderness Association, Helena, MT
24.	D.W. Pennington	USDI Bureau of Indian Affairs, Billings, MT
25.	Janet R. Kelly	County of Custer, Miles City, MT
26.	George Kurkowski	Custer County City-County Planner, Miles City, MT
27.	Paul F. Berg	Southeastern Montana Sportsman Association, Billings, MT

PUBLIC MEETING SPEAKERS

1.	George Gunderson	Miles City - March 11, 1992
2.	George Kurkowski	Miles City - March 11, 1992
3.	Donald Reager	Miles City - March 11, 1992
4.	Tom Zook	Miles City - March 11, 1992
5.	Janelle Fallon	Billings - Billings - March 12, 1992
6.	James Phelps	Billings - Billings - March 12, 1992
7.	Paul F. Berg	Billings - Billings - March 12, 1992

The transcripts from the Miles City and Billings public meetings and the letters received during the comment period have been reprinted in this chapter. The numbered bracketing in the left hand margins correspond with the appropriate response. Responses to all oral and written comments follow the letters.

APPENDIX A
OIL AND GAS OPERATIONS

GEOPHYSICAL MANAGEMENT

Notification Process

Geophysical operations on public lands are approved by the Federal Surface Management Agency (SMA). An oil and gas lease is not required before geophysical operations are conducted. Exploration on BLM-administered public lands requires review and approval following the procedures in the Code of Federal Regulations at 43 CFR 3150 and 3151 (1990). In the Miles City District the Area Manager is authorized to act for the District Manager to approve geophysical operations. The responsibilities of the geophysical operator and the BLM Area Manager during geophysical operations are described below.

1. Geophysical Operator - The operator is required to file Form 3150-4, "Notice of Intent to Conduct Oil and Gas Geophysical Exploration Operations" (NOI), for all operations on public surface administered by the BLM. The NOI includes the "Terms and Conditions for Notice of Intent To Conduct Geophysical Exploration," Form 3150-4a (Illustration A-1). Maps showing the location of the proposed lines and all access routes must accompany the Form 3150-4.

When the Notice of Intent is filed, the Authorized Officer (AO) may request a prework conference or field inspection. Any special requirements or procedures that are identified by the AO are included in the "Terms and Conditions." By signing the NOI and "Terms and Conditions" the operator agrees to comply with requirements specified by the AO. The Notice of Intent, maps, and a signed copy of "Terms and Conditions" must be filed in the BLM Resource Area Office before operations begin.

Bonding of the operator also is required. A copy of proof of satisfactory bonding shall accompany the Notice of Intent (NOI). Proper bonding may include a nationwide or statewide oil and gas bond with a rider for geophysical exploration or a $5,000 individual surety bond filed with the Authorized Officer.

Surface disturbing activities, such as bulldozing, require written approval by the AO. The operator is required to comply with all applicable Federal, state, and local laws such as the Federal Land Policy and Management Act of 1976, the National Historic Preservation Act of 1966, as amended, and the Endangered Species Act of 1973, as amended. Operators may be required to submit an archeological survey if dirt work is contemplated or if there is reason to believe that significant cultural resources may be adversely affected.

Any changes in the original NOI must be submitted in writing to the AO. Written approval must be secured before activities proceed.

When operations are completed, the operator is required to file the form "Notice of Completion of Oil and Gas Geophysical Exploration," Form 3150-5, which includes a statement certifying compliance with terms and conditions of the NOI and a map (preferably 1:24,000 scale topographic map) showing actual line and shothole locations or other details of the survey.

2. BLM Area Managers - The AO is required to contact the operator within 5 working days after the filing of the Notice of Intent to explain the terms of the Notice, including the "Terms and Conditions", all current laws, and all BLM administrative requirements. At the time of the prework conference or field inspection, written instructions or orders are given to the operator. The AO is responsible for the examination of resource values to determine appropriate surface protection and reclamation measures.

The AO is required to make a final inspection following filing of the Notice of Completion. When reclamation is approved, obligation against the operator's bond is released. The BLM has 30 days after the filing of the Notice of Completion to notify the operator whether the reclamation work is satisfactory or if additional reclamation is necessary. Bonding liability will automatically terminate unless the AO notifies the operator of the need for additional reclamation work within 90 days of the filing of the Notice of Completion.

State Standards

In Montana, geophysical operators register with the state through the County Clerk and Recorder's Office. There are requirements for shothole locations and plugging and abandonment procedures. Operators in South Dakota follow procedures set forth by BLM.

Mitigation

When a geophysical NOI is received, restrictions may be placed on the application to protect resource values or

mitigate impacts to them. Some of these requirements may be the same as oil and gas lease stipulations (Appendix B). Other less restrictive measures may be used when impacts to resource values will be less severe. This is due in part to the temporary nature of geophysical exploration. The decisions concerning the level of protection required are made on a case-by-case basis when an NOI is received.

LEASING PROCESS

Federal oil and gas leasing authority is found in the 1920 Mineral Leasing Act, as amended, for public lands and the 1947 Acquired Lands Leasing Act, as amended, for acquired lands. Leasing of Federal oil and gas is affected by other acts such as the National Environmental Policy Act of 1969, the Wilderness Act of 1964, the National Historic Preservation Act of 1966, the Endangered Species Act of 1973, the Federal Land Policy and Management Act of 1976, and the Federal Onshore Oil and Gas Leasing Reform Act of 1987. Regulations governing Federal oil and gas leasing are contained in 43 CFR 3100 with additional requirements and clarification found in Onshore Operating Orders and Washington office manuals and instruction memorandums.

The lease grants the right to explore, extract, remove, and dispose of oil and gas deposits that may be found in the leased lands. The lessee may exercise the rights conveyed by the lease subject to the following lease terms.

Lease rights may be subject to a lease stipulation and permit approval requirements. Stipulations and restrictions describe how lease rights are modified.

The BLM planning process is the mechanism used to evaluate and determine where and how Federal oil and gas resources will be made available for leasing. In areas where oil and gas development will conflict with other land uses or resources, even with mitigation measures, the area is closed to leasing. Areas where oil and gas development could coexist with other land uses or resources will be open to leasing. Leases in these areas will be issued with or without stipulations based upon decisions in the land use document. Stipulations are a part of the lease only when environmental and planning records demonstrate the necessity for the stipulations (modifications of the lease).

Currently, leases are issued as either competitive leases with a 5-year term or over-the-counter leases with a 10-year term. The competitive leases will be sold to the highest qualified bidder at on oral auction. After the sale, tracts that received no bid during the auction will be issued over-the-counter to the first qualified applicant. Rental payments for these leases will be $1.50 per acre for the first 5 years and $2 per acre thereafter until production is established. Leases will be issued with a fixed 12.5 percent royalty rate.

OPERATING STANDARDS AND APPROVAL PROCEDURES

The following description is a summary of information from the publication "Surface Operating Standards for Oil and Gas Exploration and Development" (USDI and USDA, 1989a), commonly referred to as the "Gold Book". It contains information developed to aid the operator in permit approval and conduct of oil and gas operations on Federal lands, from exploration through development and production, to abandonment. Information is provided for preparation of the surface use and drilling plans.

An array of laws, regulations, and orders govern the drilling and production of oil and gas. These include regulations in 43 CFR 3160, Onshore Oil and Gas Orders, Notices to Lessees (NTL), lease terms, conditions of approval, and other written orders and instructions by the AO. The approval process for Applications for Permit to Drill and conduct of operations are guided by these provisions.

Initiating the Process

Before drilling can begin, an Application for Permit to Drill (APD) must be approved. The APD includes information about both the downhole drilling and the associated surface disturbing activities. Changes to an existing APD must also be approved before the new activities are conducted.

The process of obtaining approval to drill is begun by filing either a Notice of Staking (NOS) or an APD with the District Office. The choice is the operator's, but eventually a complete and acceptable APD must be filed. By filing the NOS, the operator triggers an onsite inspection prior to filing an APD and is furnished appropriate surface use and reclamation requirements for incorporation into the APD. This may result in a more complete APD which can be approved in less time. There is no required form for the NOS but the informational requirements are specific. If the APD option is selected, the onsite inspection is held after the filing of the APD with the BLM. If the lands involved are managed by a Federal agency other than the BLM, the NOS must be filed with both the appropriate SMA and the BLM.

Whether the process begins with submission of the NOS or APD, the well location must be staked and planned access roads flagged prior to the onsite inspection. Surveying and staking may be done without advance approval from the

BLM or SMA except for lands used for military purposes or areas where significant surface disturbance is likely during the staking process.

Tables in the "Gold Book", pages 6-8, describe the basic procedures used in the approval of most lease operations and summarize the requirements and responsibilities contained in Onshore Oil and Gas Order No. 1. The timeframe for each step of the approval process for both operator and BLM officials is also given.

Application for Permit to Drill

No drilling operations or related construction activities may be conducted without an APD approved by the Assistant District Manager for Mineral Resources, in consultation with the appropriate SMA. A complete APD consists of the surface use plan and the drilling plan, evidence of bond coverage, and other information that may be required by applicable Onshore Orders and NTLs, such as H_2S Contingency Plans. Onshore Oil and Gas Order No. 1 describes the specific information requirements of the drilling and surface use plans.

As part of the approval, an EA is completed for each APD. Either the APD or NOS must be posted for public review in the District Office for a minimum of 30 days before approval. Approved APDs are generally valid for 1 year. Before beginning construction the operator is required to contact the BLM and the appropriate SMA.

Onsite Inspection - Environmental Review

The BLM normally conducts the onsite inspection within 15 days after receiving the NOS or APD. The inspection team includes BLM and SMA representatives, the operator or agent, and other interested parties, such as the dirt work contractor or drilling contractor. When the location is on private surface, the surface owner is invited.

The purpose of the onsite inspection is to identify problems and potential environmental impacts associated with the proposal and methods to mitigate these impacts. Based on information from the onsite inspection and the APD, BLM develops conditions of approval for individual APDs. These measures are designed to protect surface and subsurface resources located at or near the drilling location. The results of the onsite inspection and all mitigating measures are documented in an EA.

New Field Discoveries

When development begins on a new field having Federal minerals, the District prepares an Environmental Analysis (EA). The EA process identifies the cumulative impacts of full field development and specifies appropriate mitigating measures.

Unitization

Unitization involves the joining together of lands that may be logically explored as a single area. It allows a company to explore and develop a prospect under a cost-sharing arrangement with other mineral owners and/or lessees. To receive the benefits of unitization, an operator must drill at least one well to the target formation within 6 months of approval. Generally, there is no requirement to drill more than one well. If the initial well is dry, the operator must commence a second well within 6 months or the unit will automatically terminate.

If commercial production is established, interest owners participate in production on the basis of their percentage of ownership of the proven area. The prospect must be defined within a five year period (which can be extended as long as the operator continues to diligently drill new wells outside of the proven area, with each new well commencing within 90 days of the completion of the previous well). If no new wells are drilled, the unit contracts to the configuration of the proven area, and all other lands are eliminated from the unit. Separate participating areas are established for each producing horizon.

A discovery extends the terms of all leases committed to the unit agreement. A unit will terminate when production ceases from all producing areas. When a unit terminates, Federal leases committed to the unit receive a two-year extension from the date of termination.

Approval from Other Agencies

BLM approval of an APD does not relieve the operator of the responsibility for obtaining any other authorizations required for drilling or subsequent operations. These include requirements of other Federal, state, or local authorities.

Producing Operations

Onshore oil and gas operations should be conducted in a manner which ensures the proper handling, measurement, and disposition of leasehold production. Site security for

the location and protection of other natural resources, environmental quality, life, and property are also required. The objective is to maximize ultimate recovery of oil and gas with minimum waste and with minimum adverse effects to other resources.

Production reports must be submitted to the Minerals Management Service (Form MMS 3160) as required by 43 CFR 3162.4-3.

Well Completion Report

A Well Completion or Recompletion Report and Log (Form 3160-4) is required to be filed within 30 days after completion of a well, either for abandonment or production. The completion report describes the mechanical and physical condition of the well, such as casings, perforations, and production status of the well. Geologic information which is also required includes information on the completed interval and production rates if the well is a producer.

Subsequent Well Operations

Producing wells in active oil and gas fields periodically require repair and workover operations. Even if no new surface disturbance occurs, requests to redrill, deepen, and plug back require prior approval by the District Office. Requests to perform other operations such as casing repairs, altering casing, performing nonroutine fracturing jobs, recompletion in a different zone, completion of water shutoff, commingling production, or converting to injection or disposal well require the submission of the Sundry Notices and Reports on Wells (called the Sundry Notice, Form 3160-5) for prior approval by the AO.

Unless additional surface disturbance is involved, prior approval is not required for routine fracturing or acidizing jobs or recompletion in the same interval when applications conform to standard and prudent operating practices. However, a Sundry Notice (SN) must be filed subsequent to these activities.

No prior approval or subsequent report is required for well cleanout work, routine well maintenance, bottom-hole pressure surveys or for repair, replacement, or modification of surface production equipment as long as no additional surface disturbance is involved.

Approval Procedures

When prior approval is required, the operator must submit either a Sundry Notice or an APD. A detailed written statement of the plan of work must be submitted with the appropriate form. When additional surface disturbance will occur, a description of any new construction or alteration of existing facilities must be submitted for environmental review and approval. An SN must be submitted and approved before conducting surface disturbing activities. Emergency repairs may be conducted without prior approval as long as the District is promptly notified.

Production Startup Notification

Operators are required to notify the AO no later than the 5th business day after any Federally supervised well begins production, or resumes production in the case of a well which has been out of production for more than 90 days.

Painting of Facilities

As required in the Conditions of Approval (COA) of an APD, or a SN for the approval or modification of existing facilities, a standard color may be specified. Standardized color charts are available in the District or Resource Area Office.

Measurement of Production

If economically feasible, all oil and gas or other hydrocarbons produced from leased lands are to be put in a marketable condition.

Oil production is measured by tank gauging, positive displacement metering system, or other methods acceptable to the AO. In the absence of prior approval from the District Office, no oil is to be diverted to a pit except in emergency situations.

Gas production is measured by orifice meters or other methods acceptable to the AO. The flaring or venting of gas from leasehold operations must meet the requirements of NTL-4A or subsequent onshore oil and gas order. Before approving any request to flare or vent gas from a Federal well, an EA is prepared by the District Office to document the environmental effects of the proposal.

Disposal of Produced Water

Produced water will be disposed of by subsurface injection, lined pits, or by other approved methods described in NTL-2B or subsequent onshore oil and gas order. Disposal of produced water in an injection or disposal well requires permit(s) from the primacy state or EPA. Primacy means

that a state or agency has the ultimate responsibility for permitting and monitoring the Underground Injection Control (UIC) program for Class 2 wells (saltwater disposal and secondary recovery wells). South Dakota is a primacy state. Montana is currently a primacy state candidate; operators in Montana must seek EPA approval until primacy is granted. In some instances, an additional SMA authorization may be necessary. An EA is prepared for all requests concerning disposal of produced water from Federal wells.

Undesirable Events

All spills or leaks of oil, gas, produced water, toxic liquids or waste materials, and blowouts, fires, personal injuries, or deaths must be reported by the operator to the BLM and SMA in accordance with the requirements of NTL-3A or subsequent onshore oil or gas order. All Class 1 events (fatalities, spills exceeding 100 barrels of fluid, or release of more than 500 MCF of gas) must be reported immediately.

Inspection and Enforcement

All leases which produce significant quantities of oil and gas in any year or have a history of noncompliance are inspected at least once a year. Other factors such as health and safety, environmental concerns, and potential conflict with other resources also determine inspection priority. Inspections of lease operations are made to ensure compliance with applicable laws, regulations, lease terms, onshore orders, NTLs, and other written orders.

Reclamation and Abandonment

A reclamation plan is part of the surface use plan of operations. Reclamation may be required for any surface previously disturbed which is not necessary for continued well operations. When abandoning a well and other facilities that do not have a previously approved reclamation plan, one should be submitted with a Notice of Intent to Abandon (NIA), on Form 3160-5.

Well abandonment operations may not be started without prior approval of the Sundry Notice (Form 3160-5). For newly drilled dry holes, failures, or emergency situations, oral approval may be obtained from the AO. The operator is required to submit a sundry notice within 30 days of completion of work. The surface reclamation requirements are stipulated in the APD for newer wells. Additional requirements may be added if needed. The operator must contact the BLM prior to plugging a well to allow for approval and witnessing of the plugging operations. Guidelines for pit closure are found in the "Gold Book" (USDI, BLM, 1989a). BLM will require pit closure to be in compliance with any stricter state requirements. The following items are generally part of any reclamation plan:

1. Pit reclamation
2. Revegetation and noxious weed control
3. Visual resources
4. Pipeline and flowline reclamation
5. Well site reclamation
6. Road reclamation

The operator must file a Subsequent Report of Abandonment (SRA) on Form 3160-5 following the plugging of a well. A Final Abandonment Notice (FAN) on Form 3160-5 must be filed upon completion of reclamation operations when the location is ready for inspection. After approval of the SRA, the MCDO notifies the BLM RA office or SMA office that the well has been plugged and that the location is ready for inspection. An initial site inspection is conducted within one year after approval of the SRA and may be conducted prior to receipt of the FAN. Final abandonment will be approved when the required reclamation work is acceptable to the SMA. Abandonment inspections of BLM-administered lands are made by the appropriate Resource Area Office. Other inspections are handled by the appropriate SMA.

If a well is covered by an individual lease bond, the liability period on the bond can be terminated once the final abandonment or phased bonding release has been approved. If a well is covered by a statewide or nationwide bond, termination of the liability period is not approved until final abandonment of all activities covered under the bond has been approved.

CONDITIONS OF APPROVAL

Applications for Permit to Drill are approved for the Miles City District by the Assistant District Manager, Division of Mineral Resources. The approval letter includes the Conditions of Approval which the operator must follow from site construction through abandonment. Also, the approval letter contains informational notices which cite the regulatory requirements from the Code of Federal Regulations, Onshore Operating Orders 1 and 2, and other guidance.

Conditions Of Approval

1. Site Specific COAs are based on analysis of the proposed location for the well. They include the following:
   A. Drilling Plan
   B. Access Road

C. Production Facilities
D. Water Supply
E. Waste Disposal
F. Well-site Layout
G. Surface Restoration

2. Verbal Notifications (made to the BLM, MCDO 406-232-4331, or after business hours to the appropriate individual's home phone shown on the list attached).
   A. Notify this office verbally at least 48 hours prior to beginning construction.
   B. Notify this office verbally at least 12 hours prior to spudding the well. (To be followed up in writing within 5 days.)
   C. Notify this office verbally at least 12 hours prior to running any casing or BOP tests. (To be followed up in writing within 5 days.)
   D. Notify this office verbally at least 24 hours prior to plugging the well to receive verbal plugging orders. (Refer to Informational Notice Item 2 for additional abandonment instructions.)
   E. Notify this office verbally at least 24 hours prior to removal of fluids from the reserve pit.
   F. Failure to comply within specified notification timeframes may incur an assessment under 43 CFR 3163.1 and may also incur civil penalties under 43 CFR 3163.2.

3. A complete copy of the approved Application for Permit to Drill (APD), including conditions, stipulations, and the H_2S contingency plan (if required) shall be available for reference at the well site during the construction and drilling phases.

4. This drilling permit is valid for either 1 year from the approval date or until lease expiration, whichever occurs first.

5. Construction of access roads and well pads, and installation of cattleguards, culverts, fences, and other structures shall be in accordance with the BLM/FS brochure entitled "Surface Operating Standards for Oil and Gas Exploration and Development" (1989) which is available for reference in this office.

6. The operator is responsible for informing all persons in the area who are associated with this project that they will be subject to prosecution for knowingly disturbing historic or archaeological sites, or for collecting artifacts. If historic or archaeological materials are uncovered during construction, the operator is to immediately stop work that might further disturb such materials, and contact the authorized officer (AO). Within five working days the AO will inform the operator as to:
   - whether the materials appear eligible for the National Register of Historic Places;
   - the mitigation measures the operator will likely have to undertake before the site can be used (assuming in site preservation is not necessary); and,
   - a timeframe for the AO to complete an expedited review under 36 CFR 800.11 to confirm, through the State Historic Preservation Officer, that the findings of the AO are correct and that mitigation is appropriate.

   If the operator wishes, at any time, to relocate activities to avoid the expense of mitigation and/or the delays associated with this process, the AO will assume responsibility for whatever recordation and stabilization of the exposed materials may be required. Otherwise, the operator will be responsible for mitigation costs. The AO will provide technical and procedural guidelines for the conduct of mitigation. Upon verification from the AO that the required mitigation has been completed, the operator will then be allowed to resume construction.

7. It is the responsibility of the operator to control noxious weeds on lands disturbed in association with oil and gas lease operations. Lease-associated weed control strategies, when required by the Bureau of Land Management (BLM), are to be coordinated with any involved surface owners and local weed control boards. A pesticide-use proposal must be prepared, and reviewed and approved by the BLM, prior to any herbicide application on lands disturbed by Federal oil and gas lease operations. A pesticide application record must be completed within 24 hours after completion of application of herbicides.

8. The abandonment marker shall exhibit the same information required for the well sign (Refer to Informational Notice Item 6). The abandonment marker identified below must be installed when the well is plugged.
   _____A steel pipe (minimum 4" diameter, capped, minimum 4' above ground) set in cement.
   _____A steel plate welded to surface casing at the recontoured ground level.
   _____A steel plate welded to surface casing _____ below ground level.

9. Additional requirements may be imposed if changes in operational and/or environmental conditions dictate.

10. These Conditions of Approval are subject to the State Director Review (SDR) and appeals provisions of 43 CFR 3165.3 and 3165.4.

Informational Notice

The following items are from the Federal Oil and Gas regulations (43 CFR 3160, Onshore Orders Nos. 1 and 2, Notices to Lessees, and other guidance). This is not a complete list of requirements, but is an abstract of some major requirements.

1. General Requirements
   a. The lessee or designated operator shall comply with applicable laws and regulations; with the lease terms, Onshore Oil and Gas Orders, NTLs; and with other orders and instructions of the Authorized Officer. Any deviation from the terms of the approved APD requires prior approval from BLM (43 CFR 3162.1(a))

   b. If at any time the facilities located on public lands authorized by the terms of the lease are no longer included in the lease (due to a contraction in the unit or other lease or unit boundary change) the BLM will process a change in authorization to the appropriate statute. The authorization will be subject to appropriate rental or other financial obligations determined by the Authorized Officer.

2. Drilling Operations (Onshore Order No. 2)
   a. Onshore Order No. 2 requires surface casing shall have centralizers on at least every fourth joint starting with the shoe joint.

   b. If DSTs are run, the Miles City District Office shall be notified at least 6 hours prior to testing. All applicable safety precautions outlined in Onshore Order No. 2 shall be observed.

   c. All indications of usable water (10,000 ppm or less TDS) shall be reported to Miles City District Office prior to running the next string of casing or before plugging orders are requested, whichever occurs first.

3. Well Abandonment (43 CFR 3162.3-4, Onshore Order No. 1-Sec. V)

   Approval for abandonment shall be obtained prior to beginning plugging operations. Initial approval for plugging operations may be verbal, but shall be followed up in writing within 30 days. Subsequent and final abandonment notifications are required and shall be submitted on Sundry Notices and Reports on Wells, Form 3160.5, in triplicate.

4. Reports and Notifications (43 CFR 3162.4-1, 3162.4-3)

   a. Within 30 days of completion of the well as a dry hole or producer, a copy of all logs, core descriptions, core analyses, well-test data, geologic summaries, sample descriptions or data obtained and compiled during the drilling, workover, and/or completion operations shall be filed with Well Completion or Recompletion Report and Log, Form 3160-4, in duplicate.

   b. In accordance with 43 CFR 3162.4-3 this well shall be reported on MMS Form 3160, "Monthly Report of Operations", starting with the month in which any operations commence, including drilling, and continuing each month until the well is physically plugged and abandoned.

   c. Notify this office within 5 business days of production start-up if either of the following two conditions occur:
      (1) The well is placed on production.
      (2) The well resumes production after being off production for more than 90 days.

      "Placed on production" means shipment or sales of hydrocarbons from temporary tanks, production into permanent facilities or measurement through permanent facilities.

      Notification may be written or verbal with written follow-up within 15 days, and must include the following information:
      (1) Operator name, address, and telephone number.
      (2) Well name and number, county and state.
      (3) Well location, "1/4-1/4, Section, Township,Range, P.M."
      (4) Date well begins or resumes production.
      (5) The nature of the well's production; that is, crude oil, or crude oil casing gas, or natural gas and entrained liquid hydrocarbons.
      (6) The Federal or Indian lease number.
      (7) As appropriate, the Unit Agreement name, number and Participating Area name.
      (8) As appropriate, the Communitization Agreement number.

5. Environmental Obligations and Disposition of Production (43 CFR 3162.5-1, 3162.7-1 and 40 CFR 302.4)

   a. With BLM approval, water produced from newly completed wells may be temporarily disposed of into unlined pits up to 90 days. During this initial period, application for the permanent disposal method shall be made to this office in accordance with NTL-2B. If underground injection is pro-

posed, an EPA or State Permit shall also be obtained.

b. Spills, accidents, fires, injuries, blowouts and other undesirable events must be reported to this office within the timeframes in NTL-3A.

c. Gas may be vented or flared during emergencies, well evaluation, or initial production tests for a time period of up to 30 days or the production of 50 MMCF of gas, whichever occurs first. After this period, approval from this office shall be obtained to flare or vent gas in accordance with NTL-4A.

6. Well Identification (43 CFR 3162.6)

Each drilling, producing, or abandoned well shall be identified with the operator's name, the lease serial number, the well number, and the surveyed description of the well (either footages or the quarter-quarter section, the section, township and range). The Indian allottee lessor's name may also be required. All markings shall be legible, and in a conspicuous place.

7. Site Security (43 CFR 3162.7.5)
   a. Oil storage facilities shall be clearly identified with a sign, and tanks must be individually identified (43 CFR 3162.6 (c)).

   b. Site security plans shall be completed within 60 days of production startup (43 CFR 3162.7-5(c)).

   c. Site facility diagrams shall be filed in this office within 60 days after facilities are installed or modified (43 CFR 3162.7-5(d)(1)).

8. Confidentiality (43 CFR 3162.8)

All submitted information not marked "CONFIDENTIAL INFORMATION" will be available for public inspection upon request. The exception is Indian leaseinformation which is always considered confidential.

District Office Address And Contacts

The approval letter concludes with the complete address, phone number, and business hours for the District Office. A list of staff members, their job titles, and home phone numbers is also provided for the company to use when the office is closed.

SITE CONSTRUCTION

After the APD is approved, the operator begins construction of the access road and site. Location and construction are done in accordance with the lease stipulations and Conditions of Approval (COA). The shortest feasible route is chosen to minimize haulage distances and construction costs while considering environmental factors and the surface owner's wishes. In the planning area the kind of drill rig and drilling depth varies and is determined by the geologic province and expected product from the well.

The first phase of construction is building the access road using bulldozers and graders to connect the existing road or trail and the drillsite. In some cases improvements such as cattle guards and culvert crossings are installed because of the terrain.

Most wells in the planning area are drilled from a fixed platform rather than a truck-mounted rig. Site preparation generally takes about a week before the drill rig is assembled. For moderate depth oil wells in south-central Montana and the Central Montana Uplift, drilling generally takes 2 to 4 weeks, although deeper wells in the Williston Basin in South Dakota may require longer drilling time because of the geologic formations encountered. Wells drilled from a platform require more surface preparation and cause disturbance to a larger area for the ancillary facilities.

Illustration A-2 compares the typical surface disturbance for wells drilled across the planning area.

Drillsites on sloping terrain are constructed by cutting and filling to create a level site for the drill platform. The site is selected so that the drill rig is placed on the cut area for stability. Topsoil is stockpiled separately to be used for the final rehabilitation. Before an APD is approved for sites on slopes greater than 30 percent, the soils resource stipulation requires that an engineering/reclamation plan must be approved. This plan sets standards for operations on the location. Construction of water bars or other features may be needed to control surface runoff and erosion.

A reserve pit is built on the site. It holds the drilling fluids and drillhole cuttings. Deeper wells require a reserve pit with larger capacity which increases the size of the drillsite. Reserve pits are generally square or oblong, but may be irregular in shape to conform to terrain. The size of reserve pits for deeper wells can be reduced by the use of steel mud tanks. For truck-mounted drill rigs used in shallow gas fields, a small pit (called the blooie pit) is used. Most or all of the reserve pit is located in the cut location of the drillsite for stability. When the drillsite is completed, the rig and ancillary equipment are moved on location and drilling begins.

ILLUSTRATION A-2 COMPARISON OF WELL CHARACTERISTICS IN PRODUCING PROVINCES

Location	Maximum Common Depth in Feet	Product	Size of Drill Site in Acres	Access and Ancillary Facilities in Acres
Central Montana Uplift	5,000	Oil with associated gas	2	1.5
South-central Montana Bighorn Basin	7,000	Oil with associated gas	2-3	1.5
Southeastern Montana Powder River Basin	7,500	Oil and gas	2-3	1.5
Williston Basin, South Dakota	9,000	Oil with associated gas	3-4	1.5-3
Southern South Dakota Minnelusa play	3,500	Oil with associated gas	2	1.5-3
Shallow gas wells (planning area)	2,000	Gas	0.5	1.5

DRILLNG OPERATIONS

Water for drilling is obtained from nearby sources such as rivers, wells, or privately owned reservoirs. It is trucked or piped onto location and is stored in the reserve pit or storage tanks. A number of additives can be used in the drilling mud depending upon the geologic conditions downhole. Bentonite is the basic ingredient in drilling mud. It creates a gel which serves several purposes during drilling. It coats the wellbore to seal off porous zones, it cools and lubricates the drill bit, and carries cuttings to the surface. Other additives are used to adapt the drilling mud to special downhole conditions. Air is sometimes used as a drilling fluid. The decision to use air is related to downhole conditions, the kind of rocks being drilled through, and the kind of well completion being attempted.

The drilling fluid is circulated down the wellbore through the drill pipe to the bottom of the hole. It passes through the bit, and returns to the surface with the well cuttings in the annular space between the drill pipe and the borehole walls. Drilling fluid returned to the reserve pit is reused in the drilling process after cuttings settle out or are mechanically separated by a screen.

The initial stage of drilling, called spudding, is generally completed quickly because of the unconsolidated nature of shallow formations. A drill bit with revolving teeth removes fragments of rock as the weight of the drillstem carries the bit downward.

The rig structure and hoisting equipment are used to control the weight of the drillstem which keeps the hole vertical or deviates from the vertical when desired. Samples of the cuttings from the reserve pit are collected at 10 foot intervals to record the lithology of the rocks being drilled. Hydrocarbon content of the cuttings is also checked during this process.

The rotating motion of the drillstem is created by the drive mechanism of the rig. A square or hexagonal rod called the kelly fits through a large turntable, the rotary table, on the drilling rig floor. Drillstem sections fit through the rotary table and are turned by the kelly. As the drill string moves downward in the hole, more lengths of pipe are added until the well reaches the total depth. During the drilling process the bit becomes worn and must be replaced. The entire string of drillpipe is lifted from the hole and the bit is changed. The pipe is reassembled, a new length is added, and drilling continues. Changing the bit is called “tripping”.

Drilling operations run 24 hours a day until the well’s total depth is reached. During this process, BLM personnel, generally a Petroleum Engineering Technician, may conduct periodic inspections to ensure compliance with the approved APD and Conditions of Approval.

APPENDIX B
LEASE FORMS AND STIPULATIONS FOR ALTERNATIVES

ALTERNATIVE A

Stipulations for Alternative A, No Action, use the Oil and Gas Lease Stipulations, Form MT-3109-1 (See next page). Special stipulations for Alternative A use the No Surface Occupancy, Timing, and Controlled Surface Use Forms MT-3109-2 through 4 (pages follow description of stipulations for Alternative D).

ALTERNATIVES B, C, AND D, THE PREFERRED

Stipulations for Alternatives B, C, and D, the Preferred, follow the "Uniform Format for Oil and Gas Lease Stipulations", (USDI and USDA, 1989b). Changes in the stipulation on a lease parcel are made by application of Waivers, Exceptions, and Modifications (WEMs). A WEM is a statement of an exemption from conditions of the stipulation. It allows the oil and gas operation to proceed while still protecting or mitigating the resource.

Waivers are a permanent exemption from a lease stipulation. This occurs when the resource no longer requires the protection of stipulation. For example, a waiver would be granted to all lands stipulated for a Threatened and Endangered species if it were declared recovered and had been removed from the list of protected species.

Exceptions are granted on a case-by-case basis. Each time the lessee applies for an exception, the resource objective of the stipulation must be met. An example of an exception is the granting of access into Crucial Winter Range before the end of the period specified by the Timing stipulation. In this plan the period from December 1 through March 31. If an open winter has occurred and the winter range is no longer being used before March 31, an exception might be granted for entry before the time period has elapsed. The decision is granted only for the year in question. In the following year an exception would have to be evaluated on current seasonal conditions and use.

Modifications are fundamental changes to the provisions of a lease stipulation either temporarily or for the term of the lease. A specific example of a modification to a stipulation in this plan is in an area of active coal mining. There is a No Surface Occupancy stipulation on coal mines with approved mine plans. When an area has been mined, there is no longer any need to restrict access for oil and gas development. The boundary of the coal mine area which is stipulated would be modified to allow oil and gas development to occur where the coal has been removed.

In some cases the granting of a Waiver, Exception, or Modification may involve an issue of major concern. When the operator requests a WEM, the action will be subject to a public review period. This determination is made by the Authorized Officer, usually the Resource Area Manager. Each stipulation which requires this review period will be identified with the statement: "A 30-day public notice period is required prior to modification or waiver of this stipulation."

Split Estate Lands

Stipulations were developed for all Federal oil and gas lands, regardless of surface ownership. In the case of private surface ownership (split estate lands), the landowner's input is actively solicited by the BLM at the actual operations approval or APD stage (Onshore Order No. 1). The private surface owner's wishes are addressed at this stage. Lease stipulations on private surface are not intended to dictate surface management, but are intended to provide required protection of important resources that may be impacted by federal actions (BLM Manual Handbook H-3101-1, Montana).

Plan Maintenance

Changes in the data inventory occur as a result of field work by the resource specialists. New use areas and resource locations can be identified during this process. In the same way use areas and resource locations which are no longer valid can be identified. These resources usually cover small areas, requiring the same protection or mitigation as identified resources in this amendment. Identification of new areas or removal of old areas which no longer have those resource values will result in the use of the same lease stipulations as in this amendment. These areas will be added to the existing data inventory without a plan amendment. In cases where the changes constitute a change in resource allocation or cover an extensive geographic area, a plan amendment may be required to analyze the impacts

to other resources. Data inventory maps are available for public inspection at the appropriate Resource Area office.

STIPULATIONS FOR ALTERNATIVE B

NO SURFACE OCCUPANCY

RESOURCE: Coal.

STIPULATION: Surface occupancy and use is prohibited within existing coal leases with approved mining plans.

OBJECTIVE: To protect existing coal leases with approved mining plans.

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan of operation which is compatible with existing or planned coal mining operations and is approved by all affected parties.

MODIFICATION: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area are not needed for existing or planned mining operations, or where mining operations have been completed, and the modification is approved by all affected parties.

WAIVER: This stipulation may be waived by the authorized officer if it is determined that all coal lease operations within the leasehold have been completed, or if the lease is terminated, canceled, or relinquished.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Riparian/Hydrology.

STIPULATION: Surface occupancy and use is prohibited within riparian areas, 100-year flood plains of major rivers, and on water bodies and streams.

OBJECTIVE: To protect the unique biological and hydrological features associated with riparian areas, 100-year flood plains of major rivers, and water bodies and streams.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area do not include riparian areas, flood plains, or water bodies.

WAIVER: This stipulation may be waived by the authorized officer if it is determined that the entire leasehold does not include riparian areas, flood plains, or water bodies.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Soils.

STIPULATION: Surface occupancy is prohibited on slopes over 30 percent.

OBJECTIVE: To maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, and to avoid areas subject to slope failure, mass wasting, piping, or having excessive reclamation problems.

EXCEPTION: An exception to this stipulation may be granted by the Authorized Officer if the operator demonstrates in a plan of operations that mass erosion or slope failure and/or slumping can be avoided or otherwise successfully mitigated.

MODIFICATION: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area do not include slopes over 30 percent.

WAIVER: This stipulation may be waived by the authorized officer if it is determined that none of the leasehold includes slopes over 30 percent.

(Stipuluation applies only to this alternative.)

LEASE NOTICE

RESOURCE: Land Use Authorizations

MANAGEMENT DECISION: Land Use Authorizations incorporate specific surface land uses allowed on BLM administered lands by authorized officers and those surface uses acquired by BLM on lands administered by other entities. These BLM authorizations include rights-of-way, leases, permits, conservation easements, and Recreation and Public Purpose leases and patents.

The rights acquired, reserved, or withdrawn by BLM for specified purposes include non-oil and gas leases, conservation easements, archeological easements, road easements, fence easements, and administrative site withdrawals. The

existence of such land use authorizations shall not preclude the leasing of the oil and gas. The locations of land use authorizations are noted on the oil and gas plats and in ALMRS/ORCA. The plats are a visual source noting location; ORCA provides location by legal description through the Geographic Cross Reference program.

The specifically authorized acreage for land use should be avoided by oil and gas exploration and development activities. All authorized surface land uses are valid claims to prior existing rights unless the authorization states otherwise.

The right of the Secretary to issue future land use authorizations on an oil and gas lease is reserved by provision of section 29 of the Mineral Leasing Act, 30 U.S.C. s 186 (1982) {ref.IBLA 88-258, vol.110 pg.89}.

All FLPMA authorizations are subject to valid existing rights {Section 701 (b), FLPMA}.

Land uses are authorized in accordance to the law which applies to that specific use at the time of issuance.

AUTHORITIES:
Federal Land Policy and Management Act (FLPMA), October 21, 1976.
Mineral Leasing Act of 1920, as amended.
Recreation and Public Purpose Act of 1926, as amended.
Pre-FLPMA
Revised Statute 2477
Taylor Grazing Act of 1934
Mining Law of 1872, as amended
Acquired Mineral Leasing Act of August 7, 1947
Executive Orders
Secretarial Orders

(Lease Notice the same for Alternatives B, C, and D.)

Special Management Area

NO LEASE

RESOURCE: Pryor Mountain Wild Horse Range.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect habitat within the boundary of the Pryor Mountain Wild Horse Range that is used by wild horse herds. This area also has primitive recreation values.

CHANGES: This management decision could be changed if the wild horse herd ceases to use this area or if there is a change in the management plan for the wild horse herd.

(No Lease decision the same for Alternatives B and D.)

Special Management Area

NO LEASE

RESOURCE: Ft. Meade Recreation Area.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect the intensive management of the developed recreation areas and structures, the cultural and historical values, wildlife habitat, and scenic values of Fort Meade.

(No Lease decision the same for Alternatives B and D.)

Special Management Area

NO LEASE

RESOURCE: Meeteetse Spires Proposed ACEC.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect the esthetic quality of the Meeteetse Spires pinnacles and habitat of the rare plant species Shoshonia (*Shoshonea pulvinata*) and Townsendia (*Townsendia spathulata*) found around or near the tops of the pinnacles.

(No Lease decision the same for Alternatives B and D.)

Special Management Area

NO LEASE

RESOURCE: Rosebud Battlefield.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect the historic battlefield site and surrounding area to maintain the visual quality of the cultural resources.

(No Lease decision applies only to this alternative.)

Special Management Area

NO LEASE

RESOURCE: Dryhead Overlook.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect from visual and audial intrusions into traditional Native American religious practices.

(No Lease decision applies only to this alternative.)

TIMING

RESOURCE: Wildlife - Crucial Winter Range.

STIPULATION: Surface use is prohibited from December 1 to March 31 within crucial winter range for wildlife. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect crucial white-tailed deer, mule deer, elk, antelope, moose, bighorn sheep, and sage grouse winter range from disturbance during the winter use season, and to facilitate long-term maintenance of wildlife populations.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain crucial winter range for wildlife. The dates for the timing restriction may be modified if new wildlife use information indicates that the December 1 to March 31 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains crucial winter range for wildlife.

(Stipulation the same for Alternatives B, C, and D.)

TIMING

RESOURCE: Wildlife - Elk Spring Calving Range.

STIPULATION: Surface use is prohibited from April 1 to June 15 within established spring calving range for elk. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect elk spring calving range from disturbance during the spring use season, and to facilitate long-term maintenance of wildlife populations.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain spring calving range for elk. The dates for the timing restriction may be modified if new elk use information indicates that the April 1 to June 15 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains spring calving range for elk.

(Stipulation the same for Alternatives B, C, and D.)

Special Management Area

NO LEASE

RESOURCE: Powder River Breaks Bighorn Sheep Range.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect the limited area of bighorn sheep habitat in southeastern Montana.

(No Lease decision applies only to this alternative.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Grouse Leks.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of grouse leks.

OBJECTIVE: To protect sharptail and sage grouse lek sites necessary for the long-term maintenance of grouse populations in the area.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting grouse lek sites.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting grouse lek sites, or if all lek sites within 1/4 mile of the leasehold have not been used for 5 consecutive years.

(Stipulation the same for Alternatives B, C, and D.)

TIMING

RESOURCE: Wildlife - Grouse Nesting Zone.

STIPULATION: Surface use is prohibited from March 1 to June 15 in grouse nesting habitat within 2 miles of a lek. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect sharptail and sage grouse nesting habitat from disturbance during spring and early summer in order to maximize annual production of young, and to protect nesting activities adjacent to nesting sites for the long-term maintenance of grouse populations in the area.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain grouse nesting habitat within 2 miles of a lek. The dates for the timing restriction may be modified if new information indicates that the March 1 to June 15 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains grouse nesting habitat within 2 miles of a lek.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Raptor Nests.

STIPULATION: Surface use is prohibited within 1/2 mile of raptor nest sites which have been active within the past 2 years. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect nest sites of raptors which have been identified as species of special concern in Montana, North or South Dakota.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated. An exception may also be allowed from July 1 through March 15 (the non-breeding season) if the anticipated activity will not disturb the production potential of the nest site.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer are within 1/2 mile of raptor nest sites which have been active within the past 2 years. The dates for the timing restrictions may be modified if new information indicates that the March 1 to August 1 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer is within 1/2 mile of raptor nest sites which have been active within the past 2 years.

(Stipulation applies only to this alternative.)

NO SURFACE OCCUPANCY

RESOURCE: Reservoirs with Fisheries.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of designated reservoirs with fisheries.

OBJECTIVE: This stipulation is intended to protect the fisheries and recreational values of reservoirs.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting the fisheries and recreational values of the reservoir.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting the fisheries and recreational values of the reservoir.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Designated black-footed ferret reintroduction areas that have been determined to be essential for black-footed ferret recovery.

STIPULATION: Surface occupancy and use is prohibited within designated or potential black-footed ferret reintroduction areas.

OBJECTIVE: To protect designated or potential black-footed ferret reintroduction habitat areas.

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan demonstrating that the proposed action will not affect the black-footed ferret or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by the authorized officer in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with the USFWS, determines that portions of the area are no longer essential for black-footed ferret reintroduction.

WAIVER: This stipulation may be waived if the authorized officer, in consultation with the USFWS, determines that the entire leasehold no longer contains habitat essential for black-footed ferret reintroduction, or if the black-footed ferret is declared recovered and is no longer protected under the Endangered Species Act (ESA).

NOTE: If this stipulation is to be modified or waived, the authorized officer, in consultation with the USFWS, will also determine if the Controlled Surface Use stipulation for potential black-footed ferret habitat should be applied in its place.

(Stipulation applies only to this alternative.)

NO SURFACE OCCUPANCY

RESOURCE: Potential black-footed ferret habitat (prairie dog colonies and complexes 80 acres or more in size that are not designated as black-footed ferret reintroduction sites).

STIPULATION: Prior to surface disturbance, prairie dog colonies and complexes 80 acres or more in size will be examined to determine the absence or presence of black-footed ferrets. The findings of this examination may result in some restrictions to the operator's plans or may even preclude use and occupancy that would be in violation of the Endangered Species Act (ESA) of 1973.

The lessee or operator may, at their own option, conduct an examination on the leased lands to determine if black-footed ferrets are present, or if the proposed activity would have an adverse effect, or if the area can be cleared. This examination must be done by or under the supervision of a qualified resource specialist approved by the Surface Management Agency (SMA). An acceptable report must be provided to the SMA documenting the presence or absence of black-footed ferrets and identifying the anticipated effects of the proposed action on the black-footed ferret and its habitat. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To assure compliance with the Endangered Species Act (ESA) by locating and protecting black-footed ferrets and their habitat.

EXCEPTION: An exception may be granted by the authorized officer for surface-disturbing activities determined to have no adverse effect on black-footed ferrets and ferret habitat.

MODIFICATION: The boundaries of the stipulated area may be modified by the authorized officer if portions of the leasehold are cleared based on current and/or past ferret surveys.

WAIVER: This stipulation may be waived if the entire leasehold is block cleared, or permanently cleared based on current and/or past ferret surveys, or if the ferret is declared recovered and no longer subject to the ESA.

(Stipulation applies only to this alternative.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Bald Eagle Nest Sites and Nesting Habitat.

STIPULATION: Surface occupancy and use is prohibited within 1/2 mile of known bald eagle nest sites which have been active within the past 7 years and within bald eagle nesting habitat in riparian areas.

OBJECTIVE: To protect bald eagle nesting sites and/or nesting habitat in accordance with the Endangered Species Act (ESA) and the Montana Bald Eagle Management Plan.

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the bald eagle or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area can be occupied without adversely affecting bald eagle nest sites or nesting habitat.

WAIVER: This stipulation may be waived if the autho-

rized officer, in consultation with USFWS, determines that the entire leasehold can be occupied without adversely affecting bald eagle nest sites or nesting habitat, or if the bald eagle is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Peregrine Falcon.

STIPULATION: Surface occupancy and use is prohibited within 1 mile of identified peregrine falcon nesting sites.

OBJECTIVE: To protect the habitat of the peregrine falcon, an endangered species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the peregrine falcon or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area no longer are critical to the peregrine falcon.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the peregrine falcon, or if the peregrine falcon is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Ferruginous Hawk.

STIPULATIONS: Surface occupancy and use is prohibited within 1/2 mile of known ferruginous hawk nest sites which have been active within the past 2 years.

OBJECTIVE: To maintain the production potential of ferruginous hawk nest sites, which are very sensitive to disturbance and have been identified as Category 2 species under the Endangered Species Act (ESA).

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the impacts from the proposed action are acceptable or can be adequately mitigated. Seasonal exceptions may be allowed from August 1 through March 1 (the nonbreeding season) if the authorized officer determines that the proposed activity will not disturb the production potential of ferruginous hawk nest sites.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting the production potential of ferruginous hawk nest sites.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting the production potential of ferruginous hawk nest sites.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Piping Plover.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of wetlands identified as piping plover habitat.

OBJECTIVE: To protect the habitat of the piping plover, a threatened species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the piping plover or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area are no longer critical to the piping plover.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the piping plover, or if the piping plover is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE : Wildlife - Interior Least Tern.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of wetlands identified as interior least tern habitat.

OBJECTIVE: To protect the habitat of the interior least tern, an endangered species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the interior least tern or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area are no longer critical to the interior least tern.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the interior least tern, or if the interior least tern is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Cultural Resources.

STIPULATION: Surface occupancy and use is prohibited within sites or areas designated for conservation use, public use, or sociocultural use.

OBJECTIVE: To protect those cultural properties identified for conservation use, public use, and sociocultural use (see definitions for use categories within BLM Manual 8111).

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the lessee or operator submits a plan which demonstrates that the cultural resource values which formed the basis for designation are not affected, or if adverse impacts are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the designated site or area can be occupied without adversely affecting the cultural resource values for which the site or area was designated.

WAIVER: This stipulation may be waived if the authorized officer determines that all designated sites or areas within the leasehold can be occupied without adversely affecting the cultural resource values for which such sites or areas were designated, or if all designated sites or areas within the leasehold are allocated for other uses.

NOTE: Compliance with Section 106 of the National Historic Preservation Act is required for all actions which may affect cultural properties eligible to the National Register of Historic Places.

(Stipulation the same for Alternatives B, C, and D.)

LEASE NOTICE

CULTURAL RESOURCES: An inventory of the leased lands may be required prior to surface disturbance to determine if cultural resources are present and to identify needed mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator shall:

1. Contact the Surface Management Agency (SMA) to determine if a cultural resource inventory is required. If an inventory is required, then;
2. The SMA will complete the required inventory; or the lessee or operator may choose to engage the services of a cultural resource consultant acceptable to the SMA to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the standard 10-acre minimum to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the SMA for review and approval no later than that time when an otherwise complete application for approval of drilling or subsequent surface-disturbing operation is submitted.
3. Implement mitigation measures required by the SMA. Mitigation may include the relocation of proposed lease-related activities or other protective measures such as data recovery and extensive recordation. Where impacts to cultural resources cannot be mitigated to the satisfaction of the SMA, surface occupancy on that area must be prohibited. The lessee or operator shall immediately bring to the attention of the SMA any cultural resources discovered as a result of approved operations under this lease and shall not disturb such discoveries until directed to proceed by the SMA.

AUTHORITIES: Compliance with Section 106 of the National Historic Preservation Act is required for all actions which may affect cultural properties eligible to the National Register of Historic Places. Section 6 of the Oil and Gas Lease Terms (Form 3100-11) requires that operations be conducted in a manner that minimizes adverse impacts to cultural and other resources.

NOTE: All leases in the district will be issued with this lease notice.

(Lease Notice the same for Alternatives B and C.)

NO SURFACE OCCUPANCY

RESOURCE: Paleontological Resources.

STIPULATION: Surface occupancy and use is prohibited within designated paleontological sites.

OBJECTIVE: To protect significant paleontological sites.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the lessee or operator submits a plan which demonstrates that the paleontological resource values which formed the basis for designation are not affected, or if adverse impacts are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the designated site can be occupied without adversely affecting the paleontological resource values for which the site was designated, or if the boundaries of the designated site are changed.

WAIVER: This stipulation may be waived if the authorized officer determines that all designated sites within the leasehold can be occupied without adversely affecting the paleontological resource values for which the sites were designated, or if all designated sites within the leasehold are allocated for other uses.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Recreation.

STIPULATION: Surface occupancy and use is prohibited within developed recreation areas and undeveloped recreation areas receiving concentrated public use.

OBJECTIVE: To protect developed recreation areas and undeveloped recreation areas receiving concentrated public use.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified by the authorized officer if the recreation area boundaries are changed.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains developed recreation areas or undeveloped recreation areas receiving concentrated public use.

(Stipulation the same for Alternatives B, C, and D.)

CONTROLLED SURFACE USE

RESOURCE: Visual Resource Management (VRM) Classes II, III, IV.

STIPULATION: All surface-disturbing activities, semi-permanent and permanent facilities in VRM Class II, III, and IV areas may require special design, including location, painting, and camouflage, to blend with the natural surroundings and meet the visual quality objectives for the area.

OBJECTIVE: To control the visual impacts of activities and facilities within acceptable levels.

EXCEPTION: None.

MODIFICATION: None.

WAIVER: None.

Note: This stipulation will not prevent surface access. There are no Waivers, Exceptions, or Modifications because a land use plan amendment would be needed to change the classification of lands. In order to maintain the visual qualities of Class II, III, and IV lands the operations plan for the well must meet the objectives for that class.

(Stipulation applies only to this alternative.)

STIPULATIONS FOR ALTERNATIVE C

NO SURFACE OCCUPANCY

RESOURCE: Coal.

STIPULATION: Surface occupancy and use is prohibited within existing coal leases with approved mining plans.

OBJECTIVE: To protect existing coal leases with approved mining plans.

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan of operation which is compatible with existing or planned coal mining operations and is approved by all affected parties.

MODIFICATION: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area are not needed for existing or planned mining operations, or where mining operations have been completed, and the modification is approved by all affected parties.

WAIVER: This stipulation may be waived by the authorized officer if it is determined that all coal lease operations within the leasehold have been completed, or if the lease is terminated, canceled, or relinquished.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Riparian/Hydrology.

STIPULATION: Surface occupancy and use is prohibited within riparian areas, 100-year flood plains of major rivers, and on water bodies and streams.

OBJECTIVE: To protect the unique biological and hydrological features associated with riparian areas, 100-year flood plains of major rivers, and water bodies and streams.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area do not include riparian areas, flood plains, or water bodies.

WAIVER: This stipulation may be waived by the authorized officer if it is determined that the entire leasehold does not include riparian areas, flood plains, or water bodies.

(Stipulation the same for Alternatives B, C, and D.)

LEASE NOTICE

RESOURCE: Land Use Authorizations

MANAGEMENT DECISION: Land Use Authorizations incorporate specific surface land uses allowed on BLM administered lands by authorized officers and those surface uses acquired by BLM on lands administered by other entities. These BLM authorizations include rights-of-way, leases, permits, conservation easements, and Recreation and Public Purpose leases and patents.

The rights acquired, reserved, or withdrawn by BLM for specified purposes include non-oil and gas leases, conservation easements, archeological easements, road easements, fence easements, and administrative site withdrawals. The existence of such land use authorizations shall not preclude the leasing of the oil and gas. The locations of land use authorizations are noted on the oil and gas plats and in ALMRS/ORCA. The plats are a visual source noting location; ORCA provides location by legal description through the Geographic Cross Reference program.

The specifically authorized acreage for land use should be avoided by oil and gas exploration and development activities. All authorized surface land uses are valid claims to prior existing rights unless the authorization states otherwise.

The right of the Secretary to issue future land use authorizations on an oil and gas lease is reserved by provision of section 29 of the Mineral Leasing Act, 30 U.S.C. s 186 (1982) {ref.IBLA 88-258, vol.110 pg.89}.

All FLPMA authorizations are subject to valid existing rights {Section 701 (b), FLPMA}.

Land uses are authorized in accordance to the law which applies to that specific use at the time of issuance.

AUTHORITIES:
Federal Land Policy and Management Act (FLPMA), October 21, 1976.
Mineral Leasing Act of 1920, as amended.
Recreation and Public Purpose Act of 1926, as amended.
Pre-FLPMA
- Revised Statute 2477
- Taylor Grazing Act of 1934

Mining Law of 1872, as amended

Acquired Mineral Leasing Act of August 7, 1947
Executive Orders
Secretarial Orders

(Lease Notice the same for Alternatives B, C, and D.)

Special Management Area

NO SURFACE OCCUPANCY

RESOURCE: Pryor Mountain Wild Horse Range.

MANAGEMENT DECISION: Surface occupancy and use is prohibited within the designated wild horse range.

OBJECTIVE: To protect habitat within the boundary of the Pryor Mountain Wild Horse Range that is used by wild horse herds. This area also has primitive recreation values.

EXCEPTIONS: None.

WAIVERS: None.

MODIFICATIONS: None.

NOTE: This stipulation affects only those lands in the PMWHR outside the WSA designation.

(Stipulation applies only to this alternative.)

Special Management Area

NO SURFACE OCCUPANCY

RESOURCE: Ft. Meade Recreation Area.

MANAGEMENT DECISION: Surface occupancy and use is prohibited within the designated Fort Meade boundaries.

OBJECTIVE: To protect the intensive management of the developed recreation areas and structures, the cultural and historical values, wildlife habitat, and scenic values of Fort Meade.

EXCEPTION: None.

MODIFICATION: None.

WAIVER: None.

(Stipulation applies only to this alternative.)

Special Management Area

NO SURFACE OCCUPANCY

RESOURCE: Meeteetse Spires Proposed ACEC.

MANAGEMENT DECISION: Surface occupancy and use is prohibited in the proposed area.

OBJECTIVE: To protect the esthetic quality of the Meeteetse Spires pinnacles and habitat of the rare plant species Shoshonia (Shoshonea pulvinata) and Townsendia (Townsendia spathulata) found around or near the tops of the pinnacles.

(Stipulation applies only to this alternative.)

TIMING

RESOURCE: Wildlife - Crucial Winter Range.

STIPULATION: Surface use is prohibited from December 1 to March 31 within crucial winter range for wildlife. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect crucial white-tailed deer, mule deer, elk, antelope, moose, bighorn sheep, and sage grouse winter range from disturbance during the winter use season, and to facilitate long-term maintenance of wildlife populations.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain crucial winter range for wildlife. The dates for the timing restriction may be modified if new wildlife use information indicates that the December 1 to March 31 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains crucial winter range for wildlife.

(Stipulation the same for Alternatives B, C, and D.)

TIMING

RESOURCE: Wildlife - Elk Spring Calving Range.

STIPULATION: Surface use is prohibited from April 1 to June 15 within established spring calving range for elk. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect elk spring calving range from disturbance during the spring use season, and to facilitate long-term maintenance of wildlife populations.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain spring calving range for elk. The dates for the timing restriction may be modified if new elk use information indicates that the April 1 to June 15 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains spring calving range for elk.

(Stipulation the same for Alternatives B, C, and D.)

Special Management Area

TIMING

RESOURCE: Powder River Breaks Bighorn Sheep Range.

STIPULATION: Surface occupancy is prohibited from December 1 to June 30 within crucial winter range and during the lambing period for bighorn sheep. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect crucial bighorn sheep range from disturbance during the winter use and lambing season, and to facilitate long-term maintenance of wildlife populations.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain crucial winter and lambing for bighorn sheep. The dates for the timing restriction may be modified if new wildlife use information indicates that the December 1 to June 30 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains crucial winter and lambing range for bighorn sheep.

(Stipulation applies only to this alternative.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Grouse Leks.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of grouse leks.

OBJECTIVE: To protect sharptail and sage grouse lek sites necessary for the long-term maintenance of grouse populations in the area.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting grouse lek sites.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting grouse lek sites, or if all lek sites within 1/4 mile of the leasehold have not been used for 5 consecutive years.

(Stipulation the same for Alternatives B, C, and D.)

TIMING

RESOURCE: Wildlife - Grouse Nesting Zone.

STIPULATION: Surface use is prohibited from March 1 to June 15 in grouse nesting habitat within 2 miles of a lek. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect sharptail and sage grouse nesting habitat from disturbance during spring and early summer in order to maximize annual production of young, and to protect nesting activities adjacent to nesting sites for the long-term maintenance of grouse populations in the area.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed

action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain grouse nesting habitat within 2 miles of a lek. The dates for the timing restriction may be modified if new information indicates that the March 1 to June 15 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains grouse nesting habitat within 2 miles of a lek.

(Stipulation the same for Alternatives B, C, and D.)

TIMING

RESOURCE: Wildlife - Raptor Nests.

STIPULATION: Surface use is prohibited from March 1 - August 1, within 1/2 mile of raptor nest sites which have been active within the past 2 years. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect nest sites of raptors which have been identified as species of special concern in Montana, North or South Dakota.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer are within 1/2 mile of raptor nest sites which have been active within the past 2 years. The dates for the timing restrictions may be modified if new information indicates that the March 1 to August 1 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer is within 1/2 mile of raptor nest sites which have been active within the past 2 years.

(Stipulation the same for Alternatives C and D.)

NO SURFACE OCCUPANCY

RESOURCE: Reservoirs with Fisheries.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of designated reservoirs with fisheries.

OBJECTIVE: This stipulation is intended to protect the fisheries and recreational values of reservoirs.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting the fisheries and recreational values of the reservoir.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting the fisheries and recreational values of the reservoir.

(Stipulation the same for Alternatives B, C, and D.)

CONTROLLED SURFACE USE

RESOURCE: Praire dog towns within potential black-footed ferret reintroduction areas that have been determined to be essential for black-footed ferret recovery.

STIPULATION: The "Draft Guidelines for Oil and Gas Activities in Prairie Dog Ecosystems Managed for Black-footed Ferret Recovery" (FWS, 1990), will be used as appropriate to develop site-specific conditions of approval to protect black-footed ferret reintroduction and recovery. Specific conditions of approval will depend on type and duration of proposed activity, proximity to occupied ferret habitat, and other site-specific conditions.

OBJECTIVE: To maintain the integrity of designated black-footed ferret reintroduction area habitat for reintroduction and recovery of black-footed ferrets.

EXCEPTIONS: May be granted by the authorized officer for activities that are determined, through coordination with the Montana Black-Footed Ferret Coordination Committee (MBFFCC) to have no adverse impacts on reintroduction and recovery of ferrets.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in coordinations with the MBFFCC, determines that portions of the area are no longer essential for ferret reintroduction and recovery.

WAIVER: The stipulation may be waived if the authroized officer, in coordination with the MBFFCC, determines that the entire leasehold no longer contains habitat essential for the reintroduction and recovery of the ferret or if the ferret is removed from protection under the Endangered Species Act.

(Stipulation the same for Alternatives C and D.)

CONTROLLED SURFACE USE

RESOURCE: Potential black-footed ferret habitat (prairie dog colonies and complexes 80 acres or more in size that are not designated as black-footed ferret reintroduction sites).

STIPULATION: Prior to surface disturbance, prairie dog colonies and complexes 80 acres or more in size will be examined to determine the absence or presence of black-footed ferrets. The findings of this examination may result in some restrictions to the operator's plans or may even preclude use and occupancy that would be in violation of the Endangered Species Act (ESA) of 1973.

The lessee or operator may, at their own option, conduct an examination on the leased lands to determine if black-footed ferrets are present, or if the proposed activity would have an adverse effect, or if the area can be cleared. This examination must be done by or under the supervision of a qualified resource specialist approved by the Surface Management Agency (SMA). An acceptable report must be provided to the SMA documenting the presence or absence of black-footed ferrets and identifying the anticipated effects of the proposed action on the black-footed ferret and its habitat. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To assure compliance with the Endangered Species Act (ESA) by locating and protecting black-footed ferrets and their habitat.

EXCEPTION: An exception may be granted by the authorized officer for surface-disturbing activities determined to have no adverse effect on black-footed ferrets and ferret habitat.

MODIFICATION: The boundaries of the stipulated area may be modified by the authorized officer if portions of the leasehold are cleared based on current and/or past ferret surveys.

WAIVER: This stipulation may be waived if the entire leasehold is block cleared, or permanently cleared based on current and/or past ferret surveys, or if the ferret is declared recovered and no longer subject to the ESA.

(Stipulation the same for Alternatives C and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Bald Eagle Nest Sites and Nesting Habitat.

STIPULATION: Surface occupancy and use is prohibited within 1/2 mile of known bald eagle nest sites which have been active within the past 7 years and within bald eagle nesting habitat in riparian areas.

OBJECTIVE: To protect bald eagle nesting sites and/or nesting habitat in accordance with the Endangered Species Act (ESA) and the Montana Bald Eagle Management Plan.

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the bald eagle or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area can be occupied without adversely affecting bald eagle nest sites or nesting habitat.

WAIVER: This stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold can be occupied without adversely affecting bald eagle nest sites or nesting habitat, or if the bald eagle is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Peregrine Falcon.

STIPULATION: Surface occupancy and use is prohibited within 1 mile of identified peregrine falcon nesting sites.

OBJECTIVE: To protect the habitat of the peregrine falcon, an endangered species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the

peregrine falcon or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area no longer are critical to the peregrine falcon.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the peregrine falcon, or if the peregrine falcon is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Ferruginous Hawk.

STIPULATIONS: Surface occupancy and use is prohibited within 1/2 mile of known ferruginous hawk nest sites which have been active within the past 2 years.

OBJECTIVE: To maintain the production potential of ferruginous hawk nest sites, which are very sensitive to disturbance and have been identified as Category 2 species under the Endangered Species Act (ESA).

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the impacts from the proposed action are acceptable or can be adequately mitigated. Seasonal exceptions may be allowed from August 1 through March 1 (the nonbreeding season) if the authorized officer determines that the proposed activity will not disturb the production potential of ferruginous hawk nest sites.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting the production potential of ferruginous hawk nest sites.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting the production potential of ferruginous hawk nest sites.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Piping Plover.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of wetlands identified as piping plover habitat.

OBJECTIVE: To protect the habitat of the piping plover, a threatened species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the piping plover or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area are no longer critical to the piping plover.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the piping plover, or if the piping plover is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE : Wildlife - Interior Least Tern.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of wetlands identified as interior least tern habitat.

OBJECTIVE: To protect the habitat of the interior least tern, an endangered species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the interior least tern or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and

Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area are no longer critical to the interior least tern.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the interior least tern, or if the interior least tern is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alterntives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Cultural Resources.

STIPULATION: Surface occupancy and use is prohibited within sites or areas designated for conservation use, public use, or sociocultural use.

OBJECTIVE: To protect those cultural properties identified for conservation use, public use, and sociocultural use (see definitions for use categories within BLM Manual 8111).

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the lessee or operator submits a plan which demonstrates that the cultural resource values which formed the basis for designation are not affected, or if adverse impacts are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the designated site or area can be occupied without adversely affecting the cultural resource values for which the site or area was designated.

WAIVER: This stipulation may be waived if the authorized officer determines that all designated sites or areas within the leasehold can be occupied without adversely affecting the cultural resource values for which such sites or areas were designated, or if all designated sites or areas within the leasehold are allocated for other uses.

NOTE: Compliance with Section 106 of the National Historic Preservation Act is required for all actions which may affect cultural properties eligible to the National Register of Historic Places.

(Stipulation the same for Alterntives B, C, and D.)

LEASE NOTICE

CULTURAL RESOURCES: An inventory of the leased lands may be required prior to surface disturbance to determine if cultural resources are present and to identify needed mitigation measures. Prior to undertaking any surface-disturbing activities on the lands covered by this lease, the lessee or operator shall:

1. Contact the Surface Management Agency (SMA) to determine if a cultural resource inventory is required. If an inventory is required, then;
2. The SMA will complete the required inventory; or the lessee or operator may choose to engage the services of a cultural resource consultant acceptable to the SMA to conduct a cultural resource inventory of the area of proposed surface disturbance. The operator may elect to inventory an area larger than the standard 10-acre minimum to cover possible site relocation which may result from environmental or other considerations. An acceptable inventory report is to be submitted to the SMA for review and approval no later than that time when an otherwise complete application for approval of drilling or subsequent surface-disturbing operation is submitted.
3. Implement mitigation measures required by the SMA. Mitigation may include the relocation of proposed lease-related activities or other protective measures such as data recovery and extensive recordation. Where impacts to cultural resources cannot be mitigated to the satisfaction of the SMA, surface occupancy on that area must be prohibited. The lessee or operator shall immediately bring to the attention of the SMA any cultural resources discovered as a result of approved operations under this lease and shall not disturb such discoveries until directed to proceed by the SMA.

AUTHORITIES: Compliance with Section 106 of the National Historic Preservation Act is required for all actions which may affect cultural properties eligible to the National Register of Historic Places. Section 6 of the Oil and Gas Lease Terms (Form 3100-11) requires that operations be conducted in a manner that minimizes adverse impacts to cultural and other resources.

NOTE: All leases in the district will be issued with this lease notice.

(Lease Notice the same for Alternatives B and C.)

NO SURFACE OCCUPANCY

RESOURCE: Paleontological Resources.

STIPULATION: Surface occupancy and use is prohibited

within designated paleontological sites.

OBJECTIVE: To protect significant paleontological sites.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the lessee or operator submits a plan which demonstrates that the paleontological resource values which formed the basis for designation are not affected, or if adverse impacts are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the designated site can be occupied without adversely affecting the paleontological resource values for which the site was designated, or if the boundaries of the designated site are changed.

WAIVER: This stipulation may be waived if the authorized officer determines that all designated sites within the leasehold can be occupied without adversely affecting the paleontological resource values for which the sites were designated, or if all designated sites within the leasehold are allocated for other uses.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Recreation.

STIPULATION: Surface occupancy and use is prohibited within developed recreation areas and undeveloped recreation areas receiving concentrated public use.

OBJECTIVE: To protect developed recreation areas and undeveloped recreation areas receiving concentrated public use.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified by the authorized officer if the recreation area boundaries are changed.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains developed recreation areas or undeveloped recreation areas receiving concentrated public use.

(Stipulation the same for Alternatives B, C, and D.)

CONTROLLED SURFACE USE

RESOURCE: Visual Resource Management (VRM) Class II.

STIPULATION: All surface-disturbing activities, semi-permanent and permanent facilities in VRM Class II, areas may require special design, including location, painting, and camouflage, to blend with the natural surroundings and meet the visual quality objectives for the area.

OBJECTIVE: To control the visual impacts of activities and facilities within acceptable levels.

EXCEPTION: None.

MODIFICATION: None.

WAIVER: None.

NOTE: This stipulation will not prevent surface access. There are no Waivers, Exceptions, or Modifications because a land use plan amendment would be needed to change the classification of lands. In order to maintain the visual qualities of Class II, lands the operations plan for the well must meet the objectives for that class.

(Stipulation the same for Alternatives C and D.)

STIPULATIONS FOR ALTERNATIVE D, THE PREFERRED

NO SURFACE OCCUPANCY

RESOURCE: Coal.

STIPULATION: Surface occupancy and use is prohibited within existing coal leases with approved mining plans.

OBJECTIVE: To protect existing coal leases with approved mining plans.

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan of operation which is compatible with existing or planned coal mining operations and is approved by all affected parties.

MODIFICATION: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area are not needed for existing or planned mining operations, or where mining operations have been completed, and the modification is approved by all affected parties.

WAIVER: This stipulation may be waived by the authorized officer if it is determined that all coal lease operations within the leasehold have been completed, or if the lease is terminated, canceled, or relinquished.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Riparian/Hydrology.

STIPULATION: Surface occupancy and use is prohibited within riparian areas, 100-year flood plains of major rivers, and on water bodies and streams.

OBJECTIVE: To protect the unique biological and hydrological features associated with riparian areas, 100-year flood plains of major rivers, and water bodies and streams.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area do not include riparian areas, flood plains, or water bodies.

WAIVER: This stipulation may be waived by the authorized officer if it is determined that the entire leasehold does not include riparian areas, flood plains, or water bodies.

(Stipulation the same for Alternatives B, C, and D.)

CONTROLLED SURFACE USE

RESOURCE: Soils.

STIPULATION: Prior to surface disturbance on slopes over 30 percent, an engineering/reclamation plan must be approved by the authorized officer. Such plan must demonstrate how the following will be accomplished:

- Site productivity will be restored.
- Surface runoff will be adequately controlled.
- Off-site areas will be protected from accelerated erosion, such as rilling, gullying, piping, and mass wasting.
- Water quality and quantity will be in conformance with state and federal water quality laws.
- Surface-disturbing activities will not be conducted during extended wet periods.
- Construction will not be allowed when soils are frozen.

OBJECTIVE: To maintain soil productivity, provide necessary protection to prevent excessive soil erosion on steep slopes, and to avoid areas subject to slope failure, mass wasting, piping, or having excessive reclamation problems.

EXCEPTION: None.

MODIFICATION: The area affected by this stipulation may be modified by the authorized officer if it is determined that portions of the area do not include slopes over 30 percent.

WAIVER: This stipulation may be waived by the authorized officer if it is determined that the entire leasehold does not include slopes over 30 percent.

(Stipulation applies only to this alternative.)

LEASE NOTICE

RESOURCE: Land Use Authorizations

MANAGEMENT DECISION: Land Use Authorizations incorporate specific surface land uses allowed on BLM administered lands by authorized officers and those surface

uses acquired by BLM on lands administered by other entities. These BLM authorizations include rights-of-way, leases, permits, conservation easements, and Recreation and Public Purpose leases and patents.

The rights acquired, reserved, or withdrawn by BLM for specified purposes include non-oil and gas leases, conservation easements, archeological easements, road easements, fence easements, and administrative site withdrawals. The existence of such land use authorizations shall not preclude the leasing of the oil and gas. The locations of land use authorizations are noted on the oil and gas plats and in ALMRS/ORCA. The plats are a visual source noting location; ORCA provides location by legal description through the Geographic Cross Reference program.

The specifically authorized acreage for land use should be avoided by oil and gas exploration and development activities. All authorized surface land uses are valid claims to prior existing rights unless the authorization states otherwise.

The right of the Secretary to issue future land use authorizations on an oil and gas lease is reserved by provision of section 29 of the Mineral Leasing Act, 30 U.S.C. s 186 (1982) {ref.IBLA 88-258, vol.110 pg.89}.

All FLPMA authorizations are subject to valid existing rights {Section 701 (b), FLPMA}.

Land uses are authorized in accordance to the law which applies to that specific use at the time of issuance.

AUTHORITIES:
Federal Land Policy and Management Act (FLPMA), October 21, 1976.
Mineral Leasing Act of 1920, as amended.
Recreation and Public Purpose Act of 1926, as amended.
Pre-FLPMA
Revised Statute 2477
Taylor Grazing Act of 1934
Mining Law of 1872, as amended
Acquired Mineral Leasing Act of August 7, 1947
Executive Orders
Secretarial Orders

(Lease Notice the same for Alternatives B, C, and D.)

Special Management Area

NO LEASE

RESOURCE: Pryor Mountain Wild Horse Range.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect habitat within the boundary of the Pryor Mountain Wild Horse Range that is used by wild horse herds. This area also has primitive recreation values.

CHANGES: This management decision could be changed if the wild horse herd ceases to use this area or if there is a change in the management plan for the wild horse herd.

NOTE: Some lands in the PMWHR are currently in WSA status. This Special Management Area decision will add lands to the WSA lands if wilderness designation is confirmed by an act of Congress.

(No Lease decision the same for Alternatives B and D.)

Special Management Area

NO LEASE

RESOURCE: Ft. Meade Recreation Area.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect the intensive management of the developed recreation areas and structures, the cultural and historical values, wildlife habitat, and scenic values of Fort Meade.

(No Lease decision the same for Alternatives B and D.)

Special Management Area

NO LEASE

RESOURCE: Meeteetse Spires Proposed ACEC.

MANAGEMENT DECISION: No Lease.

OBJECTIVE: To protect the esthetic quality of the Meeteetse Spires pinnacles and habitat of the rare plant species Shoshonia (*Shoshonea pulvinata*) and Townsendia (*Townsendia spathulata*) found around or near the tops of the pinnacles.

(No Lease decision the same for Alternatives B and D.)

TIMING

RESOURCE: Wildlife - Crucial Winter Range.

STIPULATION: Surface use is prohibited from December 1 to March 31 within crucial winter range for wildlife. This stipulation does not apply to the operation and main-

tenance of production facilities.

OBJECTIVE: To protect crucial white-tailed deer, mule deer, elk, antelope, moose, bighorn sheep, and sage grouse winter range from disturbance during the winter use season, and to facilitate long-term maintenance of wildlife populations.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain crucial winter range for wildlife. The dates for the timing restriction may be modified if new wildlife use information indicates that the December 1 to March 31 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains crucial winter range for wildlife.

(Stipulation the same for Alternatives B, C, and D.)

TIMING

RESOURCE: Wildlife - Elk Spring Calving Range.

STIPULATION: Surface use is prohibited from April 1 to June 15 within established spring calving range for elk. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect elk spring calving range from disturbance during the spring use season, and to facilitate long-term maintenance of wildlife populations.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain spring calving range for elk. The dates for the timing restriction may be modified if new elk use information indicates that the April 1 to June 15 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains spring calving range for elk.

(Stipulation the same for Alternatives B, C, and D.)

Special Management Area

NO SURFACE OCCUPANCY

RESOURCE: Powder River Breaks Bighorn Sheep Range.

STIPULATION: Surface occupancy is prohibited in the designated Bighorn Sheep Range.

OBJECTIVE: To protect the limited area of bighorn sheep habitat in southeastern Montana.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain Bighorn Sheep habitat.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains bighorn sheep habitat.

(Stipulation applies only to this alternative.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Grouse Leks.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of grouse leks.

OBJECTIVE: To protect sharptail and sage grouse lek sites necessary for the long-term maintenance of grouse populations in the area.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting grouse lek sites.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting grouse lek sites, or if all lek sites within 1/4 mile of the leasehold have not been used for 5 consecutive years.

(Stipulation the same for Alternatives B, C, and D.)

TIMING

RESOURCE: Wildlife - Grouse Nesting Zone.

STIPULATION: Surface use is prohibited from March 1 to June 15 in grouse nesting habitat within 2 miles of a lek. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect sharptail and sage grouse nesting habitat from disturbance during spring and early summer in order to maximize annual production of young, and to protect nesting activities adjacent to nesting sites for the long-term maintenance of grouse populations in the area.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer contain grouse nesting habitat within 2 miles of a lek. The dates for the timing restriction may be modified if new information indicates that the March 1 to June 15 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains grouse nesting habitat within 2 miles of a lek.

(Stipulation the same for Alternatives B, C, and D.)

TIMING

RESOURCE: Wildlife - Raptor Nests.

STIPULATION: Surface use is prohibited from March 1 - August 1, within 1/2 mile of raptor nest sites which have been active within the past 2 years. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To protect nest sites of raptors which have been identified as species of special concern in Montana, North or South Dakota.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area no longer are within 1/2 mile of raptor nest sites which have been active within the past 2 years. The dates for the timing restrictions may be modified if new information indicates that the March 1 to August 1 dates are not valid for the leasehold.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer is within 1/2 mile of raptor sites which have been active within the past 2 years.

(Stipulation the same for Alternatives C and D.)

NO SURFACE OCCUPANCY

RESOURCE: Reservoirs with Fisheries.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of designated reservoirs with fisheries.

OBJECTIVE: This stipulation is intended to protect the fisheries and recreational values of reservoirs.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting the fisheries and recreational values of the reservoir.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting the fisheries and recreational values of the reservoir.

(Stipulation the same for Alternatives B, C, and D.)

CONTROLLED SURFACE USE

RESOURCE: Prairie dog towns within potential black-footed ferret reintroduction areas that have been determined to be essential for black-footed ferret recovery.

STIPULATION: The "Draft Guidelines for Oil and Gas Activities in Prairie Dog Ecosystems Managed for Black-footed Ferret Recovery" (FWS, 1990) will be used as appropriate to develop site-specific conditions of approval to protect black-footed ferret reintroduction and recovery. Specific conditions of approval will depend on type and

duration of proposed activity, proximity to occupied ferret habitat, and other site-specific conditions.

OBJECTIVE: To maintain the integrity of designated black-footed ferret reintroduction area habitat for reintroduction and recovery of black-footed ferrets.

EXCEPTION: May be granted by the authorized officer for activites that are determined, through coordination with the Montana Black-Footed Ferret Coordination Committee (MBFFCC) to have no adverse impacts on reintroduction and recovery of ferrets.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in coordination with MBFFCC, determines that portions of the area are no longer essential for ferret reintroduction and recovery.

WAIVER: The stipulation may be waived if the authorized officer, in coordination with the MBFFCC, determines that the entire leasehold no longer contains habitat essential for the reintroduction and recovery of the ferret or if the ferret is removed from protection under the Endangered Species Act.

(Stipulation the same as Alternatives C and D.)

CONTROLLED SURFACE USE

RESOURCE: Potential black-footed ferret habitat (prairie dog colonies and complexes 80 acres or more in size that are not designated as black-footed ferret reintroduction sites).

STIPULATION: Prior to surface disturbance, prairie dog colonies and complexes 80 acres or more in size will be examined to determine the absence or presence of black-footed ferrets. The findings of this examination may result in some restrictions to the operator's plans or may even preclude use and occupancy that would be in violation of the Endangered Species Act (ESA) of 1973.

The lessee or operator may, at their own option, conduct an examination on the leased lands to determine if black-footed ferrets are present, or if the proposed activity would have an adverse effect, or if the area can be cleared. This examination must be done by or under the supervision of a qualified resource specialist approved by the Surface Management Agency (SMA). An acceptable report must be provided to the SMA documenting the presence or absence of black-footed ferrets and identifying the anticipated effects of the proposed action on the black-footed ferret and its habitat. This stipulation does not apply to the operation and maintenance of production facilities.

OBJECTIVE: To assure compliance with the Endangered Species Act (ESA) by locating and protecting black-footed ferrets and their habitat.

EXCEPTION: An exception may be granted by the authorized officer for surface-disturbing activities determined to have no adverse effect on black-footed ferrets and ferret habitat.

MODIFICATION: The boundaries of the stipulated area may be modified by the authorized officer if portions of the leasehold are cleared based on current and/or past ferret surveys.

WAIVER: This stipulation may be waived if the entire leasehold is block cleared, or permanently cleared based on current and/or past ferret surveys, or if the ferret is declared recovered and no longer subject to the ESA.

(Stipulation the same for Alternatives C and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Bald Eagle Nest Sites and Nesting Habitat.

STIPULATION: Surface occupancy and use is prohibited within 1/2 mile of known bald eagle nest sites which have been active within the past 7 years and within bald eagle nesting habitat in riparian areas.

OBJECTIVE: To protect bald eagle nesting sites and/or nesting habitat in accordance with the Endangered Species Act (ESA) and the Montana Bald Eagle Management Plan.

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the bald eagle or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area can be occupied without adversely affecting bald eagle nest sites or nesting habitat.

WAIVER: This stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold can be occupied without adversely affecting bald eagle nest sites or nesting habitat, or if the bald eagle is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Peregrine Falcon.

STIPULATION: Surface occupancy and use is prohibited within 1 mile of identified peregrine falcon nesting sites.

OBJECTIVE: To protect the habitat of the peregrine falcon, an endangered species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the peregrine falcon or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area no longer are critical to the peregrine falcon.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the peregrine falcon, or if the peregrine falcon is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Ferruginous Hawk.

STIPULATION: Surface occupancy and use is prohibited within 1/2 mile of known ferruginous hawk nest sites which have been active within the past 2 years.

OBJECTIVE: To maintain the production potential of ferruginous hawk nest sites, which are very sensitive to disturbance and have been identified as Category 2 species under the Endangered Species Act (ESA).

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan which demonstrates that the impacts from the proposed action are acceptable or can be adequately mitigated. Seasonal exceptions may be allowed from August 1 through March 1 (the nonbreeding season) if the authorized officer determines that the proposed activity will not disturb the production potential of ferruginous hawk nest sites.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the area can be occupied without adversely affecting the production potential of ferruginous hawk nest sites.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold can be occupied without adversely affecting the production potential of ferruginous hawk nest sites.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Wildlife - Piping Plover.

STIPULATION: Surface occupancy and use is prohibited within 1/4 mile of wetlands identified as piping plover habitat.

OBJECTIVE: To protect the habitat of the piping plover, a threatened species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the piping plover or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area are no longer critical to the piping plover.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the piping plover, or if the piping plover is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE : Wildlife - Interior Least Tern.

STIPULATION: Surface occupancy and use is prohibited

within 1/4 mile of wetlands identified as interior least tern habitat.

OBJECTIVE: To protect the habitat of the interior least tern, an endangered species under the Endangered Species Act (ESA).

EXCEPTION: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the interior least tern or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area are no longer critical to the interior least tern.

WAIVER: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the interior least tern, or if the interior least tern is declared recovered and is no longer protected under the ESA.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Cultural Resources.

STIPULATION: Surface occupancy and use is prohibited within sites or areas designated for conservation use, public use, or sociocultural use.

OBJECTIVE: To protect those cultural properties identified for conservation use, public use, and sociocultural use (see definitions for use categories within BLM Manual 8111).

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the lessee or operator submits a plan which demonstrates that the cultural resource values which formed the basis for designation are not affected, or if adverse impacts are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the designated site or area can be occupied without adversely affecting the cultural resource values for which the site or area was designated.

WAIVER: This stipulation may be waived if the authorized officer determines that all designated sites or areas within the leasehold can be occupied without adversely affecting the cultural resource values for which such sites or areas were designated, or if all designated sites or areas within the leasehold are allocated for other uses.

NOTE: Compliance with Section 106 of the National Historic Preservation Act is required for all actions which may affect cultural properties eligible to the National Register of Historic Places.

(Stipulation the same for Alternatives B, C, and D.)

LEASE NOTICE

CULTURAL RESOURCES: The Surface Management Agency is responsible for assuring that the leased lands are examined to determine if cultural resources are present and to specify mitigation measures. Guidance for application of this requirement can be found in NTL-MSO-85-1.

OBJECTIVE: This Notice would be consistent with the present Montana guidance for cultural resource protection related to oil and gas operations (NTL-MSO-85-1).

(Lease Notice applies only to this alternative.)

NO SURFACE OCCUPANCY

RESOURCE: Paleontological Resources.

STIPULATION: Surface occupancy and use is prohibited within designated paleontological sites.

OBJECTIVE: To protect significant paleontological sites.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the lessee or operator submits a plan which demonstrates that the paleontological resource values which formed the basis for designation are not affected, or if adverse impacts are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified if the authorized officer determines that portions of the designated site can be occupied without adversely affecting the paleontological resource values for which the site was designated, or if the boundaries of the designated site are changed.

WAIVER: This stipulation may be waived if the authorized officer determines that all designated sites within the leasehold can be occupied without adversely affecting the paleontological resource values for which the sites were designated, or if all designated sites within the leasehold are allocated for other uses.

(Stipulation the same for Alternatives B, C, and D.)

NO SURFACE OCCUPANCY

RESOURCE: Recreation.

STIPULATION: Surface occupancy and use is prohibited within developed recreation areas and undeveloped recreation areas receiving concentrated public use.

OBJECTIVE: To protect developed recreation areas and undeveloped recreation areas receiving concentrated public use.

EXCEPTION: An exception to this stipulation may be granted by the authorized officer if the operator submits a plan demonstrating that impacts from the proposed action are acceptable or can be adequately mitigated.

MODIFICATION: The boundaries of the stipulated area may be modified by the authorized officer if the recreation area boundaries are changed.

WAIVER: This stipulation may be waived if the authorized officer determines that the entire leasehold no longer contains developed recreation areas or undeveloped recreation areas receiving concentrated public use.

(Stipulation the same for Alternatives B, C, and D.)

CONTROLLED SURFACE USE

RESOURCE: Visual Resource Management (VRM) Class II.

STIPULATION: All surface-disturbing activities, semi-permanent and permanent facilities in VRM Class II, areas may require special design, including location, painting, and camouflage, to blend with the natural surroundings and meet the visual quality objectives for the area.

OBJECTIVE: To control the visual impacts of activities and facilities within acceptable levels.

EXCEPTION: None.

MODIFICATION: None.

WAIVER: None.

NOTE: This stipulation will not prevent surface access. There are no Waivers, Exceptions, or Modifications because a land use plan amendment would be needed to change the classification of lands. In order to maintain the visual qualities of Class II, lands the operations plan for the well must meet the objectives for that class.

(Stipulation the same for Alternatives C and D.)

Lease Form

Oil and gas leases are issued on Form 3100-11, Offer to Lease and Lease for Oil and Gas (Illustration B-2). Stipulations are attached to this form when resources have been identified for protection or mitigation (Forms MT-3109-2 through 4, Illustrations B-3, 4, 5.

Special Stipulations For Other Surface Management Agencies

Lands leased for the Bureau of Reclamation and the Department of the Air Force will use special stipulation forms to identify operating requirements on Lands under their jurisdiction (Illustration B-6).

APPENDIX C
OIL AND GAS DEVELOPMENT POTENTIAL

These reports are based on 1988 oil field data. Illustration C-1 is a map of the geologic structures in the region. A strategraphic correlation chart shows the relationships across the planning area (Illustration C-2). Illustration C-3 shows development potential for Montana. Illustration C-4 is the development potential map for South Dakota.

BIG COULEE - ELK BASIN AREA, MONTANA

INTRODUCTION

The western edge of the planning area lies within the Big Coulee-Elk Basin map area. The boundaries are the Wyoming state line on the south, a line 4 miles west of Big Timber on the west, the Big Snowy Uplift on the north, and a line through Billings and Roundup on the east. The area covered is 72 to 78 miles east to west, and 116 to 120 miles north and south.

Topography is quite variable. The river valleys of the Yellowstone and Musselshell are approximately 3,300 feet above sea level. The mountains of the Beartooth Front average approximately 8,000 feet, with plateaus occurring at 8,000 to 10,000 feet, and the highest peaks near 12,000 feet. Intervening areas include flat prairie, rolling hills, breaks, and small mountains. The principal drainage direction is eastward.

The formations mapped in the area represent all geologic ages except Silurian. Quaternary-Tertiary terraces are extensive along the south flank of the Big Snowy Uplift and the north flank of the Beartooth Front. There are large areas of Tertiary Fort Union and Tertiary-Cretaceous Livingston Formations at the surface. There are some local, coarse-grained Tertiary intrusive rocks. Cretaceous volcanics cover a large area from the Dean Dome vicinity to the west edge of this map. Cretaceous rocks outcrop almost everywhere else except for older rocks from the Beartooth Front and the Pryor uplift. The Triassic and the Permian rocks pinch out from south to north, along a pre-Jurassic erosion surface, and are present only in the southern part of this map area.

In the past 15 years, 705 wells for oil and gas have been drilled; averaging four wells per month. In 1989, 13 wells were drilled in this area. Eight were in Yellowstone County. Target formations were the Lower Cretaceous Dakota and Lakota Formations. Three are testing for production, and five are apparently dry. Three wells were reported in Carbon County: one apparently dry, one a "tight hole" test of the Eagle Formation, and one an apparent producer in the Elk Basin field. There are two test wells in the Reedpoint syncline in an area where gas shows have been noted in several Cretaceous horizons.

Drilling activity for the next 15 years is expected at a rate of up to three wells per township per year in the following areas: 8 townships lying north and west of Roundup; 23 townships from the Fromberg fault, northwestward through Lake Basin and Big Coulee to Mud Creek; 1 township in the Broadview area; 1 township in the Crooked Creek area; 3 townships in the Reedpoint area; 3 townships along the Nye-Bowler lineament and Beartooth Front area; and 8 townships north-northwestward from Elk Basin through the Dry Creek-Golden Dome area.

Eight townships in the southwest part of this map are behind the Beartooth Front and no wells are expected to be drilled there in the next 15 years. Also behind the Beartooth Front, but nearer to the fault zone, are 6 townships that may have one or two wells drilled in the entire 6-township area in the next 15 years. Each of the remaining 170 townships will have as many as three wells drilled during the upcoming 15 years.

Lands of the Crow Indian Reservation on the Pryor Uplift, at the southeast part of this map (comprising about 8 townships), are not evaluated.

OCCURRENCE POTENTIAL

The thickness of the sedimentary rocks in the area covered by this map ranges from 0 to 25,000 feet. A very low potential is assigned to the area southwest of the Beartooth Front (about 8 townships). This is the only surface exposure of Precambrian rocks in the map area. The distance from the Beartooth Front, where the foot wall and hanging wall of the thrust both occur in crystalline Precambrian rocks, is not known with any degree of certainty. However, there is either an overturned interval below the thrust or a sheared off zone of sub-thrust sediments. Either is considered to have low occurrence potential and is estimated to cover about 6 townships. Areas with fewer than 2,000 feet of sediments are found on the Pryor Mountains Uplift and also are considered to have low potential. Reservoir rocks of pre-Cretaceous ages may be charged with fresh water from their outcrops along the river. Southeast of the Fromberg fault, on the northwest edge of the Pryor Mountains Uplift where less than 2,000 feet of sediment remains above the Precambrian formations, is a small area having moderate occurrence potential. All of the remainder of this mapped area is considered to have high occurrence potential. The type log for the area is from Superior 71-22

Copulos (T. 2 N., R. 21 E., sec. 22), in Lake Basin Field, Stillwater County.

DISCUSSION OF DEVELOPMENT POTENTIAL

The largest area of high development potential consists of 23 townships in Stillwater, Wheatland, and Yellowstone Counties. This area includes 8 producing oil and gas fields: Mosser Dome, Laurel, Lake Basin, North Lake Basin, Rapelje, Little Basin, Big Coulee-Hailstone Dome, and Mud Creek.

Mosser Dome has produced about 350,000 barrels of oil. Thirty wells were drilled in this township in the past 15 years. Due to low drilling investment, this rate will probably continue for the next 15 years. Mosser Dome currently has 23 wells producing a total of 29 barrels of oil per day. One well per year may be drilled near the Fromberg fault.

The Laurel Field is similar to Mosser Dome, and activity is predicted at two wells per year although, at present, it is shut-in. The adjacent townships should experience one well per year.

Lake Basin Field, discovered in 1924, produced oil until 1958. Cumulative oil production is reported as 474,000 barrels of oil. Large but unknown quantities of gas were produced from the Frontier-Mowry Big Elk sand, Telegraph Creek, and Eagle Formations. Current production is only gas from the Upper Cretaceous Telegraph Creek and Eagle. Two or three wells per year are anticipated to be drilled. Significant gas shows have been noted in T. 1 N., R. 22 E., Tps. 1 and 2 S., Rs. 21 and 22 E.; one well per year may be expected somewhere in this five-township area. Lake Basin currently has 20 wells which produce a total of 646 MCFPD.

North Lake Basin Field produces gas from the Big Elk sand and the Eagle Formation. It currently has two wells producing 26 MCFPD. One well per year can be expected in this township.

Rapelje Field has gas producing horizons in the Upper Cretaceous Judith River, Claggett, and Eagle-Virgelle sands. Eleven wells currently produce 102 MCFPD. This area can expect two wells per year for the next 15 years.

Little Basin Field produces gas from the Cretaceous Frontier-Mowry with two wells currently producing 105 MCFPD. This township can expect to average one well per year for the next 15 years.

Big Coulee-Hailstone Dome Field has 7 wells on production at a rate of about 926 MCFPD. The deeper Jurassic Morrison and the shallower Lower Cretaceous Kootenai, and the Cretaceous Frontier Formations all contributed gas at some time. This structural feature is about 6 miles long by 3 miles wide and has at least 200 feet of closure. Two wells per year are expected in this area of 5 townships.

Mud Creek gas field is a local structural closure on the Shawmut anticline. The field has been shut-in since discovery. The lower Cretaceous basal Mowry is also gas productive but shut-in. A gauge of the Amsden Formation gas showed an initial potential of 1.4 MCFPD. A well approximately 9 miles south (T. 5 N., R. 17 E., sec. 27) reported 250 MCFGPD. Gas shows of this magnitude indicate that at least 1 well will be drilled in this area in the upcoming 15 years.

The second largest area of high development potential is a group of eight townships in south-central Carbon County where the west-northwest plunging trend of the Elk Basin anticline contains four oil fields. The Dry Creek-Golden Dome anticline, also trending west-northwest along the Nye-Bowler lineament, features four gas fields with some oil production. The Elk Basin trend includes the Elk Basin Field which originally produced from the Cretaceous Frontier and Lower Cretaceous Greybull member of the Dakota, Permian Phosphoria, Pennsylvanian Tensleep, Mississippian Madison, Devonian Jefferson, and Ordovician Big Horn Formations. The Greybull, Jefferson and Big Horn currently are not producing. Northwest Elk Basin (11 wells) is now producing from Frontier, Tensleep, and Madison. (The Greybull has produced in the past.) Clarks Fork South and Clarks North fields are now shut-in, except for 1 gas well. Belfry Field is also shut-in, after producing from the Greybull. The three townships between the Elk Basin structural trend and the Dry Creek structural trend have had only five wells drilled (four in the last 15 years). However, two of these reported significant gas shows in the Virgelle sand and the Mowry shale, and one reported oil shows in the Frontier. Undrilled structural traps probably exist and stratigraphic traps are almost a certainty in T. 8 S., Rs. 21-23 E. Depths to the Jurassic vary from 5,000 to 12,000 feet. Drilling at a rate of 7 wells per year for the next 15 years is expected for this area.

Northwestern Musselshell County has an area with high development potential where 9 wells per year can be expected. Fields include Mason Lake (on the Pole Creek-Devil's Pocket anticline), Wagon Box, and Winnett Junction. Producing horizons include the Cat Creek sands (Dakota-Lakota) at Mason Lake, Tyler Formation at Wagon Box and Winnett Junction, Amsden at Mason Lake (shut-in), and Heath Formation at Devil's Basin. (Otter Formation production is shut-in.) Multiple objectives and shallow drilling depths (1,500 to 5,500 feet) are incentives for continued operations here.

Fields in three townships along the Nye-Bowler lineament in Carbon and Stillwater Counties (T. 5 S., R. 17 E., and T. 6 S., Rs. 17 and 18 E.), have produced from six faulted structures. Only Dean Dome is currently producing. The

Greybull member is the productive interval, although gas and oil shows have been noted in the Frontier, Mowry, and Tensleep. Revised structural interpretations (newly identified fault blocks) will generate activity here during the next 15 years with the possibility of two wells per year in the three-township area.

A currently nonproducing area (T. 1 S., Rs. 17 and 18 E., and T. 2 S., R. 17 E.) has significant gas shows in Judith River, Eagle-Virgelle, Telegraph Creek and Frontier, and a new field may be opened in the future. One well per year within this three-township area is expected. Crooked Creek (T. 4 N., R. 25 E.), is a noncommercial Dakota oil field discovered in 1985 in Yellowstone County. One well every 2 or 3 years may be drilled in, or adjacent to, this township. Tensleep oil shows were noted in section 11 in an 8,000 foot deep Ordovician test.

Broadview is a shut-in gas field (T. 5 N., R. 22 E., sec. 35), in Golden Valley County. Completion was for 930 MCFGPD from the Frontier Formation. Frontier drilling depths are less than 3,000 feet in this area, and further exploratory tests are likely. As many as four wells are expected in this township or adjacent to it during the next 15 years.

Drilling is not anticipated in the next 15 years in Carbon and Stillwater Counties in the eight townships where the development potential is very low. The low potential area around the Beartooth Front in Carbon, Stillwater, and Sweetgrass Counties is not expected to have more than one well drilled in the next 15 years. The same is true for the Pryor Mountains Uplift low potential area in Carbon County and the Big Snowy Uplift area in Wheatland and Golden Valley Counties.

All of the remaining lands in this map area have moderate potential and will average 1 well drilled per township during the next 15 years. In the previous 15 years, 191 wells were drilled in this area classified as having only moderate potential.

THREE FORKS-BIG TIMBER AREA, MONTANA

INTRODUCTION

The Three Forks-Big Timber Oil and Gas Development potential map covers the western one-fourth of Wheatland and Sweetgrass Counties in the planning area. It comprises a strip 8 to 12 miles from east to west and 126 miles from north to south. The Wheatland County portion lies on the southeast edge of the Little Belt Uplift and the east edge of the Castle Mountains where the structural dip plunges into the Wheatland Syncline. The Sweetgrass County portion is in the Crazy Mountains Basin and the Beartooth Uplift. Currently, there are no producing oil and gas wells in the area.

OCCURRENCE POTENTIAL

The area from the Musselshell River on the north to the Boulder River on the south (vicinity of McLeod) is considered to have high oil and gas occurrence potential. At least 5,000 feet of sedimentary rocks of lower Cretaceous through Cambrian age are present on Big Elk Dome except for Triassic, Permian, and Silurian rocks which are missing. The type log for the area is from the Norris l Federal (T. 7 N., R. 13 E., NESE sec. 28).

A thick sequence of Tertiary-Upper Cretaceous Livingston Formation and mountain topography increase the depth to as much as 30,000 feet near the south peak of the Crazy Mountains. Cretaceous, Jurassic, and Pennsylvanian gas production is established 25 to 40 miles to the east of Big Elk Dome. Oil production from the Lower Cretaceous occurs about 20 miles southeast of McLeod.

Precambrian rocks are exposed at the surface of the Beartooth Uplift from 10 miles south of McLeod for another 30 miles farther south. This area has low occurrence potential.

DISCUSSION OF DEVELOPMENT POTENTIAL

None of this area is considered to have high development potential because there are no producing fields, and only five tests for oil and gas have been drilled in the last 15 years. Significant oil and gas shows were not reported for the older wells. Slight gas and oil shows are indicated on Big Elk Dome. A sedimentary section is present that has proven productive to the east and southeast so most of the area is rated as having moderate development potential. Exploratory drilling during the next 15 years is expected to be similar to the past 15 years; 5 wells are anticipated.

The southernmost 25 miles of the area are on, or adjacent to, the Beartooth Uplift and its development potential is rated as low to very low or unknown. Another low rated area is the south peak of the Crazy Mountains. The area is topographically high and has Tertiary intrusives on much of the surface. The shape of the intrusive body is not known except at the surface. One or two wells may be expected in these areas in the next 15 years.

CEDAR CREEK-POWDER RIVER AREA, MONTANA

INTRODUCTION

The Cedar Creek-Powder River area is one of the more active oil and gas drilling areas in the planning area. Drilling is expected to be just as active over the next 15 years as it has been for the last 15 years. The map includes portions of Carter, Dawson, Fallon, Powder River, Prairie, and Wibaux Counties. The Williston Basin crosses the

northeast corner of the map area. The Cedar Creek Anticline is the major producing structure and separates the Williston Basin from the Powder River Basin. Bell Creek Field, a stratigraphic trap, is the second largest producer in the map area.

OCCURRENCE POTENTIAL

All of the Cedar Creek-Powder River area is classified as having high oil and gas occurrence potential. Regional geologic mapping (Mallory, 1972, p. 56) indicates that the area contains more than 5000 feet of sedimentary rocks. The type log for the area is from the Marathon 1 State (T. 2 N., R. 61 E., NWSW sec. 16) which logged 10,262 feet of sedimentary rock before drilling into the Precambrian. The source rocks and reservoirs are proven by the number of producing oil and gas wells in this area.

DISCUSSION OF DEVELOPMENT POTENTIAL

All active producing townships in the Cedar Creek-Powder River area have been rated as having high oil and gas development potential. Along the Cedar Creek anticline, primary targets have been the Cretaceous Eagle gas sands and the oil-bearing Ordovician Red River Formation. Bell Creek Field is a mature field producing from the Cretaceous Muddy Sandstone. Because exploration and development typically center around traditional producing areas, these townships can expect a high amount of development activity over the next 15 years. Based on this analysis, 1 to 45 additional wells could be drilled in each of these townships, with numerous producers expected in the next 15 years. This area has been a target for oil and gas exploration for more than 60 years (Tonnsen, 1985). The recent purchase of Bell Creek Field by Exxon Corporation, in anticipation of a carbon dioxide tertiary recovery project and the advent of horizontal drilling along the Cedar Creek Anticline, will cause this area to experience continued drilling activity and production in the next 15 years, despite the present depressed conditions in the domestic oil industry.

The rest of the Cedar Creek-Powder River area is classified as having moderate development potential because the sedimentary rocks are just as thick as those in the adjacent producing areas of the Williston and Powder River Basins. Wildcatting and limited development will occur in these townships in the next 15 years and will involve one to three wildcat wells being drilled per township. Since the Pennsylvanian Minnelusa sandstone produces oil from hundreds of fields in the Wyoming portion of the Powder River Basin, a Minnelusa discovery in Montana will create a surge in wildcat drilling above normal moderate development potential levels.

MILES CITY-TONGUE RIVER AREA, MONTANA

INTRODUCTION

The Miles City-Tongue River oil and gas development potential map covers portions of the Big Dry, Billings, and Powder River Resource Areas. Counties included are parts of Big Horn, Custer, Powder River, Rosebud and Treasure. Also within this limit is the eastern segment of the Northern Cheyenne Indian Reservation. Lands within this reservation are not discussed in this report.

The topography is open flat grasslands with the Yellowstone River crossing the north-central portion of the area in a west-east direction. A major part of the surface outcrops are Tertiary Fort Union with Upper Cretaceous rocks outcropping along the drainage systems (Ross and others, 1955). The Precambrian basement forms a structural saddle in a northwest-southeast direction that separates the Williston and Powder River basins. The structural depth of the crystalline basement is 5000 to 6,000 feet below mean sea level (Mallory, 1972). These rocks are overlain by a nearly complete section of Paleozoic and Cretaceous rocks greater than 5,000 feet thick (Mallory, 1972). Three major structural features are mapped in this area: the Porcupine Dome and the Miles City Arch in the north, and the northern limit of the Powder River Basin in the south (Dobbin and Erdmann, 1955). Minor structural features are also noted within these major structural trends.

There have been 181 wells drilled in this part of Montana in the past 15 years. Liscom Creek and Pumpkin Creek Fields on the northern flank of the Powder River Basin were discovered in the 1950s. Liscom Creek is producing from the Upper Cretaceous Shannon Sandstone. Pumpkin Creek produced from both Upper Cretaceous Eagle and Shannon Sandstone. The type log for the area is from the 1 Ivan E. Blum (T. 7 N., R. 48 E., sec. 21). The well was drilled in 1957 by Anschutz Drilling. The well spudded in the Tertiary Fort Union Formation and reached maximum depth in the Ordovician Winnipeg Formation at 8,992 feet. This well was completed as a dry hole.

OCCURRENCE POTENTIAL

All of the Miles City-Tongue River area is classified as having high occurrence potential. This classification is based on: 1) a sedimentary package of Paleozoic and Cretaceous rocks greater than 5,000 feet thick (Mallory, 1972), and several formations within this package that are productive in this area and elsewhere in the state; and 2) a geologic setting which may have potential for structural and stratigraphic traps.

DISCUSSION OF DEVELOPMENT POTENTIAL

The Miles City-Tongue River area has five townships classified as having high development potential. This is based on established production, significant hydrocarbon shows from past drilling within those townships, and the geologic setting with possible structural and stratigraphic traps. The remaining townships are classified as showing moderate development potential based on: 1) the presence of a thick sedimentary package that is productive within the area and elsewhere in the state, 2) a geologic setting that is conducive to the formation of structural and stratigraphic traps for oil and gas, and 3) the lack of drilling data and established production.

Based on the geologic setting and the past activity, it is expected that this area will have a moderate level of drilling activity over the next 15 years. This activity could include the drilling of one to eight wells in any given township.

SUMATRA-BIG HORN AREA, MONTANA

INTRODUCTION

This narrative discusses all of the Sumatra-Big Horn oil and gas development potential map, except for the southeastern corner of Petroleum County (14 townships). It is bounded on the west by a line through Billings and Roundup, on the east by the eastern side of the Crow Indian Reservation and the west edge of Porcupine Dome, and on the north by the East Dome of the Cat Creek anticline. The southern boundary crosses into Wyoming following the boundary of the Pryor Mountain Wild Horse Range.

It includes portions of Garfield, Rosebud, Musselshell, Yellowstone, Treasure, and Big Horn Counties. The area covered is 72 miles east to west and 138 miles north to south. It is considered to be in the Montana Plains province, except for the southwestern part (about 36 townships) on the north end of the Big Horn Mountains, and all of East Pryor Mountain. The principal structural features are the Sumatra Anticline and the Bull Mountains Basin.

The Tertiary Fort Union Formation occupies the Bull Mountains Basin and the eastern 15 to 20 miles of the Crow Indian Reservation. Pre-Cretaceous rocks are exposed around the north end of the Big Horn Mountains and on the Pryor Mountains. The majority of this map is covered by Cretaceous exposures, ranging from Hell Creek Formation downward into the Colorado Group.

In the past 15 years, 1,077 wells have been drilled in this map area; 783 were in the 23-township area of the Tyler Formation play on, or near, the Sumatra Anticline. Production in the past 15 years in the Toluca gas field has resulted in 26 wells (T. 1 S., Rs. 31 and 32 E., and T. 1 N., R 32 E.). The Frontier Formation has tested for gas up to 40 MCFGPD at drilling depths of 1,000 to 1,500 feet. Presently, these wells are shut-in or abandoned. The Wolf Springs-South Wolf Springs area currently is producing from eight Amsden oil wells. Eighteen wells have been drilled during the past 15 years. This pace of one well per year should continue in this general area, looking for fault traps in the Amsden and Tensleep Formations, and for the northward erosional pinchout of the Tensleep. An additional 250 exploratory wells can be expected throughout the remaining area over the next 15 years, covering approximately 138 townships.

OCCURRENCE POTENTIAL

There is a high occurrence potential nearly throughout the area, with a range of sedimentary thickness up to 10,000 feet in the Bull Mountains Basin. An exception is the East Pryor Mountain area in Carbon County where the sedimentary section is only 1,000-3,000 feet thick and the occurrence potential is low to moderate.

The type log used for this map is from the Madison Limestone Test Well 3 (T. 2 N., R. 27 E., NWSE sec. 35), Yellowstone County. This well was drilled to 7,190 feet into the Precambrian. It illustrates the permeability of potential reservoir beds in the lower Cretaceous, Pennsylvanian, Mississippian, Devonian, Ordovician, and Cambrian formations through drill stem tests which flowed water to the surface. The well was not located for hydrocarbons.

DISCUSSION OF DEVELOPMENT POTENTIAL

The 23-township area along the Sumatra Anticline has high development potential. It contains 28 oil fields ranging in size from one producing well, such as Howard Coulee, to 68 producing wells in the Sumatra complex. Most of the wells are completed in the Tyler sands; however, Big Wall and Sumatra fields also produce from the Amsden. The Tyler sands are Pennsylvanian in age and are deposited in fluvial beds that fill channels eroded into Mississippian Chester age marine shales and limestone. The resulting oil traps are abruptly discontinuous. Smaller tributary channels will continue to be targets for Tyler drilling but at a reduced rate of perhaps one well per township per year. The high potential Toluca gas field area, immediately west of Hardin, is a shallow, low-cost area that should experience a number of new ventures as gas prices rise. There should be 20 to 25 wells drilled in this area in the next 15 years. Approximately 6 townships in Carbon County, Montana, and Bighorn County, Wyoming have low development potential. One well may be expected in this entire area in the coming 15 years. The remaining lands on this map have moderate development potential. From 150 to 300 new wells are anticipated during the coming 15 years, or about one well per township.

BIBLIOGRAPHY - MONTANA

Dobbin, C. E., and Erdmann, C. E., 1955, Structure contour map of the Montana Great Plains: U.S. Geological Survey Oil and Gas Investigation Map OM 178A, scale 1:1,000,000.

Mallory, W. W., editor, 1972, Geologic atlas of the Rocky Mountain Region: Rocky Mountain Association of Geologists, pp. 30, 34, 37-39, and 56.

Montana Board of Oil and Gas Conservation, 1989, Montana Oil and Gas Statistical Bulletin, V. 37, nos. 1-4.

Ross, C. P., Andrews, D. A., and Witkind, I. J., compilers, 1955, Geologic map of Montana: U.S. Geological Survey, scale 1:500,000, 2 sheets.

Tonnsen, J. J., editor, 1985, Montana oil and gas fields symposium: Montana Geological Society, 2 vols., 1,250 p.

DEVELOPMENT POTENTIAL FOR COALBED METHANE IN MONTANA

In the planning area, the most likely location for development of coalbed methane is in the northern Bighorn Basin between Red Lodge and Bearcreek, Montana, in the Billings Resource Area. There are two townships, T. 8 S., Rs. 20 and 21 E., Montana Principal Meridan, which contain the bulk of the coal resources. This deposit is located 1 to 5 miles south of Red Lodge and 2 to 4.5 miles southwest of the community of Bearcreek.

There are six coal beds at least 4 feet thick, totaling 40 to 45 feet, within the coal-bearing rocks. Locally, some coal beds may reach a thickness of 13 feet. These coals are in the Fort Union Formation of Paleocene age, and are classified as subbituminous A and B with an average heating value of 10,600 BTUs per pound.

Between 1990 and 1991 Florentine Exploration and Production Company drilled 5 wells to depths between 1,182 and 1,900 feet. None of these are located on the Federal oil and gas estate. One was plugged and abandoned after it encountered water above the coal interval; probably that well was not drilled deep enough to penetrate the coal beds. A second well has been perforated, sand-fractured, and is classified as a "non-producing coal seam methane well" (as of July 1991). Water occurrence data within and between the coal beds is unknown at this time.

State spacing for gas wells is one well per 640 acres. Spacing exceptions can be granted upon approval by the Montana Board of Oil and Gas Conservation. An additional 6 wells probably will complete the exploratory work in the Red Lodge-Bearcreek area. Three of these wells are likely to be located on the Federal oil and gas estate.

The Powder River Basin is another area of consideration for coalbed methane development within the planning area. The composite thickness of multiple subbituminous coal beds reaches 150 feet with single beds as thick as 80 feet. Commercial development of coalbed methane in the Powder River Basin began in 1986 north of Gillette, Wyoming. Shallow wells produced coal gas from sands and coals at depths of 400 to 1,000 feet. Numerous deeper tests have been drilled near the center of the basin in Wyoming, none of which have attained commercial success. As of June 1, 1991, four wells have been drilled in the Montana portion of the Powder River Basin. The data from these wells has not been disclosed.

To a lesser extent, the Cretaceous Eagle formation in and around the Bridger Coal field is a potential target for coalbed methane activity. The composite thickness of multiple coalbeds is 18 feet. The high rank bituminous coals have higher per unit volumes of gas than those at the Red Lodge-Bearcreek and Powder River Basins. To date, there are no known proposals to drill in this area.

NORTHEASTERN COUNTIES OF SOUTH DAKOTA

INTRODUCTION

This report covers several counties in northeastern South Dakota which were determined to have low potential for oil and gas development. The following counties are covered by this report:

Beadle	Deuel	Kingsbury
Brookings	Faulk	Lake
Buffalo	Grant	Marshall
Brown	Hamlin	Miner
Clark	Hand	Potter
Codington	Hyde	Roberts
Day	Jerauld	Sanborn
		Spink
		Sully

All these counties lie east of the Missouri River in the northeastern part of South Dakota. The topography in these counties varies from rolling hills near the Missouri River in the west to a flat glaciated terrace to the east (Hedges, 1968, Steece, 1965). Geologically, these counties are transected by a Precambrian structural high, the Transcontinental Arch. This structural high is the reason for the thin sedimentary cover in these counties.

There are no producing oil and gas wells in these counties. The only county containing unclassified Indian Reservation land is Buffalo County.

OCCURRENCE POTENTIAL

All of Sully, Potter and the west portion of Hyde and Buffalo Counties are classified as having moderate oil and gas occurrence potential. This is based on regional geologic mapping (Mallory, 1972, p. 56) that indicates the county contains 2,000 to 5,000 feet of sedimentary rocks. The type log for these counties, taken from the Carter 1 Strat. (T. 78 W., R. 118 N., sec. 34), encountered 3,580 feet of sedimentary rock before drilling into Precambrian basement rock (no electric log available). This is the same, but thinner, package of rocks which contain source beds and producing reservoirs in other parts of the Williston Basin.

All the other counties covered by this report, including the eastern portions of Hyde and Buffalo, are rated as having low occurrence potential. Once again, this is based on regional geologic mapping (Mallory, 1972) which shows this part of South Dakota as having fewer than 2,000 feet of sedimentary rocks. The type log for the counties is from the Wessington Springs Test Hole #1 (T. 107 N., R. 65 W., sec. 9), which indicates 1,670 feet of sedimentary rock before reaching the Precambrian basement.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of these counties are classified as having low development potential because of the thin sedimentary cover in these counties and because of the lack of wells that were specifically drilled for oil and gas exploration. Most of the counties have no oil and gas exploratory wells at all. None of the counties has any producing oil and gas wells. Widely-spaced wildcatting may occur in this area in the next 15 years.

AURORA, BRULE AND DAVISON COUNTIES, SOUTH DAKOTA

INTRODUCTION

These three counties are located in the southeast part of the state and east of the Missouri River. The topography is flat open grasslands.

Regionally, the Precambrian Sioux Ridge strikes across the three counties in an east-west direction. The plunge of this structural high is to the west. Because of the structural high and faulting to the southwest, this area is void of Paleozoic rocks (Houser, 1987). Therefore, the Cretaceous rocks are unconformable to the Precambrian granites and Sioux Quartzite. This thin Cretaceous layer has the Fall River or Dakota Formations at its base, and the Pierre and Niobrara Formations forming the surface bedrock. This bedrock surface is mantled by Miocene and Pleistocene gravel up to 400 feet thick.

Brule County has the only two oil and gas wells drilled in this three county area. The #1 Fee (T. 103 N., R. 71 W., sec. 14), was drilled in 1948. It reached Precambrian granite at a drilling depth of 1,365 feet and reported a show in the Cretaceous Dakota at 1,363 feet. This well was plugged and abandoned. The #1 Warren Gaus was drilled in 1962, one township to the north. This well reported no shows and was plugged and abandoned. Currently, there is no oil or gas production in the three county area.

There are no Indian lands within the three county area.

OCCURRENCE POTENTIAL

All three counties are classified as having low occurrence potential. This is based on a thin Cretaceous section, less than 2,000 feet thick (Mallory, 1972) and the lack of established oil or gas production.

There is no type log for the three county area.

DISCUSSION OF DEVELOPMENT POTENTIAL

Brule County has moderate and low development potential areas. The moderate development potential lands are a strip of townships that extend east to west across the central portion of the county. This potential is based on the show of oil from the #1 Fee well (T. 103 N., R. 71 W., sec. 14), and its structural placement along the crest of the Sioux Ridge. The remaining townships in this county have low development potential. This is based on: 1) the lack of Paleozoic rocks; and 2) the thin Cretaceous section and lack of production or significant shows of hydrocarbons.

Aurora and Davison counties are classified as having low development potential. This is based on: 1) the lack of Paleozoic rocks; and 2) the thin Cretaceous section and lack of drilling data and production, or significant shows of hydrocarbons.

Based on the geologic setting, it is expected that this three county area will have a low level of surface disturbance due to oil or gas exploration in the next 15 years.

BENNETT, MELLETTE, SHANNON, WASHABAUGH, AND TODD COUNTIES, SOUTH DAKOTA

INTRODUCTION

These counties are located along the south central state line between South Dakota and Nebraska. The northern county lines partially follow by the Cheyenne and White Rivers and Pennington County, with Fall River County to the west and Tripp County to the east. Bennett and Mellette Counties are the only counties that are classified in this report.

Shannon and Washabaugh (now part of Jackson County) are part of the Pine Ridge Indian Reservation, and Todd County is the Rosebud Indian Reservation. Indian lands are not classified in this report.

The area is comprised of rolling hills and open grasslands with the major drainage occurring in a northward direction. On a regional scale this area is on the hinge line between the Williston Basin to the north and the Kennedy Basin to the south. This structural trend is created by a Precambrian basement high that extends in an east-west direction across the state, and the Chadron Arch that extends from Nebraska in a northwest direction into Fall River County and which influences the southern part of Shannon County (Steece, 1961). The majority of the area is covered by the Miocene White River Formation and the Oligocene Arikaree Formation. The sedimentary package from the surface through the Cretaceous and Paleozoic section increases in thickness southward into Nebraska.

The total drilling activity for Bennett and Mellette Counties is limited to six wells, two of which were drilled in the past 15 years. Currently there are no producing wells within the five county area. The type log for this area is from the #1 Farley (T. 36 N., R. 35 W., sec. 10). This well was drilled in 1983, spudded in the Cretaceous Arikaree Formation, and reached the Precambrian at a drilling depth of 4,370 feet.

OCCURRENCE POTENTIAL

Both Bennett and Mellette Counties have 2,000 to 5,000 feet of Cretaceous and Paleozoic rocks (Mallory, 1972). There is no established production. A moderate occurrence potential is assigned to these counties.

DISCUSSION OF DEVELOPMENT POTENTIAL

Bennett and Mellette Counties are known to contain a complete sedimentary package of Paleozoic and Cretaceous age rocks. Due to lack of production, however, those counties are considered to have only moderate development potential. Bennett County has had three wells drilled, one of those in the past 15 years. Mellette County has had only three wells drilled also, one in the past 15 years. Future activity for both counties is expected to be the same.

BON HOMME, YANKTON, CLAY, AND UNION COUNTIES, SOUTH DAKOTA

INTRODUCTION

All four counties are located in the extreme southeast corner of the state. The topography is open grasslands and small rolling hills. Regional geology shows the surface to have exposures of Cretaceous Pierre, Niobrabra, and Carlile Formations, with small outcrops of Cretaceous Belle Fourche Shales in Clay and Union Counties. Each of these counties also has extensive deposits of Pleistocene gravel and glacial deposits.

Because of the topographic high created by a Precambrian uplift to the north, the Paleozoic rocks were never deposited. The Cretaceous age rocks are unconformable to the Precambrian granites and Sioux Quartzite (Houser, 1987). None of the four counties has had oil or gas exploration in the past 15 years. Numerous water wells have been drilled, which indicate that the Cretaceous age rocks are fewer than 2,000 feet thick (Mallory, 1972). Presently, there is no established oil or gas production in any of these counties. There are no Indian lands within any of these counties.

OCCURRENCE POTENTIAL

All four counties are classified as having low occurrence potential. This is based on a sedimentary section less than 2,000 feet thick, and lack of drilling data. There is no type log for any of the four counties.

DISCUSSION OF DEVELOPMENT POTENTIAL

All four counties are classified as having low development potential. This is based on: 1) the lack of a Paleozoic section and a thin Cretaceous section and, 2) the lack of established production or significant shows in any of the old oil and gas wells.

BUTTE COUNTY, SOUTH DAKOTA

INTRODUCTION

Butte County is in the northwestern corner of the state, south of Harding County. The topography in this county is primarily rolling foothills coming off the Black Hills Uplift to the south. Geologically, Butte County is on the north flank of the Black Hills uplift, the southwestern flank of the Williston Basin and the eastern edge of the Powder River Basin. Currently, there is only one marginal producing oil well in the county and several shut-in low volume gas wells.

OCCURRENCE POTENTIAL

Oil and gas occurrence potential in Butte County ranges from high to moderate. Regional geologic mapping (Mallory, 1972, p. 56) indicates that the eastern part of the county contains more than 5,000 feet of sedimentary rocks. Mobil Oil drilled the 1 Mickelson in 1963 (T. 9 N., R. 9 E., sec. 7), and encountered 7,086 feet of sedimentary rock before drilling into Precambrian gneiss. This is the same package of rocks containing source beds and producing reservoirs in the adjacent Williston Basin. This portion of the county has been classified as having high occurrence

potential. The rest of the county has been classified as having moderate occurrence potential with an average of only 2,000 to 5,000 feet of sedimentary rocks with source beds and reservoir rocks similar to the adjacent Powder River Basin.

DISCUSSION OF DEVELOPMENT POTENTIAL

No part of Butte County has been designated as having high development potential because of the lack of commercial oil and gas wells. The one producing oil well in T. 10 N., R. 1 E., sec. 23 produces little oil with high volumes of water. The shut-in gas wells scattered throughout the county tested low volumes of gas (<100 MCFGPD) with no short-term prospect of being hooked up to a pipeline.

However, all of Butte County is classified as having moderate development potential because of the numerous wells that have encountered sub-commercial gas shows in the Cretaceous Eagle and Shannon Formations and the presence of Pennsylvanian Minnelusa oil in some scattered wells. Wildcatting and limited development in the Cretaceous Eagle-Shannon interval and the Pennsylvanian Minnelusa Formation may occur in this county in the next 15 years.

CAMPBELL COUNTY, SOUTH DAKOTA

INTRODUCTION

Campbell County is east of the Missouri River in north-central South Dakota. The topography in this county ranges from the dissected breaks of the Missouri River in the western portion of the county to the flat plains in the eastern half of the county. Geologically, Campbell County is on the southeastern flank of the Williston Basin. Currently, there are no producing oil and gas wells in this county.

OCCURRENCE POTENTIAL

Most of Campbell County is rated as having high oil & gas occurrence potential. Regional geologic mapping (Mallory, 1972, p. 56) indicates that the northwestern part of the county contains more than 5,000 feet of sedimentary rocks. These are the same rocks containing source beds and producing reservoirs in the adjacent Williston Basin. The rest of the county has been classified as having moderate occurrence potential with an average of only 2,000-5,000 feet of sedimentary rocks with source beds and reservoir rocks similar to the adjacent Williston Basin.

DISCUSSION OF DEVELOPMENT POTENTIAL

No part of Campbell County has been designated as having high development potential, because there have been no oil and gas wells drilled in the county in the last 15 years and none of the tests drilled prior to that encountered any oil and gas shows.

All of Campbell County is rated as having moderate development potential, however. Seven oil and gas tests were drilled in this county in 1969 to evaluate the Cretaceous Muddy Sandstone, in response to large Muddy discoveries at that time in the neighboring Powder River Basin of Montana. None of the tests encountered any shows. However, other areas of South Dakota have reported oil and gas shows in the Muddy (Bolyard, 1969). Wildcatting and some very limited development in the Muddy Sandstone and deeper Paleozoic rocks may occur in this county in the next 15 years.

CHARLES MIX COUNTY, SOUTH DAKOTA

INTRODUCTION

Charles Mix County is located just east of the Missouri River in the southeastern part of the state. The topography is open grasslands with small rolling hills. Regional geology shows the surface to have exposures of the Cretaceous Pierre Shale and Niobrara Formation, with isolated areas of recent and Pleistocene gravel (Darton, 1951). The Precambrian granite and Sioux Quartzite vary in structural elevation from 100 to 600 feet above mean sea level. Regional dip of this basement rock is southwest (Steece, 1961). Houser (1987) has mapped a fault system along the Missouri River that strikes northwest. The upthrown side is to the northeast. It is this fault that is responsible for the lack of Paleozoic rocks in the northeast part of the county. There have been only three wells drilled in this county for oil and gas, none in the past 15 years. Two of those wells were drilled in T. 95 N., R. 65 W. These recorded questionable gas shows in the Precambrian rocks. Currently there is no established production in this county. At one time two-thirds of the county was within the Yankton Indian Reservation. Presently, only a small portion of the extreme southeast corner of the county contains Indian lands. These lands were not classified.

OCCURRENCE POTENTIAL

All of Charles Mix County is classified as having low occurrence potential. This is based on: 1) a sedimentary package less than 2,000 feet thick as seen in water well and oil and gas drilling reports, and 2) the lack of established production. There is no type log for this county.

DISCUSSION OF DEVELOPMENT POTENTIAL

All but one township in Charles Mix County is classified as having low development potential. This is based on the thin Cretaceous rocks that are present and the lack of drilling data. The township that has high development potential is

classified on the show of gas that was recorded in the Precambrian rocks. It is expected that this area will experience a low level of surface disturbance from oil and gas activity in the next 15 years.

CUSTER COUNTY, SOUTH DAKOTA

INTRODUCTION

Custer County is located in the southwest corner of the state and just north of Fall River County. Its western limit is the state line between Wyoming and South Dakota. The Pine Ridge Indian Reservation forms a portion of the eastern county line. The cuesta-type topography in the south changes gradually in a northward direction to steeper dissected rolling hills, to almost badlands. This change is due to the Black Hills to the north. Custer County is on the southern end of the Tertiary age Black Hills Uplift. This topographic high has a north to northwest axial trend and covers portions of several counties to the north. The uplift has influenced the geologic structure of the county by causing Precambrian granite and meta-sediments to be exposed in the north-central portion of the county, with the Paleozoic age and younger rocks being exposed and eroded along the flanks.

In the past 15 years, drilling has been limited to 7 townships for a total of 16 wells. Only one field, (T. 6 S., R. 2 E.), has four wells producing from the Permian-Pennsylvanian Minnelusa Formation. Because of the geologic influence of the Black Hills Uplift, it is expected that the drilling activity will remain the same, and will be focused on the isolated townships which have yielded shows of oil or gas from the Minnelusa Formation.

OCCURRENCE POTENTIAL

Custer County has lands with high, moderate, low, and very low to unknown occurrence potentials. Several of the extreme southwest townships are classified as having high occurrence potential because of the established production in those townships even though the sedimentary package is less than 5,000 feet thick (Mallory, 1972). The eastern portion of the county contains a thick Paleozoic and Cretaceous age sedimentary package (2,000 to 5,000 feet) which has the potential for both source rocks and reservoir conditions, but lacks any established production. This area has a moderate occurrence potential. The central portion of the county has a low occurrence potential based on a thin sedimentary cover of fewer than 2,000 feet, and no established production. The very low to unknown occurrence potential area is in the central part of the county where the Precambrian rocks are exposed at the surface, demonstrating a lack of a sedimentary package. There is also a lack of geologic data to indicate that such a package may exist at depth. The type log for the county is from the 1 Kaiser Ranch (T. 4 S., R. 10 E., sec. 3). This well was spudded in the Niobrara and reached maximum depth in the Minnelusa.

DISCUSSION OF DEVELOPMENT POTENTIAL

Custer County contains all four types of development potential. There are three townships rated as having high development potential based on producing wells or shows of oil and gas from current drilling activity. The moderate development potential areas are all townships adjacent to the high development areas, or townships that have demonstrated drilling interest in the past 15 years and which contain a moderate potential occurrence sedimentary package. The low development potential areas are townships that are adjacent to the outcrop of the Minnelusa, or near the Precambrian outcrop; these contain a thin sedimentary package. The very low to unknown areas are all townships in which the Precambrian outcrop is known to be exposed or very near the surface. Because of the influence of the Black Hills Uplift across most of the county, drilling activity most likely will continue the pattern of the previous 15 years in these townships. The number of wells will be approximately 3 per township.

DOUGLAS, HUTCHINSON, TURNER AND LINCOLN COUNTIES, SOUTH DAKOTA

INTRODUCTION

These four counties are located in the southeast corner of the state and east of the Missouri River. The topography is open grasslands and small rolling hills. Precambrian granite underlies all four counties at a shallow depth in the southern part of the counties (less than 1,000 feet) and deepens in a southward direction. The subcrop of the Sioux Quartzite is mapped in the northeast corner of Hutchinson County, and extends eastward through the northern parts of Turner and Lincoln Counties. This Precambrian quartzite overlies the granite and is mantled by Miocene-Pleistocene gravel up to 400 feet thick (Hedges, 1975). Overlying granite in the southern part of the counties are Cretaceous age rocks with a thickness up to 1,700 feet. The regional dip of these rocks is southward, based on the structure of the Precambrian basement rock (Steece, 1961). These Cretaceous rocks are also mantled by Miocene-Pleistocene gravel.

Douglas County has the only oil and gas exploration well for the four county area. This well was drilled in 1953 and was plugged after drilling to the Precambrian at a depth of 1,306 feet and reporting no shows. Currently, there is no established production in the area.

OCCURRENCE POTENTIAL

All of Douglas County is classified as having low occurrence potential. This is based on a sedimentary section less than 2,000 feet thick (Mallory, 1972), and the lack of established production.

Hutchinson, Turner, and Lincoln Counties have both low and very low to unknown occurrence potential areas. All townships outside the subcrop of the Sioux Quartzite are classified as having low occurrence potential. This is based on a thin sedimentary section less than 2,000 feet thick (Mallory, 1972), and the lack of established production. Townships within the subcrop of the Sioux Quartzite are classified as having very low to unknown occurrence potential. This is based on the lack of a sedimentary package that contains source rocks, and established production.

There is no type log for this four county area.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Douglas County is classified as having low development potential. This is based on the presence of a thin sedimentary package of less than 2,000 feet in thickness and the lack of drilling data. Hutchinson, Turner, and Lincoln Counties have both low and very low to unknown development potential areas. All townships outside the subcrop of the Sioux Quartzite are classified as having low development potential. This is based on the presence of a thin sedimentary package less than 2,000 feet thick and the lack of drilling data. Townships within the subcrop of the Sioux Quartzite are classified as having very low to unknown development potential. This is based on the lack of a sedimentary package that contains source rocks, and drilling data. Based on the geologic setting, it is expected that this four county area will have a low level of oil and gas exploration in the next 15 years.

MCPHERSON AND EDMUNDS COUNTIES, SOUTH DAKOTA

INTRODUCTION

McPherson and Edmunds Counties lie east of the Missouri River in north-central South Dakota. The topography in these counties consists primarily of flat glaciated plains. Geologically, the southeast edge of the Williston Basin runs through the center of McPherson County and along the northwest edge of Edmunds County. A Precambrian high, the Transcontinental Arch, runs through the southeast corner of Edmunds County. This structural high is responsible for the thin sedimentary cover in this area. There are no producing oil and gas wells in these counties.

OCCURRENCE POTENTIAL

Most of McPherson and Edmunds Counties contain moderate oil and gas occurrence potential. This is based on regional geologic mapping (Mallory, 1972, p. 56) which indicates that the counties contain 2,000 to 5,000 feet of sedimentary rocks. This is the same, but thinner, package of rocks which contain source beds and producing reservoirs in other parts of the Williston Basin. The extreme southeastern portion of Edmunds County is rated as having low occurrence potential. This is based on regional geologic mapping (Mallory, 1972) which shows this part of South Dakota to have fewer than 2,000 feet of sedimentary rocks, due to the influence of the previously-mentioned Transcontinental Arch. The type log for these counties, taken from a water well drilled in T. 123 N., R. 66 W., sec. 25, contains 1,396 feet of sedimentary rock, and terminated in Cretaceous Dakota Sandstone. No wells in these counties penetrated granite, but wells in nearby counties indicate that the Precambrian is just below the Dakota Sandstone in this part of the state.

DISCUSSION OF DEVELOPMENT POTENTIAL

The west half of McPherson and the extreme northwestern township in Edmunds County are classified as having moderate development potential. This is due to: 1) the boundary of the Williston Basin, 2) the thin sedimentary cover in these counties, 3) the few wells that were drilled specifically for oil and gas exploration, and 4) the lack of oil and gas shows in any of the wells drilled. Wildcatting may occur in these counties in the next 15 years, with perhaps one wildcat well per township at most. Should a major discovery be made, that particular township would experience additional drilling activity.

The remaining portions are classified as having low development potential because: 1) these areas are outside the confines of the Williston Basin; 2) the thin sedimentary cover will limit oil and gas exploration; and 3) there is a lack of data due to no wells being drilled specifically for oil and gas exploration in this area. Widely-spaced wildcatting may occur in this area in the next 15 years.

FALL RIVER COUNTY, SOUTH DAKOTA

INTRODUCTION

Fall River County is located in the extreme southwestern corner of the state. The Cheyenne River flows in a northeast direction with dendritic tributaries, and separates the topography into two physiographic regions. Rolling plains lie on the southeast, and a cuesta prevails on the northwest.

The geology of the county is comprised of Precambrian pink biotite granite at depth to Quaternary alluvium gravel,

eolian sands, and soils on the surface. The basement Precambrian granite varies in structural elevation from 2,500 feet above sea level in the north-central part of the county to 1,325 feet below sea level in the southwestern portion of the county (Steece, 1961). It is never exposed at the surface in the county. The majority of the county has Cretaceous Pierre Shale at the surface, with the north-central part yielding outcrops of the Lower Cretaceous and upper Jurassic age rocks. Currently, the only producing formation is the Permian-Pennsylvanian Minnelusa Formation.

Structurally, the county is influenced by the Black Hills Uplift to the north. Keene (1973) mapped three major anticlines across the county: the Cottonwood Anticline in the west, the Chilson Anticline in the south-central portion and the Cascade Anticline in the east.

Since oil and gas drilling began in this county, all but three of the townships have had some drilling activity. In the past 15 years, 25 of the 54 townships have had one or more wells drilled. Of the 25 townships, 5 have producing fields or wells capable of production.

OCCURRENCE POTENTIAL

The entire county has moderate occurrence potential based on the sedimentary thickness of 2,000 to 5,000 feet (Mallory, 1973), except for the townships that have established production. Those townships have a high occurrence potential.

DISCUSSION OF DEVELOPMENT POTENTIAL

Eight of the 54 townships are classified as having high development potential. Within these eight, seven are producing oil and gas fields. There have been 134 wells drilled across the county in the past 15 years; most have been in the western part. All of the current production is from structural and stratigraphic traps in the Minnelusa Formation. The remaining 46 townships are rated as having moderate development potential.

This is based on the past drilling activity in each township and the presence of the Minnelusa Formation at depth. It is expected that drilling activity will remain the same over the next 15 years and most likely will be in the townships with Minnelusa production or shows.

GREGORY COUNTY, SOUTH DAKOTA

INTRODUCTION

Gregory County is located in the southeastern part of the state. The topography is rolling hills and open grasslands with a general dendritic drainage pattern flowing eastward to the Missouri River.

Regional geology shows the Cretaceous Pierre Shale and Miocene Arikaree Formation to be intermixed at the surface. Structurally the Precambrian basement rock varies from 100 below to 200 feet above mean sea level across the county. The regional dip is to the east to southeast. A major basement fault system mapped by Houser (1987) strikes northwest with its trace along the Missouri River. Its down dropped side is to the west.

There have been only 7 wells drilled in the entire county, and none in the past 15 years. Currently there is no production in the county.

OCCURRENCE POTENTIAL

All of Gregory County is classified as having moderate occurrence potential. This is based on the presence of a sedimentary section of Cretaceous rocks that is estimated to be 2,000 feet thick (Mallory, 1972), and the lack of established production within the county. There is no type log within this county.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Gregory County is classified as having moderate development potential. This is because the sediment package that is known to exist in this county has potential source and reservoir rocks that produce elsewhere in the state, and there is the possibility of structural or stratigraphic traps. Because there is no production or significant show from drilling, this county cannot be classified with a higher potential.

Based on the past drilling activity in the county, and lack of the Paleozoic section, it is expected that only one to three wells will be drilled in this county in the next 15 years.

HAAKON COUNTY, SOUTH DAKOTA

INTRODUCTION

Haakon County is located in the west central part of the state. The Cheyenne River forms the north county line with Pennington County to the west and Jackson County to the south. Jones and Stanley Counties form the eastern county line. The topography varies from open flat grasslands to small flat-topped hills with steeply banked stream bottoms. The major drainage systems flow in a north and south direction because of a central east-west topographic high across the county.

Regional geology shows scattered deposits of Pleistocene gravel, Cretaceous age Pierre Shale, and isolated outcrops of Fox Hills Formation on the surface. The Precambrian basement varies in structural elevation from 200 to 1,500 feet below mean sea level. The structure of the Precambrian

rocks has been mapped by Steece (1961) as an anticlinal nose trending in a westerly direction. This basement structure creates various regional dips in the overlying Paleozoic and Cretaceous age rocks.

There have been only 42 wells drilled in the entire county in the last 15 years. Currently there is no oil or gas production in this county.

OCCURRENCE POTENTIAL

Haakon County has both high and moderate occurrence potential lands. The entire west half of the county is classified as having high occurrence potential. This area has a sedimentary section more than 5,000 feet thick containing source and reservoir characteristics that are productive elsewhere in the state. The eastern part of the county is classified as having moderate occurrence potential based on a thinner sedimentary section that is 2,000 to 5,000 feet thick (Mallory, 1972). This area has the same geologic characteristics as the high occurrence areas, but the potential is reduced because of the thinner sedimentary section.

The type log for this county is from the 1 J. W. Danielson (T. 3 N., R. 22 E., sec. 5). The well was drilled in 1952, spudded in the Pierre Shale, and reached maximum depth in the Ordovician Winnipeg Formation. This well was completed as a dry hole.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Haakon County is classified as having moderate development potential. This is because it has a sedimentary section that is known to have the necessary source and reservoir rocks that are productive elsewhere in the state plus a structural setting that is conducive to oil and gas exploration. Also, there is no established production in this county.

Based on the past drilling activity and the geologic setting of this area, it is expected that in the next 15 years this county will experience a moderate level of oil and gas exploration. This could result in one to seven wells being drilled in this county.

HANSON, MCCOOK, MINNEHAHA AND MOODY COUNTIES, SOUTH DAKOTA

INTRODUCTION

This four county area is located in the southeastern part of the state, and east of the Missouri River. The topography is open grasslands with hummocky geomorphology.

All of the four county area is underlain by the structurally high Precambrian Sioux Ridge. This west trending structural arch has Precambrian granites and Sioux Quartzite. The outcrop and subcrop of the Quartzite mapped by Darton (1951) delineates the contact between the thin Cretaceous rocks and this Precambrian basement high. The entire four county area is mantled by recent to Pleistocene age gravel, with a thickness of up to 400 feet.

There has been no oil or gas drilling in this four county area.

OCCURRENCE POTENTIAL

All four counties have low and very low to unknown occurrence potential lands. All townships within or adjacent to the outcrop and subcrop of the Sioux Quartzite are classified as having very low to unknown occurrence potential. This is based on the lack of any sedimentary package that would contain source and reservoir rocks, and lack of exploration data. All townships outside the influence of the outcrop or subcrop of the Sioux Quartzite are classified as having low occurrence potential. This is based on the presence of very thin Cretaceous age rocks which contain limited source and reservoir rocks, and the lack of exploration data.

There is no type log for this four county area.

DISCUSSION OF DEVELOPMENT POTENTIAL

Hanson and Moody Counties both have low and very low to unknown development potential. All townships in these two counties have low development potential wherever the Cretaceous rocks are outside the influence of the subcrop or outcrop of the Sioux Quartzite. This is based on the presence of thin Cretaceous rocks of less than 2,000 feet (Mallory, 1972), and the lack of exploration data or established production.

All lands in McCook and Minnehaha Counties and the remaining lands in Hanson and Moody Counties are classified as having very low to unknown development potential. The very low to unknown development potential lands in all four counties are townships that are inside or adjacent to the subcrop or outcrop of the Sioux Quartzite. This classification is based on: 1) the lack of a sedimentary section to provide source and reservoir rocks (Mallory, 1972); and 2) the lack of exploration data and established production.

Based on the geologic setting of the area, it is expected that this four county area will have a low level of oil and gas exploration in the next 15 years.

HARDING COUNTY, SOUTH DAKOTA

INTRODUCTION

Harding County lies west of the Missouri River in the extreme northwestern corner of South Dakota. The topography in this county is primarily rolling hills coming off the Black Hills Uplift to the south. Geologically, Harding County is on the northeast flank of the Black Hills Uplift and the southwestern flank of the Williston Basin. This is the most active county for oil and gas drilling in the South Dakota Resource Area with more than 100 producing oil and gas wells.

OCCURRENCE POTENTIAL

All of Harding County is classified as having high oil and gas occurrence potential. Regional geologic mapping (Mallory, 1972, p. 56) indicates that the county contains more than 5,000 feet of sedimentary rock. The type log for the county from the Smokey Oil 24-19 Gruber well (T. 23 N., R. 8 E., sec. 19), encountered 9,436 feet of sedimentary rock and only reached the Ordovician Red River Formation. This is the same package of rocks containing source beds and producing reservoirs in the adjacent Williston and Powder River Basins.

This county has been a target for oil and gas exploration for over 50 years (Rothrock, 1937). With the advent of computer modeling of the Cretaceous Shannon gas sands (Shurr et al., 1988), Harding County can be expected to experience at least as much activity in the next 15 years as in the previous 15 years.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of the active producing townships have been rated as having high oil and gas development potential in Harding County. There are two main productive horizons in these townships: 1) the Cretaceous Shannon-Eagle natural gas producing interval in the vicinity of West Short Pine Hills, and 2) the Ordovician Red River oil producing region in the northcentral part of the county.

Because exploration and development typically focus on traditional producing areas, these townships can expect a high amount of development activity over the next fifteen years, relative to the rest of the county. Based on this analysis, anywhere from 8 to 54 additional wells could be drilled in each of these townships, with numerous producers expected in the next fifteen years.

The rest of Harding County is classified as having moderate development potential because of the numerous wells that have encountered sub-commercial gas shows in the Eagle and Shannon Formations and the presence of Red River Formation oil in some scattered wells. Wildcatting and limited development in the Eagle-Shannon interval and the Red River Formation may occur in this county in the next 15 years. This will involve anywhere from one to seven wildcat wells being drilled per township. Should a major discovery be found in any of these townships, that particular township will experience additional drilling activity.

HUGHES COUNTY, SOUTH DAKOTA

INTRODUCTION

Hughes County is located in the central part of the state, east of the Missouri River. The topography is open grasslands and rolling hills.

The surface geology is Cretaceous Pierre Shale and isolated deposits of recent to Pleistocene age gravel (Darton, 1951). The Precambrian basement regionally dips northwest and structurally varies from 500 to 1,000 feet below mean sea level across the county (Steece, 1961). Paleozoic and Cretaceous age rocks overlie the crystalline basement with a thickness of 2,000 to 5,000 feet (Mallory, 1972). Smaller anticlinal structures have been mapped on top of the Pierre Formation in the southwest portion of the county (Wing, 1938). Gas was produced from the Cretaceous Dakota Formation along the flanks of one of these small anticlines near the town of Pierre in the 1930s. There have been five wells drilled within the county and only two in the last 15 years.

The Crow Creek Indian Reservation is located in the southeast corner of the county. These lands are not classified in this report.

OCCURRENCE POTENTIAL

All of Hughes County is classified as having moderate occurrence potential. This classification is based on the presence of Paleozoic and Cretaceous age rocks that are estimated to be 2,000 to 5,000 feet thick (Mallory, 1972). The rock types present are known to contain reservoir and source rocks that are productive elsewhere in the state. A lack of established production governs this classification.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Hughes County is classified as having moderate development potential. This is because 1) it has a sedimentary section of source and reservoir rocks that are productive elsewhere in the state; 2) it has a structural setting conducive to oil and gas exploration; 3) currently, there is no established production.

Based on the past drilling activity and the geologic setting of this area, it is expected that in the next 15 years this county will experience a moderate level of oil and gas

exploration. This could result in one to ten wells being drilled in this county.

JACKSON COUNTY, SOUTH DAKOTA

INTRODUCTION

Jackson County is located in the south central portion of the state, west of the Missouri River. The topography is rolling hills and open grasslands with most drainage to the south. This county is located over a Precambrian structural high that extends in an east-west direction. The regional dip is southward and increases toward the White River. The majority of the surface is covered by Cretaceous age Pierre Shale with the White River Formation exposed in the southwest part of the county. There have been 12 wells drilled in this county, only 5 in the past 15 years. Currently there is no known oil or gas production in this county.

OCCURRENCE POTENTIAL

The north-central portion of the county has high occurrence potential because of the thick sedimentary section of Paleozoic and Cretaceous age rocks greater than 5,000 feet (Mallory, 1972). The rocks are known to be productive elsewhere in the state, and the little drilling that has been done in the county has reported small shows in the Minnelusa Formation. The eastern and western parts of the county are considered to have moderate occurrence potential. This is based on the presence of a sedimentary section of Paleozoic and Cretaceous age rocks less than 5,000 feet thick, and no established production (Mallory, 1972).

A type log for this county is from the 1 Buckles-Martin (T. 3 S., R. 19 E., sec. 3). This well was drilled in 1974, and penetrated the Precambrian basement rock at a structural depth of 1,350 feet below mean sea level.

DISCUSSION OF DEVELOPMENT POTENTIAL

Jackson County is classified as having moderate development potential. This is because the occurrence potential is high to moderate and the drilling activity also has been moderate, in the past 15 years. The next 15 years are expected to be approximately the same, with five or six wells being drilled in this county.

JONES COUNTY, SOUTH DAKOTA

INTRODUCTION

Jones County is located in the south-central part of the state with a topography of rolling hills and open grasslands. The drainage system is divided by a topographic high centered in an east-west direction across the county. One system flows to the Bad River to the north, and the other flows to the White River that forms the south county line.

Regional geology shows the Cretaceous age Pierre Shale to cover the entire surface of the county. Structurally the Precambrian basement rock varies from 500 to 1,500 feet below mean sea level across the county. A major fault system has been mapped in the northeast corner of the county by Houser (1987). The system strikes in a northeast direction and is related to basement faulting. The regional dip in the county varies considerably because of the fault system.

There have been only 11 wells drilled in the entire county, and only one in the past 15 years. Currently there is no production in the county.

OCCURRENCE POTENTIAL

All of Jones County is classified as having moderate occurrence potential. This is based on the presence of a sedimentary section of Paleozoic and Cretaceous age rocks that are only 2,000 to 5,000 feet thick and no established production in the county.

There is no type log for this county.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Jones County is classified as having moderate development potential. This is because the sedimentary package known to exist in this county contains potential source and reservoir rocks that produce elsewhere in the state, and possible structural or stratigraphic traps. Because there is no production or significant show in the drilling that did occur, this county has only a moderate development potential.

Based on the past and current drilling in the county, activity is expected to remain the same, with only one or two wells being drilled in this county in the next 15 years.

LAWRENCE COUNTY, SOUTH DAKOTA

INTRODUCTION

Lawrence county is located along the western state boundary with Butte County to the north, Meade County forming the eastern line and Pennington County to the south. The south half of the county is mountainous and heavily timbered, being part of the South Dakota Black Hills. From the town of Spearfish, the topography changes northward to rolling hills and small open plains.

The Tertiary age Black Hills Uplift dominates the south half of the county. The central part of the county is the northern

part of the Uplift. In this area are the exposed granites, and meta-sediments of Precambrian age mixed with Tertiary age volcanics (Darton, 1951). Along the flanks of the Precambrian rocks are the steeply dipping Paleozoic age rocks. The northern part of the county has Cretaceous age Belle Fourche and Mowry Shales at the surface with the basement rocks only a few thousand feet below the surface.

Because of the influence of the Black Hills Uplift on the sedimentary section of Paleozoic and Cretaceous age rocks, only seven wells have ever been drilled in the entire county, two in the past 15 years. Those two wells were in the extreme northwest corner of the county.

OCCURRENCE POTENTIAL

Lawrence County has areas of low and very low to unknown occurrence potential. The very low to unknown lands are in the southeast corner of the county. These are areas in which only the Precambrian or Tertiary age volcanic rocks are exposed at the surface, and lack any sedimentary section containing source rocks. The low occurrence potential lands are areas in contact with the Precambrian and Tertiary volcanics and a sedimentary section which lacks thickness and drilling data.

A type log for the county is from the #1 Weisman, (T. 7 N., R 4 E., sec. 30). The well was drilled in 1951, spudded in the Sundance and reached maximum depth in the Deadwood Formation. This well was plugged and abandoned.

DISCUSSION OF DEVELOPMENT POTENTIAL

Lawrence County has three areas that contain moderate, low, and very low to unknown development potential lands. The very low to unknown lands comprise eight townships in the southeast corner of the county. They are areas in which only the Precambrian or Tertiary age volcanic rocks are exposed at the surface with a lack of any sedimentary section that contains source rocks. The low development potential lands are areas in contact with the Precambrian and Tertiary volcanics, but have some sedimentary section with no drilling data. These ten townships are in the central part of the county. The moderate development potential lands are areas that contain a sedimentary section, but due to the influence of the uplift and lack of drilling are classified as moderate. These eight townships are in the northern part of the county.

Only two wells in the past 15 years have been drilled in this county. There are no producing formations but some shows have been reported in the Minnelusa Formation. Future activity is expected to be the same, most likely occurring in the northwest corner of the county.

LYMAN COUNTY, SOUTH DAKOTA

INTRODUCTION

Lyman County is located in the south-central part of the state east of Jones County. The Missouri River forms the east and part of the north county lines. The topography is rolling hills and open grasslands.

Regional geology shows the Cretaceous age Pierre Shale to cover the entire surface of the county. Structurally the Precambrian basement rock varies from 600 below to 200 feet above mean sea level across the county. A major fault system has been mapped in the northeast corner of the county by Houser (1987). The system strikes in a northwest direction and is related to basement faulting. The regional dip in the county varies considerably because of the fault system.

There have been only 6 wells drilled in the entire county, and only two in the past 15 years. Currently there is no production in the county.

The Lower Brule Indian Reservation is in the northeastern part of the county, and these lands were not classified.

OCCURRENCE POTENTIAL

All of Lyman County is classified as having moderate occurrence potential. This is based on the presence of a sedimentary section of Paleozoic and Cretaceous age rocks that are only 2,000 to 5,000 feet thick with no established production in the county.

The type log for this county is from the #1 Hutchinson (T. 103 N., R 77 W., sec. 24). The well was drilled in 1967, spudded in the Pierre Shale and reached maximum depth in the Precambrian at a structural elevation of 570 feet below sea level.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Lyman County is classified as having moderate development potential. This is because the sedimentary section in this county contains potential source and reservoir rocks that produce elsewhere in the state, and possible structural or stratigraphic traps. Because there is no production and no significant show from the drilling that did occur, this county has only a moderate development potential.

Based on the past and current drilling in the county, activity is expected to remain the same, with only one or two wells being drilled in this county in the next 15 years.

MEADE COUNTY, SOUTH DAKOTA

INTRODUCTION

Meade County lies west of the Missouri River in South Dakota. The topography ranges from the mountainous terrain of the Black Hills in the west, to the rolling plains in the eastern part of the county. Geologically, the west part of Meade County is on the northeastern flank of the Black Hills Uplift. The south-central portion of the Williston Basin is in the east half of the county. Currently, there are no producing oil and gas wells in this county.

OCCURRENCE POTENTIAL

Oil and gas occurrence potential in Meade county ranges from high to low. Regional geologic mapping (Mallory, 1972, p. 56) indicates that the eastern part of the county contains more than 5,000 feet of sedimentary rocks. Camac Exploration drilled the 27-1 Nelson well (T. 10 N., R. 14 E., sec. 27), that penetrated 6,880 feet of sedimentary rock before drilling into Precambrian gneiss. This is the same sequence of rocks containing source beds and producing reservoirs in the adjacent Williston Basin. Therefore, this portion of the county has been classified as having high occurrence potential.

The central part of the county has been classified as having moderate occurrence potential because of an average sedimentary rock thickness of 2,000 to 5,000 feet with source beds and reservoir rocks similar to the adjacent Williston Basin.

The southwestern part of Meade County contains less than 2,000 feet of sedimentary rocks and is classified as having low occurrence potential.

DISCUSSION OF DEVELOPMENT POTENTIAL

No part of Meade County has been designated as having high development potential, because there are no producing oil and gas wells in the county. Most of Meade County is rated as having moderate development potential. As can be seen on the development potential map, the axis of the Williston Basin runs through the eastern part of the county. Oil shows have been encountered in the Pennsylvanian Minnelusa and Ordovician Red River Formations in two wells in the county. Wildcatting and some very limited development may occur in the Minnelusa and Red River Formations in this county over the next 15 years.

The southwestern townships of this county are rated as having low development potential because of the thin sedimentary cover, and the sparse data from oil and gas drilling in this area. Widely-spaced wildcatting may occur in this area in the next 15 years.

The extreme southwestern township of the county is classified as having very low development potential because of the complete lack of sedimentary rocks at the surface due to the outcrop of the Black Hills crystalline rocks. No wildcatting is expected to occur here in the next 15 years.

PENNINGTON COUNTY, SOUTH DAKOTA

INTRODUCTION

Pennington County lies west of the Missouri River in South Dakota. The topography in this county ranges from the mountainous terrain of the Black Hills in the west, to rolling plains near the center of the county, to dissected badlands in the eastern part of the county. The arid climate in the eastern part of the county has been responsible for a number of deep water wells which provide data points on the thickness of the sedimentary section. Currently, there are no producing oil and gas wells in this county.

OCCURRENCE POTENTIAL

Oil and gas occurrence potential in Pennington County ranges from high to very low. Regional geologic mapping (Mallory, 1972, p. 56) indicates that the northeastern part of the county contains more than 5,000 feet of sedimentary rocks (Mallory, 1972). This is the same section of strata which contains source beds and producing reservoirs in the adjacent Williston Basin. The rest of the eastern half of Pennington County contains 2,000 to 5,000 feet of sedimentary rock which is the same, but thinner, section of source and reservoir rocks. The 10-8 Federal Well in T. 4 S., R. 16 E., sec. 10 encountered 4,593 feet of sedimentary rock before drilling into Precambrian granite. The northeastern part of the county has high occurrence potential and the remainder of eastern Pennington County has moderate occurrence potential.

The west half of Pennington County outside the Black Hills Uplift contains fewer than 2,000 feet of sedimentary rock for low occurrence potential. These rocks are thinner because they are draping off the Black Hills Uplift. The Black Hills Uplift portion of the county contains only crystalline rocks; therefore, it is classified as having very low occurrence potential.

DISCUSSION OF DEVELOPMENT POTENTIAL

The only area of high development potential in Pennington County is in T. 2 N., R. 17 E. There have been three oil and gas tests drilled in this township, all in the past 15 years. All three tests reported oil shows in the Pennsylvanian Minnelusa Formation. The Minnelusa (locally known as the Leo sand) is a major oil and gas producing formation in neighboring Custer and Fall River Counties to the south. Because

wildcat exploration is feasible where there have been reports of shows, this township can expect a high amount of development activity over the next 15 years, relative to the rest of the county. Based on this analysis, three to four additional wells could be drilled in this township, with one to two producers in the next 15 years.

The major portion of Pennington County has moderate development potential. As can be seen on the development potential map, the axis of the Williston Basin runs through this part of the county. Oil and gas tests down to the Precambrian crystalline basement here indicate that this part of the county is covered with 5,000 feet or more of sedimentary rock. This is the same package of rocks which contain source beds and reservoirs in other parts of the Williston Basin. Wildcatting and some very limited development may occur in this area in the next 15 years.

The oil and gas development potential decreases as one gets closer to the Black Hills Uplift. Development activity is anticipated to be low along the rim of the Black Hills Uplift. This is due to the thin sedimentary cover in these townships, and the lack of data from oil and gas drilling in this area. Widely-spaced wildcatting may occur in this area in the next 15 years.

The central core of the Black Hills is considered to have very low development potential because of the crystalline rocks exposed at the surface, lack of sedimentary rocks at the surface, and lack of oil and gas tests in this area. No oil and gas wells are anticipated in this area in the next 15 years.

PERKINS COUNTY, SOUTH DAKOTA

INTRODUCTION

Perkins County lies west of the Missouri River in the northwestern part of South Dakota. The topography is primarily rolling hills (Searight, 1934). Geologically, Perkins County is on the southwestern flank of the Williston Basin. There are no producing oil and gas wells in this county.

OCCURRENCE POTENTIAL

All of Perkins County is classified as having high oil and gas occurrence potential. The entire county is in the southern portion of the Williston Basin. Regional geologic mapping (Mallory, 1972) indicates that the county contains more than 5,000 feet of sedimentary rock. The type log for the county, taken from the 1 Veal well (T. 17 N., R. 15 E., sec. 7), encountered 8,288 feet of sedimentary rock before drilling into Precambrian basement rock. This is the same section of rocks which contain source beds and producing reservoirs in other parts of the Williston Basin.

Despite the lack of production, this county has been the target of numerous oil and gas wildcat wells. Oil shows have been encountered in the Permo-Pennsylvanian Minnelusa, Mississippian Madison, and Ordovician Red River Formations. Some slight gas shows were encountered in the Cretaceous Muddy Sandstone.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Perkins County is classified as having moderate development potential because of the numerous wells that have encountered oil and gas shows throughout the county. Wildcatting and limited development may occur in the next 15 years, and could involve one to three additional wildcat wells per township. Should a major discovery occur, that particular township would experience additional drilling activity.

STANLEY COUNTY, SOUTH DAKOTA

INTRODUCTION

Stanley County is located in the central part of the state with topography varying from open grasslands to small flat topped hills with steep banked streams. The major drainage systems flow both north and south because of a central east-west topographic high across the county.

Regional geology shows scattered deposits of Pleistocene gravel, and Cretaceous Pierre Shale exposed at the surface. The Precambrian basement varies in structural elevation from 500 to 1,500 feet below mean sea level. The structure of the Precambrian rocks has been mapped by Steece (1961) as an anticlinal nose trending in a westerly direction. This basement structure creates various regional dips in the overlying Paleozoic and Cretaceous age rocks.

There have been only 28 wells drilled in the entire county, with 10 of those in the last 15 years. Currently there is no oil or gas production in this county.

A portion of the Lower Brule Indian Reservation is located in the extreme southeast corner of the county. These lands were not classified.

OCCURRENCE POTENTIAL

All of Stanley County is classified as having moderate occurrence potential. This classification is based on the presence of Paleozoic and Cretaceous age rocks that are estimated to be 2,000 to 5,000 feet thick (Mallory, 1972). The rock types that are present in this section are known to contain reservoir and source rocks that are productive elsewhere in the state. There is also a lack of established production in this county.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Stanley County is classified as having moderate development potential. This is because: 1) it contains a sedimentary section with source and reservoir rock that is productive elsewhere in the state; 2) it has a structural setting conducive to oil and gas exploration; and 3) there is no established production.

Based on the past drilling activity and the geologic setting of this area, it is expected that in the next 15 years this county will experience a moderate level of oil and gas exploration. This could result in one to ten wells being drilled in this county.

TRIPP COUNTY, SOUTH DAKOTA

INTRODUCTION

Tripp County is located in the south-central part of the state. The White River is the north county line; Mellette and Todd Counties are on the west. The state line forms the southern boundary and Gregory County borders Tripp County on the east. The topography is rolling hills and open grasslands.

Regional geology shows the Cretaceous age Pierre Shale to cover the northern half of the county with the Miocene Arikaree Formation exposed at the surface in the south (Darton, 1951). Structurally, the Precambrian basement rock varies from 700 to 200 feet below mean sea level across the county. The structural dip in the county is east to southeast (Steece, 1961).

There have been only 16 wells drilled in the county; 3 were in the past 15 years. Currently there is no production in the county.

OCCURRENCE POTENTIAL

All of Tripp County is classified as having moderate occurrence potential. This is based on: 1) the presence of a sedimentary section of Paleozoic and Cretaceous age rocks that are estimated to be 2,000 to 5,000 feet thick (Mallory, 1972), and 2) no established production within the county.

The type log for this county is from the #1 Swedlund, (T. 102 N., R. 78 W., sec. 11). The well was drilled in 1964, spudded in the Pierre Shale and reached maximum depth in the Precambrian at 649 feet below sea level.

DISCUSSION OF DEVELOPMENT POTENTIAL

All of Tripp County is classified as having moderate development potential. This is because the sediment section that is known to exist in this county contains potential source and reservoir rocks that produce elsewhere in the state, and possible structural or stratigraphic traps. Because there is no production or significant show from the drilling that did occur, this county has only a moderate development potential.

Based on the past and current drilling activity in the county, activity is expected to remain the same, with only one to three wells being drilled in this county in the next 15 years.

WALWORTH COUNTY, SOUTH DAKOTA

INTRODUCTION

Walworth County lies east of the Missouri River in north-central South Dakota. The topography ranges from the dissected breaks of the Missouri River in the western part to the flat plains in the eastern half. Geologically, Walworth County is on the southeastern flank of the Williston Basin. Currently, there are no producing oil and gas wells in this county.

OCCURRENCE POTENTIAL

All of Walworth County falls in an area of moderate oil and gas occurrence potential. Regional geologic mapping (Mallory, 1972) indicates that this county is underlain with 3,000 to 4,000 feet of sedimentary rock. This is the same section of rocks that contain source beds and producing reservoirs in other parts of the Williston Basin.

DISCUSSION OF DEVELOPMENT POTENTIAL

No part of Walworth County has been designated as having high development potential, because there have been no oil and gas wells drilled in the county in the last fifteen years. Only minor oil and gas shows were encountered by the wells drilled prior to 1973.

With the exception of one township all of Walworth County is rated as having moderate development potential. Three oil and gas tests were drilled in this county to evaluate the Cretaceous Muddy Sandstone, in response to large Muddy discoveries in the late 1960s in the neighboring Powder River Basin of Montana. None of these tests encountered any shows. However, other areas of South Dakota have reported oil and gas shows in the Muddy (Bolyard, 1969). Two additional wells were drilled to the Precambrian basement rocks in this county. One of these wells, the Max Pray #1 Kranzler (T. 121 N., R. 77 W., sec. 14), did encounter some oil shows in the cuttings of the Paleozoic section of the well. Wildcatting and some very limited development in the Muddy Sandstone and deeper Paleozoic rocks may occur in this county in the next 15 years.

The extreme southeastern township of this county is rated as having low development potential because it is outside

the perimeter of the Williston Basin, has a thin sedimentary cover, and there is a lack of data from oil and gas drilling in this township. Widely-spaced wildcatting may occur in this area in the next 15 years.

BIBLIOGRAPHY - SOUTH DAKOTA

Bolyard, D. W., 1969, Muddy sand potential in South Dakota, in Eastern Montana Symposium: Montana Geological Society 20th Annual Field Conference, p. 85-94.

Darton, N. H., 1951, Geologic map of South Dakota: U. S. Geological Survey, scale 1:500,000, 1 sheet.

Hedges, L. S., 1968, Geology and water resources of Beadle County, South Dakota: South Dakota Geological Survey Bulletin No. 18, 66 p.

Hedges, L. S., 1975, Geology and water resources of Charles Mix and Douglas Counties, South Dakota, Part I: South Dakota Geological Survey Bulletin No. 22, 43 p.

Houser, B. B., 1987, Southwestern bounding fault of the Sioux Quartzite, South Dakota: U. S. Geological Survey Open File Report 87-626, 11 p.

Keene, J. R., 1973, Ground water resources of the western half of Fall River County, South Dakota Geological Survey Report of Investigations No. 109, 82 p.

Mallory, W. W., editor, 1972, Geologic atlas of the Rocky Mountain Region: Rocky Mountain Association of Geologists, pp. 30, 34, 37-39, and 56.

Rothrock, E. P., 1937, Structural conditions in Harding County: South Dakota Geological Survey Report of Investigations No. 28, 35 p.

Searight, W. V., 1934, The geology of central Perkins County, South Dakota: South Dakota Geological Survey Report of Investigations No. 21, 52 p.

Shurr, G. W., Nelson, C. L., and Jenkins, J. T., Jr., 1988, Prediction of sandstone geometry in the Upper Cretaceous Shannon Sandstone in the Northern Powder River Basin, in R. P. Dedrich and others, editors, Eastern Powder River Basin-Black Hills Guidebook: Wyoming Geological Association 39th Annual Field Conference, pp. 217-228.

Steece, F. V., 1961, Precambrian surface of South Dakota: South Dakota Geological Survey Mineral Resource Investigation Map No. 2, scale: 1 inch = 30 miles.

Steece, F. V., 1965, Geology and ground water supplies in Sanborn County, South Dakota: South Dakota Geological Survey Bulletin No. 17., 182 p.

Wing, M. E., 1938, A structural survey of the Pierre Gas Field, South Dakota: South Dakota Geological Survey Report of Investigations No. 29, 20 p.

APPENDIX D
AIR QUALITY

The ambient air quality in the planning area is very good overall. Localized elevated levels of total suspended particulates (TSP) and sulfur dioxide (SO_2) are associated with agricultural activities, oil and gas production, and refining operations. Elevated SO_2 areas are prominent in the area around Billings, Montana. Emissions from Federally permitted sour gas flaring facilities contribute to some of the concentrations.

Air pollution is regulated through ambient air quality and emission standards and permit requirements established under the Clean Air Act and the appropriate state laws. Illustration D-1 lists the Federal and state standards that apply in the planning area. The BLM reviews operational approvals for compliance with Federal and state air quality standards. If a standard is exceeded, the appropriate state agency and/or the EPA is advised that a permit is needed, and the operator is asked to obtain the permit prior to BLM approval of the action.

Terrain surrounding pollution sources greatly influences the effects of emissions. Topographic features such as mountains, valleys, or river drainages can combine to severely restrict or greatly enhance the dispersion capacity of a given airshed. These effects are highly localized and often determine how much air quality degradation may occur. Federal oil and gas actions causing air pollution are generally addressed when approving an APD or Sundry Notice.

The primary air contaminants associated with routine oil and gas drilling, production, and storage operations are: (1) airborne dust from construction or traffic on dirt roads; (2) diesel fumes from heavy equipment operations; (3) combustion byproducts from operation of heater/treaters, and flaring; (4) fugitive emissions from product separators and storage; and (5) venting or releasing of gases during well testing. Health and safety considerations resulting from accidental venting or releasing of gases during situations such as a blowout or pipeline rupture are described in the Health and Safety Section of this appendix.

Illustration D-2 is a listing of sources of air pollutants likely to be emitted during oil and gas drilling, production, and storage. The degree to which individual pollutants become a concern depends on several factors including: (1) the characteristics of the site within each air quality region; (2) the type of well and the composition of the gas or oil; and (3) whether the pollutant is generated during site preparation, drilling, testing, production, or abandonment.

Air pollution affects the respiratory, circulatory, and odor-sensing systems. Air pollutants usually enter the body through the respiratory system. The effects of various pollutants depend on concentration levels during exposure, and length of exposure.

PARTICULATE MATTER

Particulate matter can be generated by a number of activities during drilling and production. Engines generate small amounts of particulates compared to site and road construction. Once the stable ground cover is removed, dry and exposed soil becomes highly susceptible to wind erosion and air turbulence created by vehicle traffic.

The impact of dust depends on the type, quantity, and drift potential of the particles released into the atmosphere. Large dust particles settle out near the source, often creating a local nuisance. Fine particles are dispersed over a greater distance from the source. The potential drift distance of particles is governed by the height of the source, the size and density of the particle, and the degree of atmospheric turbulence. Tiny particulates can damage paint, reduce visibility, and carry poisonous chemicals into the lungs. Short-term exposure to inhaled particulates can impair lung function in children. Long-term exposure can result in increased respiratory distress symptoms and disease, and permanent reduction in lung function in children and adults. Persons with asthma are known to be more susceptible to respiratory problems caused by particulate emissions (U.S. Environmental Protection Agency, 1987).

NITROGEN OXIDES

Nitrogen oxides originate in high-temperature combustion processes such as the operation of diesel engines. These pollutants which result from photochemical oxidation cause an odorous brown haze that irritates the nose and throat. Nitrogen oxide molecules occur in several different forms; the most common form found in the ambient air is nitrogen dioxide. Air quality standards are set to limit this form of nitrogen oxide. Illustration D-3 lists the effects from concentrations of this pollutant in the air.

ILLUSTRATION D-1
NATIONAL AND STATE AIR QUALITY STANDARDS

Pollutant	Federal Primary Standard	Federal Secondary Standard	Montana Standard	South Dakota Standard
Deeply inhalable particulates (PM-10+)	50 ug/m^3 annual average 150 ug/m^3 24-hr average*	50 ug/m^3 annual average 150 ug/m^3 24-hr average*	50 ug/m^3 annual average 150 ug/m^3 24-hr average*	60 ug/m^3 annual average 150 ug/m^3 24-hr average*
Sulfur Dioxide	0.03 ppm annual average 0.14 ppm 24-hr average*	0.5 ppm 3-hr average*	0.02 ppm annual average 0.10 ppm 24-hr average*	80 ug/m^3 annual average 365 ug/m^3 24-hr average*
Carbon Monoxide	99 ppm 8-hr average* 35 ppm 1-hr average*	9 ppm 8-hr average*	0.50 ppm 1-hr average** 9 ppm 8-hr average*	1300 ug/m^3 3-hr average
Nitrogen Dioxide	0.05 ppm annual average	0.05 ppm annual average	0.05 ppm annual average 0.30 ppm hourly average	100 ug/m^3 annual average 250 ug/m^3 24-hr average*
Photochemical Oxidants (ozone)	0.12 ppm 1-hr average*	0.12 ppm 1-hr average	0.10 ppm hourly average*	
Lead	1.5 ug/m^3 calendar quarter average	1.5 ug/m^3 calendar quarter average	1.5 ug/m^3 90-day average	1.5 ug/m^3 calendar quarter average
Foliar Fluoride	None	None	35 ug/m^3 grazing season average	None
Hydrogen Sulfide	None	None	0.05 ppm hourly average*	None
Settled Particulate (dustfall)	None	None	10 mg/m^2 30-day average	None
Visibility	None	None	Particle scattering coefficient of $3x10^{-5}$/m annual average (PSD Class I areas)	None

Key: PM10 = particulate matter with an aerodynamic diameter less than 10 microns.

ug/m^3 = micrograms pollutant per cubic meter of sampled air.
ppm = parts pollutant per million parts of sampled air.
+Statistical standards based on three years of data.
*Not to be exceeded more than once per year.
**Not be be exceeded more than 18 times a year.

ILLUSTRATION D-2
SUMMARY OF SOURCES AND TYPES OF AIR POLLUTANTS FROM OIL AND GAS ACTIVITY

Pollutant	Drilling Sources	Production Sources	Storage Sources
Particulates (TSP/PM-10)	-site preparation and construction activities -diesel engine exhaust -dust from access roads	-fugitive dust from access road traffic -diesel engine exhaust	
Carbon Monoxide (CO)	-diesel engine exhaust -light-duty vehicle exhaust	-light-duty vehicle exhaust	
Nitrogen Oxide (NO_X)	-drilling rig diesel engine exhaust -other vehicular traffic exhaust	-diesel engine exhaust -vehicular engine exhaust	
Hydrogen Sulfide (H_2S)	-sour well gas venting -drill stem tests -gas/oil ratio (GOR) tests -production stabilization tests -uncontrolled blowout	-flaring (incomplete combustion) -fugitive losses from pipes, pumps seals, flanges, etc. -sour oil disposition	-storage tanks oil - water -breathing losses -working losses
Total Reduced Sulfur compounds	-venting and flaring sour gas release	-sour gas venting and flaring -incomplete sour gas combustion	-storage tank working and breathing losses
Volatile Organic Compounds (VOCs) (nonmethane)	-drilling rig diesel engine exhaust	-light-duty vehicle exhaust -diesel engine exhaust	-storage tank vaporization of crude oil condensates, distillates, etc.

Source: Jim Hughes, Montana State DHES

ILLUSTRATION D-3
EFFECTS OF NITROGEN DIOXIDE

Concentration of Nitrogen Dioxide in air (ppm)	Exposure Time	Human Symptoms and Effects on Vegetation, Materials, & Visibility
300	—	Rapid Death.
150	—	Death after 2 or 3 weeks by bronchiolitis fibrosa obliterans.
50	—	Reversible, nonfatal bronchiolitis
10	—	Impairment of ability to detect odor of nitrogen dioxide.
5	15 minutes	Impairment of normal transport of gases between the blood and lungs in healthy adults.
2.5	2 hours	Increased airway resistance in healthy adults.
2	4 hours	Foliar injury to vegetation.
1.0	15 minutes	Increased airway resistance in bronchitics.
1.0	48 hours	Slight leaf spotting of pinto bean, endive, and cotton.
0.3	—	Brownish color of target 1 km distant.
0.25	Growing season	Decrease of growth and yield of tomatoes and oranges.
0.2	8 hours	Yellowing of white fabrics.
0.12	—	Odor perception threshold of nitrogen dioxide.
0.1	12 weeks	Fading of dyes on nylon.
0.1	20 weeks	Reduction in growth of Kentucky bluegrass.
0.05	12 weeks	Fading of dyes on cotton and rayon.
0.03	—	Brownish color of target 10 km distant.
0.003	—	Brownish color of target 100 km distant.

Source: Stern, and others, 1984

NATURAL GAS

Natural gas (methane) has an ignition danger at 25 percent by volume of a natural gas/air mixture (250,000 ppm), and breathing problems begin at l,000 ppm. Values at this level can result in shortness of breath, and prolonged exposure can lead to asphyxiation. (Stern, 1976; Sittig, 1979; Stern and others, 1984.)

Simple air quality screening procedures indicate that venting of 2 to 5 thousand cubic feet (MCF) per day can result in ambient air concentrations of 700-1,000 ppm within a radius of 3 to 5 feet from the vent outlet. All venting above levels too small to measure (TSTM) and up to 100 MCF per day are routinely approved by the BLM with venting consideration of an 8- to 15-foot high PVC pipe vent stack (dependent on volumes vented) to eliminate any health hazards to personnel. The objective of the vent stack would be to expose the vent to areas of positive ventilation. All vent outlets should have appropriate bird guards attached (conical shields or wires to discourage birds from sitting directly on the outlet).

Most natural gas venting in the planning area is 2 to 5 MCF per day. The State of Montana requires that all gas vented to the atmosphere at a rate exceeding 20 MCF per day for a period in excess of 72 hours shall be burned (flared). Flared, sweet natural gas of less than 100 MCF per day does not have any associated air quality impacts but may require county burn permits.

SULFUR DIOXIDE

Sulfur dioxide emissions result from the burning of oil or gas containing sulfur and/or hydrogen sulfide. The primary source of sulfur dioxide produced in the planning area is from the flaring of gas from wells. This gas is generally noncommercial and is flared in order to avoid venting hydrogen sulfide gas. Other minor sources of sulfur dioxide are temporary flaring of gas during well testing and gas burning heater/treaters.

All gas which is flared or vented on Federal and Indian leases requires approval by the BLM. Presently, a total of 22 tons per year of sulfur dioxide is produced in the planning area as a result of flaring under this permitting system. The source of this 22 tons are wells located in the South Dakota Resource Area.

HYDROGEN SULFIDE

Hydrogen sulfide is a gas found in some oil and gas wells. It also is dissolved in the oil and water produced by such wells. This gas is found in various formations throughout Montana, most notably in the Overthrust Belt, western Williston Basin, northern Big Horn Basin, and in north-central Montana. Hydrogen sulfide can be released during drilling or production phases or during storage.

Hydrogen sulfide is colorless, flammable, and about 20 percent heavier than air. Depending on meteorological conditions and how it is released, it may collect in low-lying areas such as drainages. The odor detection range of H_2S is 0.0005-1.4 ppm (API, RP49, "Recommended Practices for Safe Drilling of Wells Containing Hydrogen Sulfide", 1987a). In higher concentrations, it is a highly toxic, reactive gas, and will corrode metal.

Illustration D-4 shows the odor threshold and toxic effects on humans associated with varying levels of hydrogen sulfide.

The scientific literature indicates that some individuals may have increased susceptibility to hydrogen sulfide toxicity. Susceptible persons include those with chronic eye inflammation, anemia, respiratory problems, psychiatric problems, and persons who have consumed alcohol within 24 hours prior to exposure (Layton, and others, 1983). Elderly persons and infants may constitute a high risk group. Technical Appendix 4 (MBOGC, 1989b) contains additional data on the effects of hydrogen sulfide.

MALODOROUS/NOXIOUS GASES

Minor amounts of odorous gases other than hydrogen sulfide can be present in oil and gas. Odorous sulfur can be grouped into either total reduced sulfur or partially reduced sulfur compounds. A gas analysis must be performed to determine the content of these compounds for any given well.

Known as reduced organic sulfides, these sulfur compounds are typically associated with sour gas and can be present in sour gas, oil, and produced water. They produce offensive odors even in minute concentrations.

Oil and gas related pollutants vary widely in the planning area. Oil or gas from wells in a given formation in a field may be similar, but wells in the same field producing from different formations may produce oil or gas with different

ILLUSTRATION D-4
HYDROGEN SULFIDE EFFECTS ON HUMANS

Concentration in the air (parts per million)	Situation or Health Effect
5,000	Almost immediate death.
1,000	Initial rapid respiration leading to rapid intoxication in minutes, unconsciousness, death or permanent brain damage unless resuscitation occurs very promptly.
500	Unconscious after short exposure, cessation of breathing if not treated quickly.
200	Initial irritative phenomena—loss of smell, burning eyes, cough, shortness of breath; edemas, headache, dizziness, and staggering gait may accompany. Usually complete recovery if exposure brief. Prolonged exposure (more than 30 minutes) can lead to progressively more serious effects.
50	Exposure over 1 hour may lead to headache, dizziness, and staggering. Shorter exposure characterized by conjunctivitis, cough. Recovery appears to be complete.
	Less than 50. Depending on duration, may still have burning eyes, cough, etc. with rapid recovery.
14	"Spinner's eye" in 4 to 5 hours.
10	Occupational exposure limit "Spinners's eye" after 6 to 7 hours.
1-10	Conflicting reports. Workers usually not affected. Public experience eye irritation, nausea, vomiting, diarrhea, sleep disturbance.
0.3	Little objective evidence of disease but public complaints numerous.
.005-0.05	Odor threshold.
0.001	Typical urban level of H_2S.

Source: Petroleum Association for the Conservation of the Canadian Environment, 1985

chemical constituents. Thus, without a gas analysis, the potential air quality impacts from venting, flaring, or onsite uses cannot be determined accurately in advance for individual wells.

SITE PREPARATION AND CONSTRUCTION

Emissions during site preparation and rig setup are most likely to be vehicle exhaust from a number of mobile sources and dust from earth-moving activities during construction of roads, pads, and pits. The most common sources are diesel-powered earth-moving equipment, trucks, and gasoline-powered vehicles. Particulate emissions are the pollutant most likely to affect air quality during this phase of oil and gas activity.

Particulate emissions vary substantially from day to day depending on the level of activity, the specific operations, and the prevailing weather. Particulate emissions from site and access road construction would depend upon total area disturbed. Under worst-case conditions, emissions of fewer than 25 tons per year can normally be expected from a single oil or gas well (Environmental Research and Technology, 1983). Access road use tends to be the major source of fugitive dust.

DRILLING

An air quality permit is required for drilling operations when emissions for any single pollutant exceed the state or Federal standard, whichever amount is less. Illustration D-5 lists the ranges of emissions that can be expected from drilling engines.

PRODUCTION

The amount of air pollution generated over the life of an oil or gas well depends on the characteristics of the product and the production practices used. Oil and gas wells that produce hydrogen sulfide are termed “sour wells”. Sour wells are much more likely to cause air pollution than wells that do not produce hydrogen sulfide, termed “sweet wells”. Illustration D-6 lists the air pollutants and sources for wells that produce oil, gas, or both. An air quality permit is required when emissions for any single pollutant exceed the appropriate state or Federal standard, whichever amount is less.

In Montana any point source emitting 25 tons/year or more of SO_2 requires an Air Quality Permit. A Prevention of Significant Deterioration (PSD) Permit is required if SO_2 emissions are 250 tons/year or greater. BLM air quality permits are required for point sources of 40 tons SO_2/year. Illustration D-7 shows how to calculate SO_2 quantities given H_2S analysis and gas production rates.

ADMINISTRATIVE MEASURES

Mitigation of air quality impacts occurs as a result of the NEPA analysis performed at the time of operations (APD or SN) approval.

Gas analyses and volumes from adjacent wells, combined with histories of similar oil and gas fields, are used to estimate the potential for each sour well to cause air quality problems either during drilling or production.

At the drilling stage, analysis pursuant to the BLM’s Onshore Oil and Gas Orders Nos. 2 and 6 determines the potential radius of exposure and any possible public health and safety concerns from the well. These measures are discussed in detail in the Health and Safety Section.

During production a similar review identifies wells requiring additional production equipment to protect against potential hydrogen sulfide and sulfur dioxide pollution impacts.

A gas analysis is required by BLM for all wells requesting venting/flaring permits. Such analysis must indicate if any H_2S is present and in what concentrations.

DUST MITIGATION

Access roads create the major source of dust over the long term. Dust abatement measures include watering, applying dust-suppressing chemicals, oiling, asphalt paving, and reducing vehicle speed. Four techniques used to reduce fugitive dust are: watering roads which reduces it approximately 50 percent; chemical suppression which reduces it 75 to 85 percent; oiling and asphalt paving which reduces it 90 to 95 percent; and lowering speed which reduces it 10 to 30 percent. Other mitigating measures include closure of roads to any use except drilling, production, or administrative purposes; providing a campsite at the well to reduce road use by workers; and carpooling in highly sensitive areas such as Class I airsheds. Production measures to reduce traffic include the use of remote wellhead monitoring facilities. These measures could be imposed as APD/SN conditions of approval as derived from site-specific NEPA analysis.

ILLUSTRATION D-5
ESTIMATED EMISSIONS FROM DRILLING OPERATIONS IN MONTANA*
(Tons of Emissions)

Region	Rig horse-power	Drilling time (days)	Nitrogen Oxide (NOX)	Carbon Monoxide (CO)	Sulfur Dioxide (SO_2)	Total Pat. matter (PM-10)	Volatile compounds (VOC's)	Total rig engine emissions
Williston	900	45	9.3	2.5	1.1	1.0	0.3	14.1
	1,100	60	15.2	4.0	1.8	1.5	0.4	22.9
Central Montana	900	10	2.1	0.6	0.2	0.2	0.1	3.1
Big Horn	900	20	4.1	1.1	0.5	0.4	0.1	6.3
6 Powder River	900	15	3.1	0.8	0.4	0.3	0.1	4.7
South Dakota	900	10	2.1	0.6	0.2	0.2	0.1	3.1

*Assumes that drilling rig and associated equipment are operating 80 percent of the drilling period.

Source: Compiled by Mark Kelley, State of Montana DNRC, and Jim Hughes, State of Montana DHES.

Several procedures have the potential to affect air quality while the drilling rig is on location or just before the start of production (see MBOGC, 1989, Technical Appendix 4). These include: (1) Gas and Oil Ratio tests, (2) Drill stem tests, and (3) stabilized production tests. The most significant pollutants likely to be emitted during these activities include hydrogen sulfide gas and sulfur dioxide, and volatile organic compounds. The pollutants can be emitted in varying quantities depending on the type of well and its potential flow volume.

ILLUSTRATION D-6
SOURCES AND TYPES OF AIR POLLUTION FROM PRODUCING WELLS

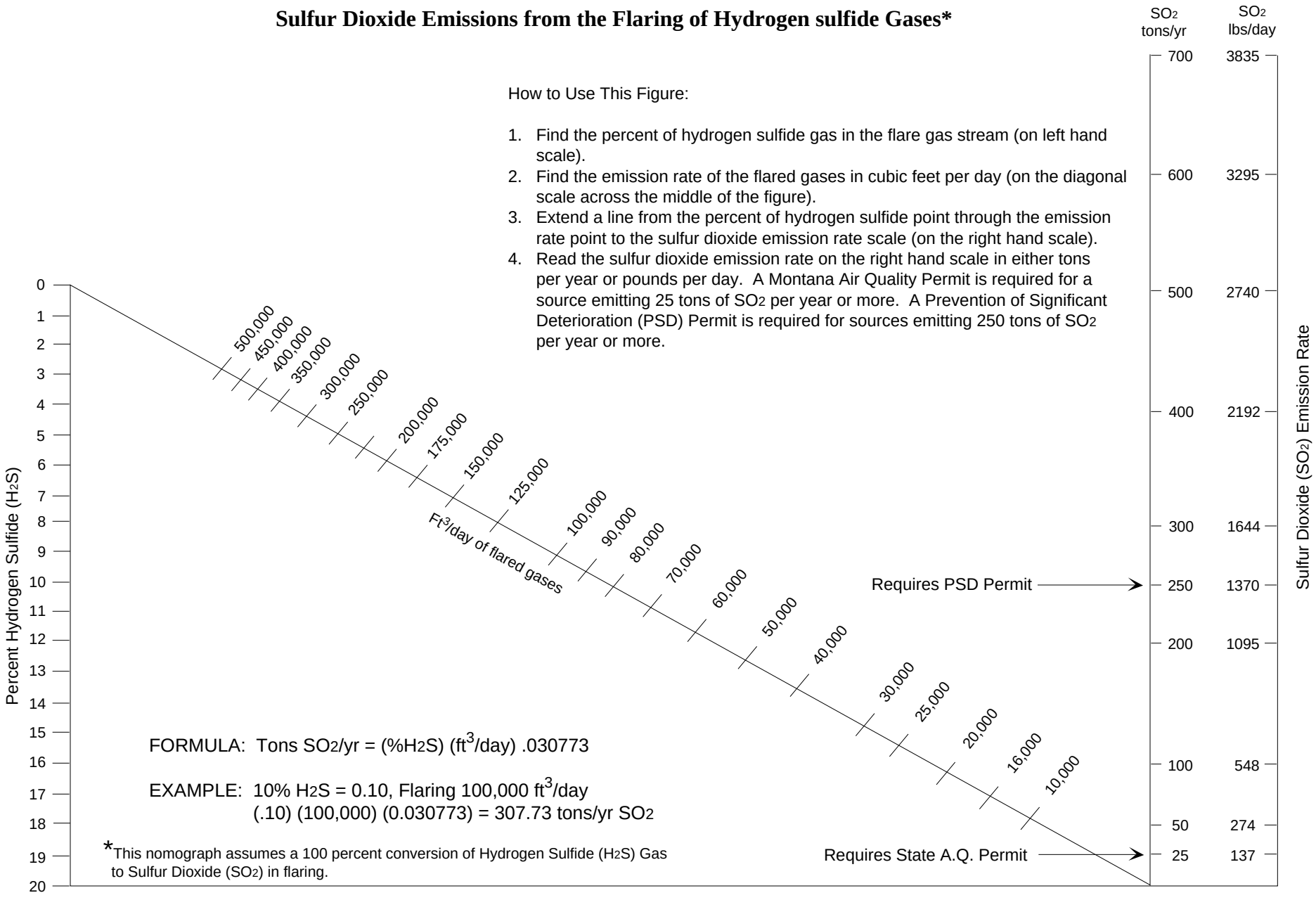
Pollutants	Oil Wells	Gas Wells	Oil-Gas Wells
Particulates	Traffic on access roads.	Traffic on access roads.	Traffic on access roads.
Nitrogen Oxides	Negligible	Negligible	Negligible
Sulfur Dioxide	Negligible from sweet wells.	Negligible from sweet wells. For sour wells: Flaring sour gas; Burning sour gas in compressors in ancillary equipment.	Negligible from sweet wells. Flaring sour gas; Burning sour gas in heater-treaters, compressors, or ancillary equipment.
Hydrogen Sulfide	Negligible from sweet wells. For sour wells: Breathing and working losses from storage tanks; Fugitive losses from pipelines, pumps, seals, flanges, etc.	Negligible from sweet wells. Venting and flaring sour gas and fugitive losses from pipelines, pumps, seals, flanges, etc.	Negligible from sweet wells. Venting/flaring of sour associated gas; Burning gas in heater-treaters, separators, etc.; Breathing and working losses from storage tanks; Fugitive losses from pipelines, pumps, seals, flanges, etc.
Carbon Monoxide	Negligible.	Negligible.	Negligible.
Volatile Organic Compounds	Negligible.	Negligible from gas wells without condensates.	Breathing and working losses from storage tanks.

Source: Compiled by Jim Hughes, State of Montana DHES.

Illustration D-7
Sulfur Dioxide Emissions from the Flaring of Hydrogen sulfide Gases*

How to Use This Figure:

1. Find the percent of hydrogen sulfide gas in the flare gas stream (on left hand scale).
2. Find the emission rate of the flared gases in cubic feet per day (on the diagonal scale across the middle of the figure).
3. Extend a line from the percent of hydrogen sulfide point through the emission rate point to the sulfur dioxide emission rate scale (on the right hand scale).
4. Read the sulfur dioxide emission rate on the right hand scale in either tons per year or pounds per day. A Montana Air Quality Permit is required for a source emitting 25 tons of SO_2 per year or more. A Prevention of Significant Deterioration (PSD) Permit is required for sources emitting 250 tons of SO_2 per year or more.



FORMULA: Tons SO_2/yr = (%H_2S) (ft^3/day) .030773

EXAMPLE: 10% H_2S = 0.10, Flaring 100,000 ft^3/day
(.10) (100,000) (0.030773) = 307.73 tons/yr SO_2

*This nomograph assumes a 100 percent conversion of Hydrogen Sulfide (H_2S) Gas to Sulfur Dioxide (SO_2) in flaring.

Source: Modified from Montana Air Quality Bureau, 1982

NITROGEN OXIDES MITIGATION

Nitrogen oxides from internal combustion engines are the most difficult exhaust pollutant to control. Both vehicles and stationary drilling-rig engines emit this pollutant. Good maintenance practices such as regular tuneups and proper fuel-to-air settings should minimize these emissions. Under worst-case conditions, violations of the 1-hour and annual nitrogen oxide standards could be avoided largely by reducing operational hours or total engine horsepower rating.

During well production, some nitrogen oxides are emitted from combustion of well gas in flares and treaters, but these emissions are usually small. If an oil or gas well flares or consumes an average of 100 MCF per day/per year, the nitrogen oxide emissions per well would average about 2.0 tons per year.

HYDROGEN SULFIDE MITIGATION

All gas flaring or venting requires BLM approval pursuant to NTL-4(a). Such approval has a NEPA analysis conducted, primarily addressing air quality impacts, and the analysis is documented. Illustration D-7 demonstrates how SO_2 equivalency is calculated from flaring H_2S.

During well production, pipelines and connections are closely monitored with various kinds of sensors to detect minor leaks or major releases of sour gas. The sensors may be used to operate an alarm system and even shut in the well. An effective inspection and maintenance program is essential to identify and prevent sulfide stress corrosion on collection pipelines, tubing, and fittings.

Wells producing sour gas would have an ignitable flare or incinerator plumbed so that gas released by a malfunction of the wellhead or associated pipeline can be routed to the flare.

Gas blankets prevent odorous sulfur compounds such as hydrogen sulfide and other hydrocarbons (also called "volatile organic compounds," or "VOCs") from escaping to the atmosphere. Gas blankets are sometimes used on storage tank facilities to mitigate fugitive hydrogen sulfide losses.

Vapor recovery may be used to mitigate odorous sulfur compounds emitted from storage tank facilities due to working and breathing losses. The collected vapors are usually placed into a sales pipeline. The feasibility of vapor recovery systems depends on site-specific economics and production rates. Another measure to reduce hydrogen sulfide emissions is underground injection of waste gas. This method has seldom been used in the planning area.

Sulfur can be removed from hydrogen sulfide by various chemical means. The practicality of using small-scale sulfur recovery plants on individual sour gas wells is determined by the production potential and economics. Gas-sweetening plants can be constructed to serve a number of gas wells requiring removal of sulfur compounds and hydrogen sulfide. Often, the produced gas is piped some distance from the wells to be sweetened by the plant before it is sold.

SULFUR OXIDES MITIGATION

Sulfur dioxide emissions can originate from a number of activities, including certain testing functions performed before and just after well completion. Sulfur dioxide is produced when sour gas is flared for safety reasons during pre-production testing of the gas-to-oil ratio and production capacity. Mitigating measures could include construction of an elevated flare stack or temporary incinerator, installation of tail-gas scrubbers, or flue gas desulfurization.

For the production phase of oil and gas operations where sour gas is burned in heater-treaters or used to fuel other equipment, sulfur dioxide emissions can be limited by installing tail-gas scrubbing facilities. If emissions are sufficient to require an air quality permit, an analysis would be required to determine the best available control technology to reduce the sulfur dioxide emissions for a given well. Elevated flares and stacks enhance atmospheric dispersion but do not reduce the total emission rate.

ODOR MITIGATION

Odorous compounds are controlled by the same measures used for hydrogen sulfide. Under good combustion conditions, burning or flaring of these compounds oxidizes them to carbon dioxide and sulfur dioxide.

HEALTH AND SAFETY

Health and safety hazards associated with oil and gas drilling and production include the following: (1) release of toxic or noxious gases from a well during drilling or production, from pipeline leaks or ruptures, and from storage tanks or other facilities, including pits for mud and produced water; (2) fire at a well, or a fire spreading to a well site from another location; (3) employee use and handling of chemicals; and (4) employee use of machinery, heavy equipment, and vehicles, including use of equipment under hazardous conditions such as high formation pressures.

Oil and gas drilling and production accidents result primarily from equipment failure, human error, or some combination of the two. The seriousness of any particular accident depends on a wide range of variables, including wellflow volume and pressure, meteorological conditions, presence of toxic gases such as hydrogen sulfide, proximity of the emission source to residences or roads, length of time that the hazardous situation exists, and availability of appropriate equipment and expertise to avoid or eliminate the hazard.

The remainder of the discussion in this section focuses on public health and safety concerns that would exist off the well site in the event of an emergency involving hydrogen sulfide gas. The public could experience adverse health effects if a large volume of toxic gas were accidentally released, due to a well blowout or major pipeline rupture; or if toxic or noxious gases were to leak or escape from storage facilities, surface pits, or pipelines.

Data from the MBOGC indicate that 4,242 wells were drilled in Montana between 1979 and 1983 with only one blowout. This occurred in Dawson County and did not involve hydrogen sulfide (MBOGC, 1985). An environmental assessment prepared for a recent drilling proposal indicated that only two blowouts occurred in Wyoming during a recent 10-year period when more than 12,000 wells were drilled (Dames and Moore, 1986).

In 1983, Lawrence Livermore National Laboratory (LLNL) conducted an extensive study for the BLM of the potential health and environmental risks associated with sour gas wells and collection pipelines in the Overthrust Belt. As part of this study, LLNL reviewed various methods for assessing health hazards associated with accidental sour gas releases. The LLNL said that the ultimate use of risk assessments is to make decisions regarding safety measures to protect nearby residents (Layton and others, 1983). A commonly used technique for analyzing potential hazards is to calculate the size and boundaries of possible "danger zones" around sour gas wells where harmful levels of hydrogen sulfide could be present if a major well blowout were to occur.

A key factor affecting the complexity of health risk analysis is whether it is necessary to calculate where, within the danger zone, the risk of high hydrogen sulfide concentrations is greatest (Layton and others, 1983). This level of information would generally be more important in populated areas or areas where future development is anticipated. It would be used to tailor contingency plans to the population living or working in relatively specific areas (schools, hospitals, subdivisions, factories, or other public facilities) where the hazard would be greatest.

Risk analyses have been done for a number of well drilling and field development proposals on Federal leases in Montana and Wyoming. Examples include the Blackleaf Field west of Choteau (USDI, BLM 1990b), a well drilled south of Red Lodge by Amoco (Dames and Moore, 1986), and the Riley Ridge field in western Wyoming (Environmental Research and Technology, Inc., 1983). The assumptions used to define an emergency planning zone varied considerably among these analyses. For example, estimated hydrogen sulfide concentrations in the gas stream ranged from 3.2 to 15 percent, and estimates concerning the probable duration of any uncontrolled release ranged from 12 hours to 3 days. Also, the hydrogen sulfide concentration levels considered sufficient to trigger emergency response action by the company or government officials ranged from 15 to 300 ppm at the well site. The ultimate size of the emergency planning zones identified for these wells ranged from 1 to 2 miles downwind from the well sites.

Alberta's Energy Resources Conservation Board (ERCB) requires operators to calculate the maximum potential release rate of hydrogen sulfide when proposing to drill into formations that are known or suspected to contain the gas (Energy Resources Conservation Board, 1987). Data from other drilling or producing wells in the same geological setting as the proposed well are used to calculate the radius of exposure for the purpose of developing contingency plans in the event of an emergency at the well (MBOGC, 1989b, Tech. App. 5).

Blowout Prevention and Safety Procedures

Illustration D-8 summarizes major safety considerations that apply to the design and operation of wells that may produce hydrogen sulfide. As noted in the illustration, many of the safety measures are standard for worker protection and control for most wells, even if hydrogen sulfide is not present. Illustration D-9 shows examples of specific methods of controlling kicks (entry of water, gas, or oil into the wellbore which may result in a blowout if not controlled) and how judgments are made about what to do if a kick occurs.

The oil and gas industry has been responsible for developing the safety measures and equipment used to protect workers and the public. The American Petroleum Institute (API) has written extensively on these subjects in a series of "recommended practice" reports that are updated on a periodic basis. A few examples include "Recommended Practices for Well Control Operations" (API, 1987b), "Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells" (API, 1984), "Recommended Practices for Safe Drilling of Wells Containing Hydrogen Sulfide" (API, 1987a), and "Recommended Practice for Occupational Safety and Health for Oil and Gas Well Drilling and Servicing Operations" (API, 1981). The recommendations and guidance in these reports establish

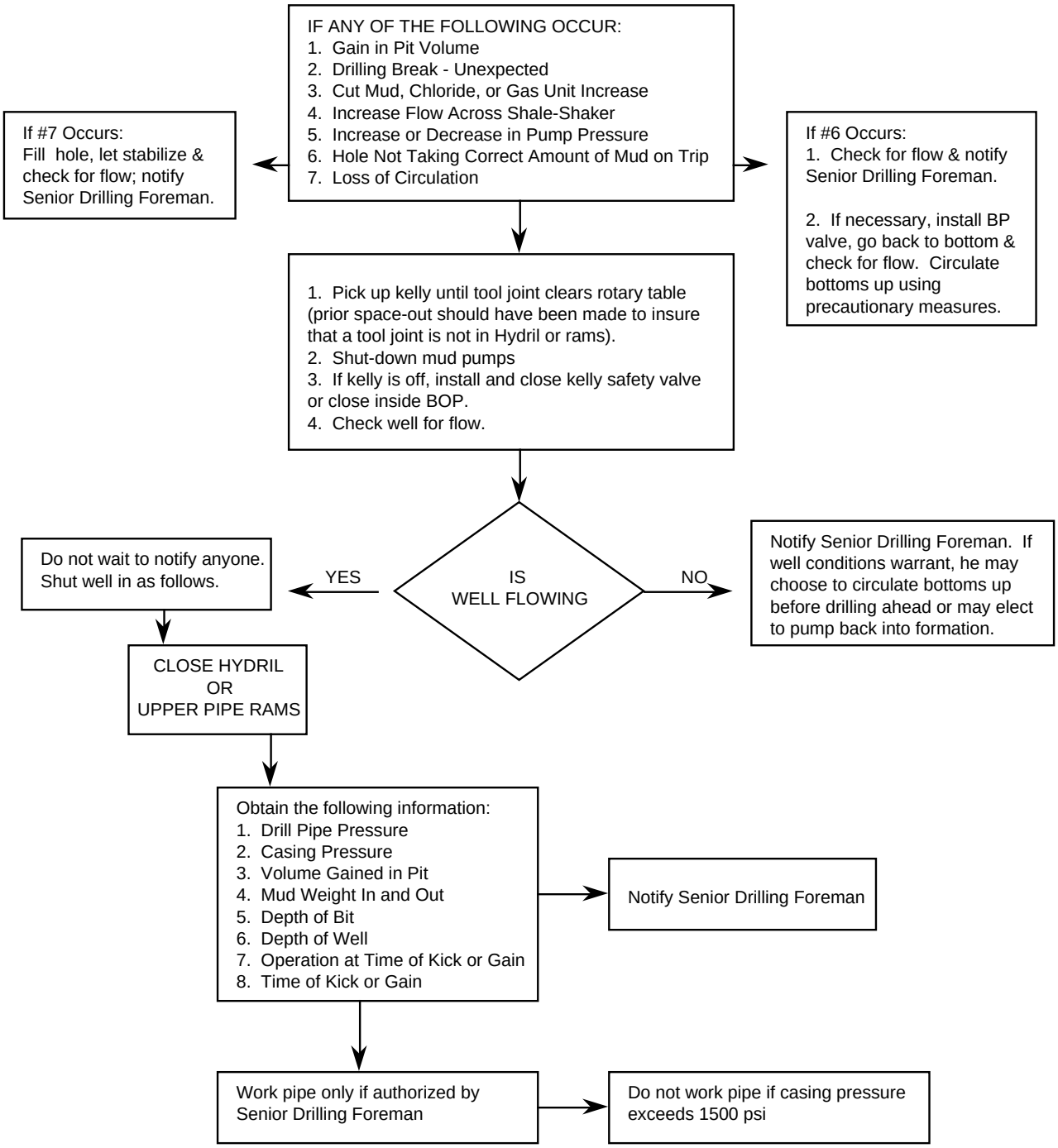
ILLUSTRATION D-8
SUMMARY OF OPTIONS AVAILABLE TO LIMIT OR PREVENT ADVERSE HEALTH EFFECTS FROM AN ACCIDENTAL RELEASE OF HYDROGEN SULFIDE

On site Safety Measures	Safety Equipment and Quality Control	Drill Crew Training	Equipment Testing	Public Safety
Layout of drilling equipment.	Hydrogen sulfide detectors and alarms.	Use of blowout preventors.+	Testing of blowout preventors.+	Identification of population at risk. Notification and and evacuation of residents.
Identification of escape routes for different wind directions.	Instrumentation for determining wind direction	Kick control procedures.+	Testing hydrogen sulfide sensors and alarms.	Ignition of released gases
Location of safety facilities.	Warning flags and signs.*+	First aid.+	Maintenance of rescue equipment.	Post-release monitoring.
Procedures for dealing with well control.*	Communications.+	Rescue techniques.+	Materials specifi-cations; e.g., hardness and corrosion resistance.	Site security.+
Chemical scavengers to remove hydrogen sulfide in drilling mud.	Blowout preventors and safety valves; specifications and quality control.+	Escape routes.	Audits for compliance with regula-tions or company procedures.+	Preemptive land ownership
Special precautions drill stem tests and coring.	Resuscitators/ breathing devices. First Aid Kits.+ Mud degasses and flare system.			

* ph of drill mud.
+ equipment or procedures common to most wells regardless of whether or not hydrogen sulfide is present.

Source: Layton and Cederwall, 1987 (adapted from Layton, and others, 1983)

Illustration D-9
Procedures for Well Control



Source: Sohio 1986

what is generally regarded as "standard practice" within the industry.

The BLM identifies site-specific requirements regarding safety and well control in COAs that are attached on a case-by-case basis to permits to drill for oil and gas on Federal and Indian land. However, over the last several years the Bureau of Land Management has been developing and enforcing general well control and safety regulations for Federal and Indian oil and gas operations. In most cases, BLM's requirements and the criteria used to identify equipment and safety practices closely parallel the recommendations and guidance contained in the API reports. The Alberta ERCB also has specific regulations identifying appropriate well control equipment and procedures, with special emphasis on sour gas wells.

NOISE

General Characteristics

Background noise for rural areas in Montana is generally 35 dB (decibels) or lower (USDI BLM, 1990b), with most of the noise intrusions associated with wildlife, hikers, picnickers, horseback riders, cross-country skiers, snowmobiles, ranch and agricultural activities, and wind-associated noises. Background noise levels in the area were measured during July and August 1983. Measurements were made with a hand-held General Radio Noise Level Meter in areas around the planning unit. The noise level would increase significantly in the immediate vicinity of the drilling well sites and access roads. The source of the increased noise levels included heavy equipment during the 3- to 10-day construction period, diesel drilling engines and generators during drilling (1 to 3 months), traffic on access roads, and, in the event of field development, compressor stations and pump jacks.

To determine the average envelope of sound impact around drilling well sites, access roads, oil pumping facilities, compressor stations, and also to determine present ambient noise levels, two General Radio Noise Level Meters were utilized by the USGS and the BLM for the 1981 Cache Creek/Bear Trust EIS in Wyoming. Both a hand-held meter and GR 1945 Community Noise Analyzer were used. Sound measurements in dBs were made at points around numerous drilling rigs, pump jacks, compressor stations, access roads, and at the proposed well sites. From the data, average envelopes of sound impacts were drawn around these components of exploratory drilling, production, and field development. These average levels were intended only to give approximate areas of impacts as individual location types, drilling rigs, and weather conditions will have an effect on sound levels.

Presented in Illustrations D-10 through D-13 are sound level averages for various exploratory and field components. These ranges are also plotted on a noise-level comparison chart in Illustration D-14.

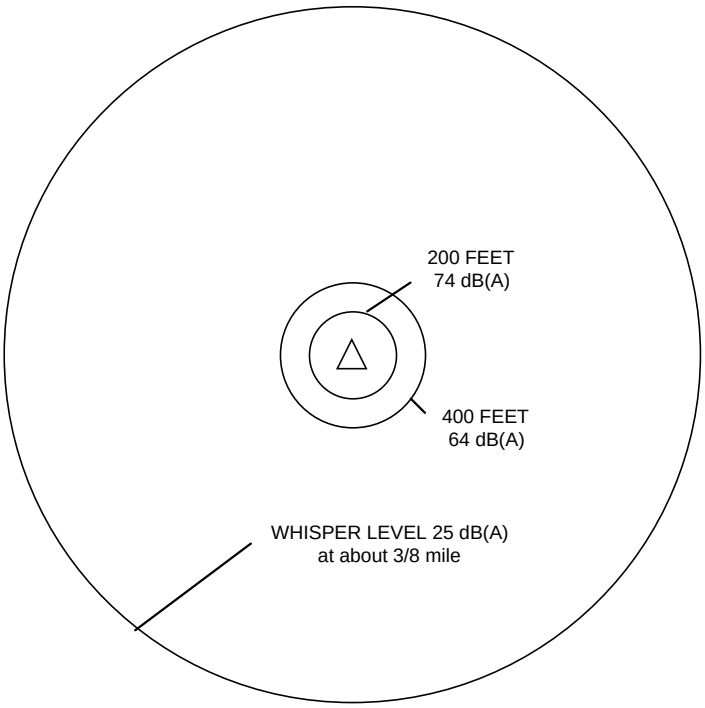
CONCLUSION

1. Drilling operations, and access road use could result in noise impact zones of 1/4- to 1/2-mile around sites and access roads.

2. Production operations would have minor noise impacts for oil production with artificial lift (pump jacks) and little or no impacts for the anticipated gas production. However, noise impact zones around access roads will remain, due to needed maintenance traffic.

Note that most wells and access roads are in remote areas where noise concerns are not a problem. Special mitigations (such as mufflers and baffle walls) may be used if nuisance noise occurs near residences or communities.

Illustration D-10
Average Envelope of Noise Levels Around a Drilling Rig



MITIGATION: Require the use of Diesel-Electric type drilling rigs which produce constant noise levels over long periods of time as opposed to Direct Drive diesel engines which produce highly variable noise levels. Require the use of mufflers on drilling rig engines that would not adversely affect engine efficiency. These mufflers are capable of up to 30 dB reduction in noise levels at certain frequencies.

Illustration D-11
Average Envelope of Noise Levels Around Oil Field Access Roads

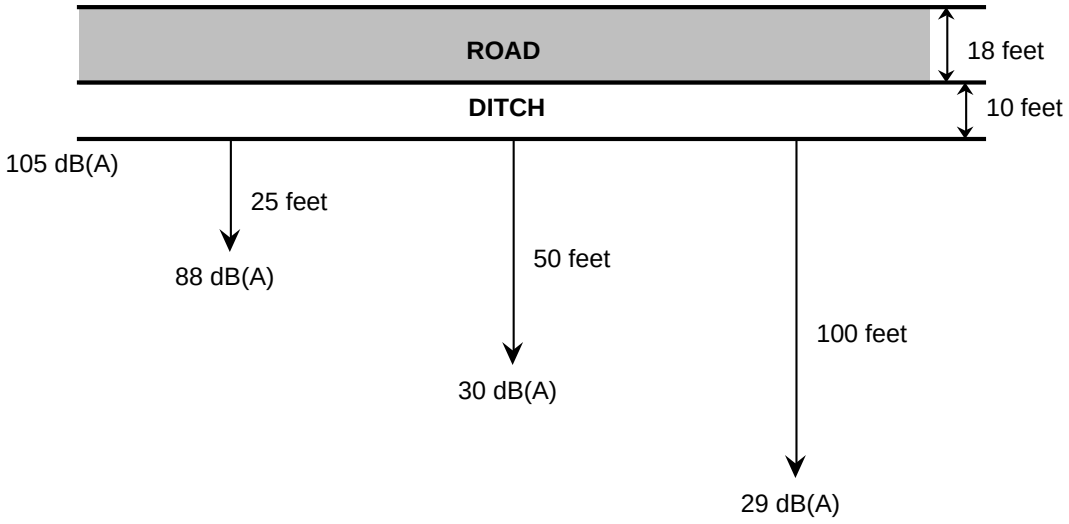
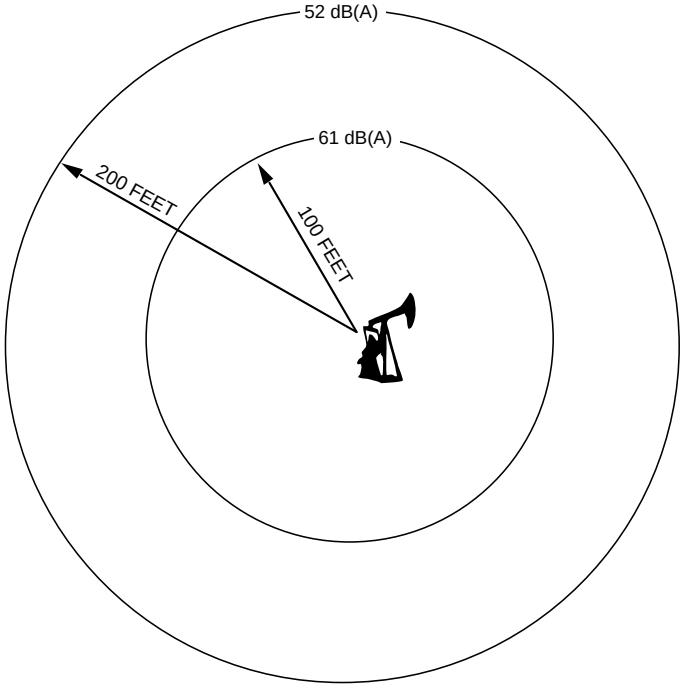
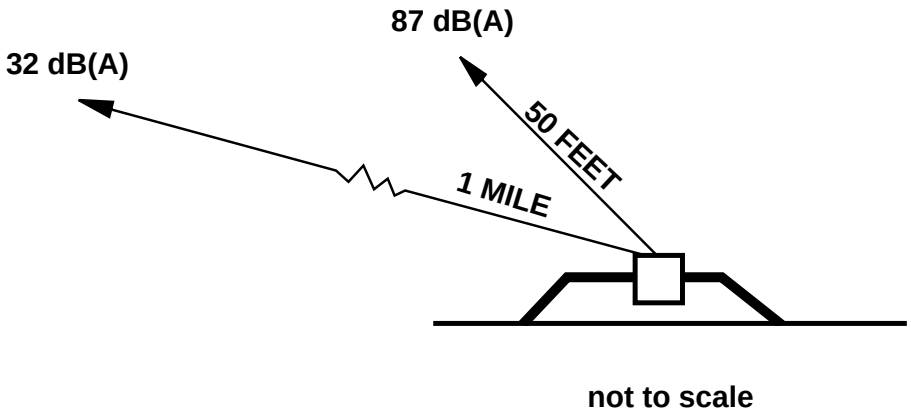


Illustration D-12
Average Envelope of Noise Levels Around a
Natural Gas Driven Pump Jack



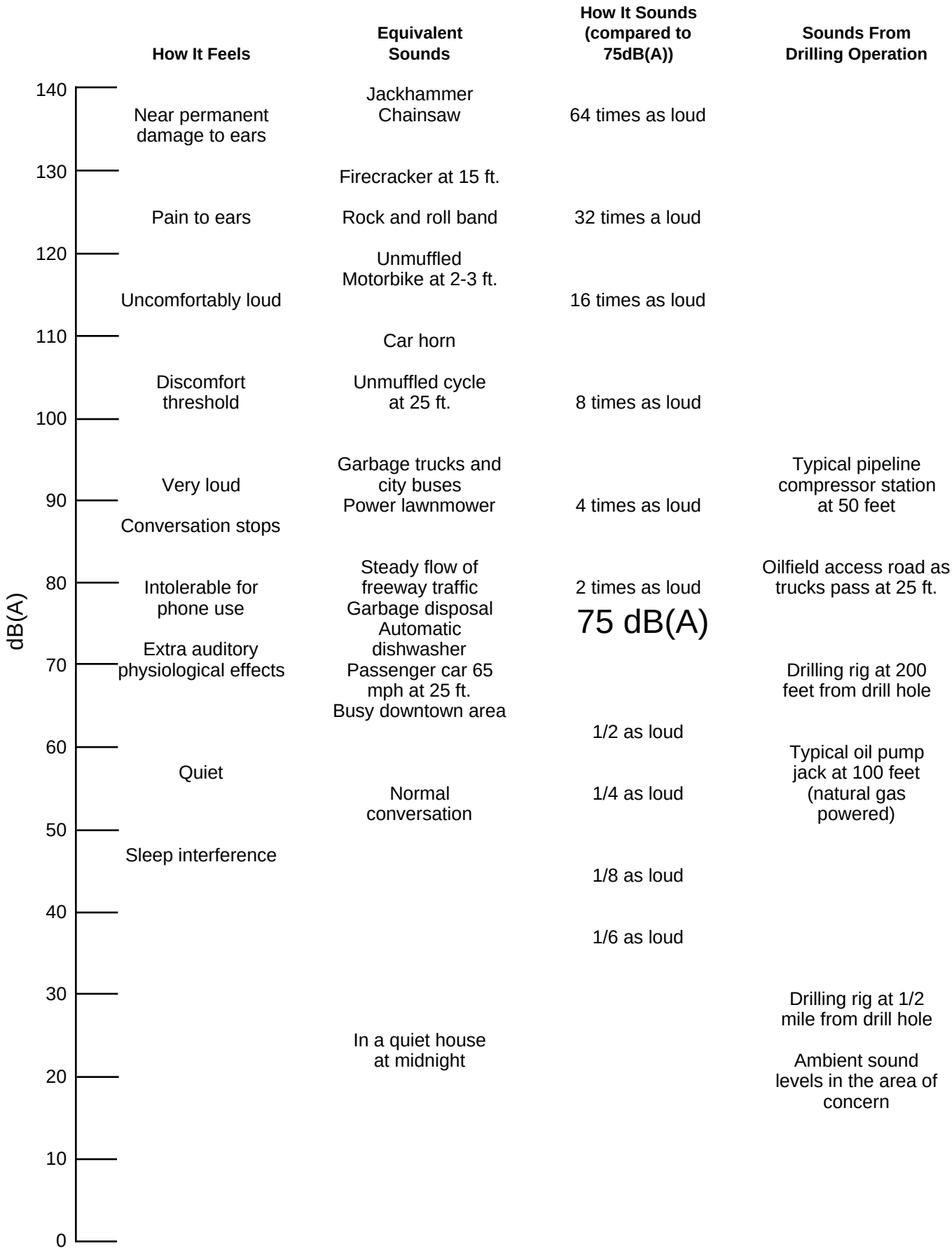
MITIGATION: Require use of electrically driven pumps that have no noise impact.

Illustration D-13
Average Envelope of Noise Impacts Around
A Typical Pipeline Compressor Unit



MITIGATION: Locate compressors away from residences and critical wildlife areas. Use of mufflers to reduce noise levels.

Illustration D-14
Noise Level Comparison Chart



APPENDIX E
EISs FOR PROPOSED ACECs

MEETEETSE SPIRES OUTSTANDING NATURAL AREA

Environmental Impact Statement for Designation as an Area of Critical Environmental Concern (ACEC).

INTRODUCTION

Purpose and Need

Meeteetse Spires Outstanding Natural Area (ONA) is being considered for designation as an ACEC. Nine hundred sixty (960) acres of public land on the eastern slope of the Beartooth Mountains would be managed to protect the esthetic quality of the Meeteetse Spires pinnacles and the habitat of two species of rare plants *Shoshonea pulvinata* and *Townsendian spathulata*.

Location

The proposed ACEC is located approximately 5 miles south of Red Lodge, Montana, in the following sections:

T. 8 S., R. 20 E., MPM
sec. 23, W2NE, NENW, N2SE, SESE;
sec 26, N2, SE;
sec. 35, E2NE, SE.

Illustration 1 shows the location of the spires and plant populations for the proposed ACEC.

Relationship to BLM Policies, Plans, and Programs

Designation of the Meeteetse Spires ACEC is consistent with objectives of the Endangered Species Act of 1973. It would afford protection and conservation of the environment of two rare species. Establishment of the ACEC will amend the existing Billings Resource Area RMP/EIS, approved September 28, 1984.

Relationship to Outside Agencies and Organizations

In 1988, The Nature Conservancy (TNC) approached the BLM concerning the establishment of a nature preserve south of Red Lodge. The BLM entered into a Memorandum of Understanding (MOU) with TNC which sets out each organization's responsibility to protect the rare plants and the esthetic value of the Spires.

ALTERNATIVES INCLUDING THE PREFERRED

Four alternatives for the management of oil and gas are considered for the Meeteetse Spires ONA. Management of other resources will follow the objectives stated in the Management Plan for the Proposed ACEC for Meeteetse Spires Outstanding Natural Area which are consistent with decisions in the Billings Resource Area RMP/EIS.

Proposed Action to Classify the Area as ACEC

The Meeteetse Spires area was nominated by TNC to be an ACEC. The BLM identified 960 acres of the original nomination which would include habitat for the two rare plant species plus protect the esthetic quality of the spires. This area was evaluated to determine if it satisfied the requirements of relevance and importance for designation as an ACEC (BLM Manual 1613.1.11 A and B).

The area meets at least three criteria for relevance: scenic value, the presence of an endangered, sensitive, or threatened plant species, and steep cliffs which represent a hazard to climbers. It also meets importance criteria: the presence of three locations of only 12 known world wide of a candidate species of plant, and the threat to human life or safety for climbers and hikers in the Spires portion of the proposed ACEC.

Management Common to All Alternatives

Under all alternatives the BLM would protect the two rare plant species found within the boundary of the proposed ACEC. The BLM prepared a management plan for the proposed ACEC as a result of the MOU with TNC. Other special management provisions in the Management Plan are described below.

Recreational activities would be permitted within the proposed ACEC boundary. Current use which causes degradation is not excessive. Monitoring would identify accelerated degradation requiring additional protection.

Access is primarily provided by the Meeteetse Trail. An easement across state land is currently being sought. The BLM and Forest Service have proposed the construction of a foot trail which would provide access into the national forest south of the proposed ACEC. The area will be monitored for signs of off-road vehicle use (ORV). If problems are observed, signs or road blockages would be

used to prevent further degradation. Parking is available at two locations on the proposed ACEC. Signs will be placed at the entrances of the proposed ACEC to provide information.

Areas adjacent to the proposed ACEC do not qualify as commercial forests. Recreational and Christmas tree cutting are not permitted, but some selective timber harvests may be necessary to protect the area's overall value.

Grazing of cattle is permitted in the area because it does not appear to threaten the populations of rare plants. Grazing use will be monitored; use for sheep grazing will not be authorized.

There are no existing leases for minerals other than oil and gas within the boundary of the proposed ACEC. The area will be withdrawn from all mineral entry.

Oil and Gas Alternatives

The alternatives for oil and gas give a range of management options varying from the existing management to a "No Lease" decision.

Alternative A, No Action, has no Special designation for the area. Currently, all 960 acres are leased for oil and gas. The northern 720 acres has the oil and gas Leasing Stipulations, MT3109-1, and oil and gas Surface Occupancy Stipulation, MT-3109-2, a No Surface Occupancy restriction during elk calving season. That lease expires in 1995. The remaining 240 acres has only the oil and gas Leasing Stipulations, MT-3109-1, and expires in 1996. The existing MOU and provisions of the ESA protect the plant species in this alternative.

Alternative B proposes establishment of the ACEC for Meeteetse Spires and a No Lease decision for it. Restrictions under this alternative are the same as for Alternative D, the preferred.

Alternative C would establish a No Surface Occupancy stipulation for the 960 acres of the proposed ACEC. Other resources have proposed additional stipulations for the area (Table 1). All 40-acre tracts within the proposed ACEC have at least three stipulations.

TABLE 1. STIPULATIONS FOR LANDS WITHIN MEETEETSE SPIRES PROPOSED ACEC

Stipulation	Type*	Acres
Meeteetse Spires ACEC	Major-NSO	960
Riparian/Hydrology	Major-NSO	560
Visual Resources	Minor-CSU	960
Crucial Winter Range	Minor-Timing	720
Soils	Minor-CSU	680
Elk Calving	Minor-Timing	400

*For an explanation of types of stipulations, see Chapter 2 and Appendix B.

Alternative D, the preferred, considers classification of a 960-acre ACEC with a No Leasing decision for oil and gas resources. This restriction would deny access for oil and gas development in order to preserve the habitat of two rare plants and prevent degradation of the esthetic quality of the Spires.

Summary of Impacts from Oil and Gas Operations

Alternative A, No Action, would allow access for exploration and development with application of one or more oil and gas Lease Stipulations or Surface Use Stipulations. The application of specific lease stipulations would be identified during the time the APD was being processed.

Alternative B, would prevent impacts from oil and gas operations by a No Lease decision.

Alternative C would apply six stipulations to substantially limit impacts while allowing leasing for oil and gas operations.

Alternative D, the preferred, would have the same impacts as Alternative B.

AFFECTED ENVIRONMENT

The Meeteetse Spires proposed ACEC is located on the eastern slope of the Beartooth Mountains about 5 miles south of Red Lodge. The terrain slopes steeply, dropping from more than 7,200 feet to approximately 5,600 feet. The spires are formed by a tilted layer of sedimentary rocks at the edge of the Beartooth Uplift. The species of rare plants are located around or near the tops of the spires. In the rest of the text the term "area" is used synonymously with "proposed ACEC".

Climate

The proposed ACEC is in the rainshadow of the Beartooth Mountains. It exhibits an extremely abrupt change in annual precipitation from nearly 26 inches on the western boundary to 6 inches east of the proposed ACEC (Lesica, 1988). Variations in moisture have affected soil development which determines the plant communities in the area.

Air Quality

The air quality of the area is rated as Class II.

Geology and Minerals

The Meeteetse Spires area is at the edge of the Beartooth Uplift which is composed of Precambrian igneous and metamorphic basement rocks. The spires are remnants of upturned Madison limestone.

The oil and gas development potential in T. 8 S., R. 20 E., is moderate. The nearest oil and gas development is about 10 miles to the northeast. Coalbed methane exploration has been conducted to the north and east less than 2 miles from the proposed ACEC boundary. The operator has not announced whether a commercial discovery has been made.

Some mining claims are located on the tops of the limestone escarpments west of the area.

Hydrology

The area is drained by nearly a dozen permanent and intermittent streams which flow eastward from the mountain front to form the Grove Creek and Wolf Creek drainages.

Soils

Soils are primarily stony and calcareous (Lesica, 1988). At higher elevations within the proposed ACEC, soils are thin and poorly developed. The outwash slopes have stony loams (Lesica, 1988).

Vegetation

Two rare plants, *Shoshonea pulvinata* and *Townsendia spathulata*, occur at higher elevations within the proposed boundary. The management plan requires the BLM to protect the habitat of these two species. *Shoshonea* is known in only three locations in Montana. Fewer than twelve locations globally are known for this species (Lesica, 1988). It is a candidate for listing. *Townsendia* is also considered rare in Montana. At lower elevations, other plant communities are Limber Pine-Douglas Fir, Limber Pine-Rocky Mountain Juniper, Montane Riparian Forest, and Douglas Fir Forests (Lesica, 1988).

Timber

The areas adjacent to the proposed ACEC do not qualify as a commercial forest. Selected timber harvests may be periodically necessary to protect the area's overall resource value. Recreational and Christmas tree cutting will be prohibited adjacent to and within the proposed ACEC.

Land Use

The entire 960 acres are public domain lands administered by the BLM. Some cattle grazing occurs in the area. The lands are unsuited for other agricultural uses.

Wildlife

Elk and deer use the area. Elk calving occurs at the northern end of the proposed ACEC. Winter range is scattered across the area. There are no known threatened or endangered animal species in the area.

Cultural Resources

There are no known cultural resources in the proposed ACEC.

Paleontology

No vertebrate fossils have been identified in rocks exposed in the area.

Wilderness

No wilderness has been designated or proposed for the area.

Recreation

The proposed ACEC is close to other recreational areas near Red Lodge. Hikers, climbers, and sightseers use the area during spring and summer (Lesica, 1988). In fall, hunters use the area intensively.

Visual Resources

The esthetic value of the spires is one of two reasons that the ACEC has been proposed. Management of the area to preserve the scenic quality is one objective of the management plan.

Social and Economic Conditions

Currently the two leases in the proposed ACEC produce $960 per year in rental. The area has no other mineral activity which produces revenue. Exploration of the existing leases would not change the economic projections for the area. A no-lease decision would remove the yearly rental from revenues received when the leases expire. The esthetic value of the proposed ACEC is directly related to the recreational uses of the area.

ENVIRONMENTAL CONSEQUENCES

Impacts to resources are described for the four oil and gas alternatives for the Meeteetse Spires proposed ACEC. Impacts identified in the management plan are also described.

Climate and Air Quality

Neither Climate nor Air Quality would be affected by any of the alternatives.

Geology and Minerals

Under Alternative A some restrictions would apply to the development of oil and gas; however, operations could be conducted.

Oil and gas resources would not be leased under Alternative B. A possible drainage situation could occur if a discovery were made adjacent to the area. This is most likely to occur if coalbed methane is discovered in commercial quantities adjacent to the area.

Six stipulations would restrict development of leases in Alternative C. Oil and gas operation costs would be greater in this alternative than for Alternative A.

The impacts for Alternative D are the same as for Alternative B.

In Alternative A, No Action, the area is open to mineral claim locations. This could impact the plant species because they occur in the same environment in the limestone escarpment. In the Preferred Alternative, the area would be withdrawn from mineral entry to protect the plants' habitat.

Hydrology

Under Alternative A impacts to surface water resulting from sedimentation or spills could occur with oil and gas development. This would also affect the Montane Riparian Forest along the two principal drainages. The soils stipulation could protect this resource by limiting activity on steep and fragile soils above the drainages.

There would be no impacts in Alternative B.

In Alternative C impacts would be similar to Alternative A.

There would be no impacts in Alternative D.

Soils

Steeply dipping and fragile soils would be protected by stipulations in Alternative A.

There would be no impacts in Alternative B.

In Alternative C impacts would be similar to Alternative A. There would be no impacts in Alternative D.

Vegetation

There will be no impacts from oil and gas activities.

Greater use of the area after designation would increase the potential impact from pedestrian traffic.

Designation of the ACEC would not significantly impact timber management.

Land Use

There will be no impact to cattle grazing.

Wildlife

Under all oil and gas alternatives, wildlife will not be affected. Alternatives A and C have stipulations to mitigate or reduce impacts from oil and gas. In Alternatives B and D, prohibition of oil and gas and mining activities would reduce disturbance to wildlife.

In D, the Preferred Alternative, establishment of the ACEC might increase public use of the area, causing some disturbance to wildlife.

Cultural Resources

There would be no impacts under any alternative.

Paleontological Resources

There would be no impacts under any alternative.

Wilderness

There would be no impacts under any alternative.

Recreation

There would be no impacts in Alternative A.

Recreational interest and opportunities may increase as a result of ACEC designation. This would increase use of the area in Alternatives B, C, and D, resulting in some potential degradation of the environment.

Oil and gas activity allowed under Alternatives A and C might reduce the esthetic quality of the area, especially during the drilling phase of operations. There would be no impacts from oil and gas in Alternatives B and D.

Visual Resources

The esthetic quality of the area is one of two primary resources which would be protected under Alternatives B, C, and D.

Some impacts, mostly short term, would result from drilling allowed under Alternatives A and C.

There would be no impacts under either Alternative B or D.

Social and Economic Conditions

Impacts under Alternatives A and C would include the cost of mitigation of oil and gas operations.

Designation of the ACEC under Alternatives B or D would result in loss of less than $2,000 for yearly oil and gas lease rental. Designation of the ACEC in Alternatives B, C, and D would increase use of the area by residents of nearby communities.

References

Lesica, Peter, 1988, Montana Preserve Design Package: The Nature Conservancy, Helena, MT. May 15, 1988.

WEATHERMAN DRAW ROCK ART COMPLEX

Environmental Impact Analysis for Designation as an Area of Critical Environmental Concern (ACEC).

INTRODUCTION

Purpose and Need

The purpose of this action is to consider the designation of an ACEC for 2,250 acres of public land in the Weatherman Draw area. As a result of this action, 1,579.83 acres would be designated as a No Surface Occupancy (NSO) area and 2,250 acres would receive Off Road Vehicle (ORV) closure designation. A total of 600 acres has been withdrawn from mineral entry previously in this area. Special designation of these lands would provide protection and management direction for the Weatherman Draw Rock Art Complex.

Conformance With Land Use Plan

Designation of the Weatherman Draw Rock Art Complex ACEC is intended to fulfill the Bureau's mandate under Section 110 of the National Historic Preservation Act to "assume responsibility for the preservation of historic properties" owned or controlled by the Bureau of Land Management (BLM). This designation conforms with the Billings Resource Area RMP/EIS, and incorporates it by reference. The NSO designation also conforms with resource management specifications of the final Miles City District Oil and Gas Leasing Amendment.

Relationship to Statutes, Regulations or Other Plans

Legislative acts and BLM manuals provide authority for special designation. This designation is a direct consequence of the implementation of the approved 1986 Weatherman Draw Locality Cultural Resource Management Plan (CRMP).

Legislative acts include:

1. National Historic Preservation Act of 1966 (NHPA) - Sets inventory, nomination, protection, and preservation responsibilities for Federally owned cultural properties. Establishes the National Register of Historic Places.

2. National Environmental Policy Act of 1969 (NEPA) - Establishes national policy to preserve important historic, cultural, and natural aspects of national heritage.

3. Executive Order 11593 - Directs Federal agencies to inventory cultural properties under their jurisdiction, nominate all qualifying properties to the National Register, and assure that plans and programs contribute to the protection and enhancement of non-Federally owned properties.

4. Federal Land Policy and Management Act of 1976 (FLPMA) - Directs the BLM to manage public lands on the basis of multiple use that protects the quality of historical resources and archeological values, including the use of Area of Critical Environmental Concern Designation.

5. American Indian Religious Freedom Act of 1978 (AIRFA) - Establishes national policy to protect and preserve Native American religious values including access to religious sites.

6. Archeological Resources Protection Act of 1979 (ARPA)- Provides penalties for the damage or theft of archeological properties or items and requires consultation with Native American groups prior to the excavation of sensitive sites.

BLM manuals include:

1. 8100 - Directs the management of cultural resources to follow the same multiple use and planning and decisionmaking processes common to all resource management.

2. 8140 - Directs the protection of cultural resources by the means and to the degree necessary to safeguard or realize the use(s) determined through evaluation and planning and the qualities that enable cultural properties to meet the criteria of the National Register.

3. 1613 - Establishes Relevance and Importance criteria for the identification of an ACEC and specifies that special management attention must be necessary to maintain values.

4. 1623 - Provides supplemental guidance on cultural resource planning including options for ACEC designation. Recognizes confidentiality of site specific information and directs consultation to the State Historic Preservation Officer and Indian Tribes.

Confidentiality of Other Information

The rock art sites within the Weatherman Draw Rock Art Complex are extremely fragile and vulnerable to vandalism. Because of this sensitivity, the location of all sites except those allocated for public use is confidential. Locations will be provided based on reasonable need.

PROPOSED ACTION AND ALTERNATIVE

Proposed Action

The proposed action is to designate the Weatherman Draw Rock Art Complex as an Area of Critical Environmental Concern under the provisions of FLPMA. Existing and Class II inventory have identified a total of 40 petroglyph and pictograph sites meeting ACEC Relevance criterion 1: "A significant historic, cultural, or scenic value (including but not limited to rare or sensitive archeological resources and religious or cultural resources important to Native Americans)." The concentration and placement of these cultural properties meet Importance criteria 1 through 3, and perhaps criteria 4 or 5. These criteria are:

1. Has more than locally significant qualities which give it special worth, consequence, meaning, distinctness, or cause for concern, especially compared to any similar resource.

2. Has qualities or circumstances that make it fragile, sensitive, rare, irreplaceable, exemplary, unique, endangered, threatened, or vulnerable to adverse change.

3. Has been recognized as warranting protection in order to satisfy national priority concerns or to carry out the mandates of FLPMA.

4. Has qualities which warrant highlighting in order to satisfy public or management concerns about safety and public welfare.

5. Poses a significant threat to human life and safety or to property.

The last two criteria relate to the extremely rugged rimrock topography of the Weatherman Draw area and the local infestation with rattlesnakes.

Three primary management goals are proposed for implementation under ACEC designation. The first is to maintain the existing state of preservation of the known rock art panels. Protective fencing utilizing a minimum of three-strand barbed wire will be required at sites susceptible to damage through cattle rubbing. Link fence with portals for photography will be required at the sites allocated for public use. These three sites are: 24CB408, 24CB630, and 24CB1023. In the interim, these sites, which are the most accessible by pedestrians from the mouth of Weatherman Draw, will be managed for scientific use to retrieve portions of their data potential.

The second goal is to manage the cultural properties within their allocated uses. Initially, all of the 40 rock art sites will be allocated to scientific use pending evaluation and cross-comparison of values. After such work is complete, some sites will be assigned to public use for interpretive purposes. However, after evaluation of the Weatherman Draw Rock Art Complex, it is the primary intent to allocate sites primarily for conservation use. This will provide a data bank of high quality rock art sites of various ages and artistic styles. Future work to understand the meaning of prehistoric and ethnographic artistic behavior will be directed to similar sites outside the complex.

The third goal is to protect the conserved sites. Regular surveillance of the area will be required, particularly at the sites allocated for public use. Although natural degradation does occur, the primary historic source of damage to the rock art sites is human. Some damage is directly attributable to oil and gas exploration but the primary cause is vandalism. ORV closure will serve to contain off-road use, diminishing the opportunity for this vandalism. No Surface Occupancy (NSO) designation will limit actual or residual adverse impacts to the cultural properties as well as the dramatic cultural landscape in which continued inventory will be necessary to complete 100 percent inventory of the lands designated through the results of Class II inventory. A local predictive model developed as a result of that inventory effort will expedite future inventory.

No-Action Alternative

A 600-acre portion of the area is currently managed under the Weatherman Draw Locality CRMP. This entire area is withdrawn from mineral entry and contains eight rock art sites. Through this CRMP, Sites 24CB408 and 24CB630 are allocated to conservation use and sites 24CB198, 24CB620, 24CB621, and 24CB631 are allocated potential scientific use and management use. No use has been assigned 24CB633 and 24CB1023 pending further evaluation.

The needs for future inventory within the area of the Weatherman Draw Locality were explicitly stated in the CRMP. The lands recommended for this inventory closely approximate those in the proposed ACEC. One result of this recommendation is the potential for determining whether rock art sites have sufficient density to receive management as a unit, or if they are scarce enough to receive management on an individual site basis.

Continuation of existing management would protect the rock art sites. An additional 1,650 acres is proposed to be designated NSO for oil and gas leasing. No ORV closures would occur. The provisions of FLPMA regarding ACEC designation would not be followed.

AFFECTED ENVIRONMENT

The Weatherman Draw Rock Art Complex occurs on the divide between Jack Creek to the north and Cottonwood Creek to the south. The area is characterized by rugged exposures of Eagle Formation Sandstone. Rock art panels composing the complex are closely associated with the intermittent Weatherman Draw drainage.

Climate

The topographic conditions surrounding the Weatherman Draw Rock Art Complex create a variable climate. Winters are generally cold with occasional mild or open years. Periods of cold weather may be quickly changed by warm chinook winds followed by warmer weather. Moderate to strong winds occasionally cause blizzard conditions, primarily January through March. The average fall-winter temperature in the resource area is 36° F.

Summers are characterized by extreme temperature variations, low relative humidity, local thundershowers, and an average temperature of 61° F. The reflection of light and heat from the sandstone exposures tends to create locally warmer conditions. Most of the annual 6-inch precipitation comes in the form of intense summer showers.

Air Quality

The air quality of the area is rated as Class II.

Geology and Topography

The surface geology of the area consists of Eagle Sandstone sandstones and shales. The formations dip to the southwest and a fault bisects Weatherman Draw itself. Erosion of the area has produced a canyon topography with numerous vertical sandstone exposures.

Energy minerals include coal and the potential for oil and gas. The area is the southernmost extension of the Bridger coal beds. One four foot seam with gypsum inclusions within the area was developed as a marginal mine, but this mine does not appear to have been worked since World War II. Initial oil and gas exploration within the area was conducted using shallow wells during the 1930s and 1940s. Current interest regarding potential resources continues within the area; the last well was drilled in 1986.

No interest in industrial minerals exists in this area.

Soils/Watershed

Six soils types are present in the affected environment. The most widespread is the rock outcrop, Travesilla complex. This occurs in areas of steep to very steep, rough, broken uplands of sandstone. Thirty percent of the area or less has Travesilla soils.

The Sandstone Outcrop soils are the second most common type in the area. This type consists of steep or very steep, barren or partially barren hard sandstone cliffs, ledges, and slopes. What soils are present consist of sands. Limited portions of the area are classed within the midway-Travesilla association hilly and steep types. These types include shallow, well-drained soils formed in calcareous, moderately coarse to medium textured sandstone. Subclassification is made on the degree of slope.

The Heldt silty clay loam of the 4 to 8 percent slopes type is restricted in distribution to the deeply incised terrace bordering the floor of Weatherman Draw. This is the only potential soils type which can support farming, but does not represent prime or unique farmlands.

The Haverson-Heldt silty loam of the 0 to 4 percent slopes type is limited to a small portion of the Cottonwood Creek drainage floor included within the affected environment. This soils type occurs in flood plains or coalescing fans of narrow drainage ways. The primary use of this soils type is for grazing.

The formal evaluation of most of the affected environment shows rapid runoff and severe erosion. This is enhanced in the Weatherman Draw area by the precipitation pattern. Use of the area for sheep grazing until 1962 was a significant factor. Erosion is prevalent throughout the entire area and severe erosion in many places is due to sparseness of vegetation, unstable soils, and steep slopes. All drainages reveal active head-cutting and bank sloughing.

No wild and scenic rivers are present in the area. The primary drainage, Cottonwood Creek, is semi-perennial and Weatherman Draw is intermittent. A seep spring in Weatherman Draw is the only live water supply. The spring, located outside the affected environment, is used for grazing purposes only. Guzzler type range developments are planned to enhance natural water sources.

No true wetlands are present. The floodplain of Cottonwood Creek occupies an extremely small part of the affected environment.

Vegetation

No threatened and endangered plants are known to exist within the affected environment, but this may be due to incomplete inventory. Weatherman Draw is vegetatively diverse and several areas of rugged topography are not grazed. The majority of the affected environment is classified as a conifer vegetative type. Dominant conifer species include limber pine, sedge, and bluebunch wheatgrass. Also present are ponderosa pine, juniper, mountain mahogany, sagebrush, yucca and cactus. Localized concentrations of Canadian wildrye also occur within both the conifer and sagebrush vegetative types. The conifer vegetative type averages 46.15 acres for cattle animal unit months (AUM) and 16.66 acres for deer AUM. The floor of Weatherman Draw and floodplains of Cottonwood Creek are classified within a sagebrush vegetative type. Dominant species are sagebrush and bluebunch wheatgrass. Blue grama cheatgrass and cactus have invaded this area in response to overgrazing. This vegetative type averages 32.43 acres for cattle AUM and 12.76 for deer AUM.

Cottonwood Creek lacks a true riparian-wetland zone. Cottonwood, box elder, and skunkbush sumac are scattered along the drainage. It probably once supported a true riparian-wetland zone which has been destroyed by intensive beaver trapping in the 1830s, intensive grazing in the 1870s, and timber cutting. The principal use of the affected environment is grazing. It occupies a portion of Pasture 3 of the Cottonwood Allotment (#5213). Grazing management is on a rest rotation schedule with cattle grazing from May to late July of the first year, late July to the end of October of the second year, and no grazing the third year. Range condition is classified as fair and static throughout most of the affected environment. Much of the Weatherman Draw Rock Art Complex is in areas classified as wasteland because the topography limits grazing. A very small portion of the area has deteriorating range conditions. No timber management is currently practiced except for trespass firewood cutting.

Wild Horses

No wild horses are present within the affected environment.

Lands

The affected environment is within a retention zone under the Classification and Multiple Use Act of 1964 (C&MU). The area has since been classified as retention lands under the land tenure adjustment program. Acquisitions of adjacent private lands have been proposed for cultural resource management and riparian enhancement. Acquisition of some lands or exclusive road easements across private lands also are necessary to guarantee public access into the area. Implementation of the 1986 Weatherman Draw Locality Cultural Resource Management Plan led to mineral withdrawal MTM-60957 on March 7, 1988. This action involved 600 acres.

Wildlife

The only big game animal within the affected environment is mule deer. Upland game birds present include sage grouse, chukar and Hungarian partridge. The area receives moderate hunting pressure, and wildlife water developments are planned to enhance the game bird population. Fur-bearers present include bobcat. The area has excellent mountain lion habitat. Trapping and hunting of both known species occur. Raptors within the Weatherman Draw area include red-tailed hawks and prairie falcon. Great horned owls may nest in the area. A large rock dove population nesting along cliffs offers a potential for peregrine falcon habitat. This habitat potential is unrealized because of the low amount of standing water in the area. No threatened and endangered species are presently known to exist within the affected environment, but an inventory is in process. Large numbers of prairie rattlesnakes inhabit the affected environment; Weatherman Draw contains several dens from which annual migrations take place. There are no waterfowl habitats or fisheries within the Weatherman Draw area.

Cultural Resources

The knowledge of cultural resources within Weatherman Draw has been accumulating for two decades, including a 1986 cultural resource management plan and a 1987 inventory. Examination of 1,320 acres culminated in the recordation of 44 new sites, 23 of which are rock art sites. The Valley of the Shields with a shield-bearing warrior motif reveals use of surface preparation by abrasion followed by detailed painting. Test excavations revealed abrading stones buried near a hearth. Radiocarbon dating places the hearth at A.D. 1105, earlier than previously estimated. Archeological interest, as well as oil and gas potential, created the need for an inventory of Weatherman Draw in 1988. The 1,320 acre sample area includes Federal minerals overlain by either Federal surface or private surface. Twenty-two new cultural properties were recorded, 19 of which contain rock art. It also was determined that Weatherman Draw is closely associated with the drainage. An additional inventory in compliance with the National Historic Preservation Act revealed six more sites, one with rock art.

The present inventory base of the Weatherman Draw area is 2,800 acres. Seventy-two cultural properties have been recorded, 46 consisting of rock art sites. A satellite area of rock art sites exists on largely Federal minerals only lands near the mouth of Castle Coulee to the north, but 40 rock art sites, 14 open occupation sites, one rock shelter, and a vision quest site can be described within a spatially bounded area. Other areas have not been inventoried, but share environmental attributes similar to these. The two sets together are proposed for ACEC designation. Table 2 summarizes the condition, information potential, and artistic styles of the rock art sites within the ACEC. Table 3 summarizes condition, information potential, age, and site type of other sites also within the ACEC. Table 4 provides the same information for all known sites in the area outside ACEC boundaries.

TABLE 2. ROCK ART SITES WITHIN PROPOSED DESIGNATION AREA

Site Number	Condition	Subsurface Potential	Rock Art Styles Present
24CB198	VG	E	Incised and abraded bear
24CB408	E	E	Prepared and painted shield bearing warriors, incised line parfleches, incised line lodges, graffiti
24CB620	G	E	Pictograph hands, fine incised line petroglyphs, historic graffiti
24CB621	VG	E	Incised geometric, abraded zoomorphs, incised feather-forms, graffiti
24CB630	E	E	Tally marks - horse hoof print pictographs, pictograph bear, prepared and painted shield bearing warriors, V-necked anthropomorph, incised line lodges

TABLE 2. ROCK ART SITES WITHIN PROPOSED DESIGNATION AREA (continued)

Site Number	Condition	Subsurface Potential	Rock Art Styles Present
24CB631	E	E	En-toto pecked anthropomorphs
24CB633	G	E	V-necked anthropomorphs, incised line zoomorphs, incised feather-forms, historic graffiti
24CB1023	E	E	Zoomorph pictographs, anthropomorph pictographs, abstract fine incised line
24CB1089	G	P	Pecked dots, abstract fine incised line designs
24CB1091	VG	P	Abstract geometric pictographs, abstract prepared surface, incised bear claws, incised horse hoof, incised feather forms, abstract fine incised line
24CB1092	VG	P	Historic graffiti, abstract fine incised line
24CB1093	P	P	Abstract fine incised line
24CB1094	E	E	Prepared and painted shield bearing warriors, pecked geometric anthropomorphs, V-necked anthropomorphs, incised and abraded bear, horse pictograph, pictograph parfleches, lance pictographs, pipe pictograph, abstract pictographs, fine incised line feather-forms, abstract fine-incised line, square-shoulder anthropomorphic, incised shield-bearing warrior, historic graffiti.
24CB1101	VG	E	Geometric anthropomorph, geometric zoomorphs, geometric design
24CB1102	VG	E	Historic graffiti
24CB1103	E	P	En-toto pecked anthropomorph
24CB1104	VG	E	Fine incised line bird, abstract fine incised line, historic graffiti
24CB1105	E	P	Historic pistol petroglyph, historic graffiti
24CB1106	VG	P	Incised identity pictograph, fine incised line bird, incised parfleche, incised zoomorph, abstract fine incised line, incised historic sailing vessel, historic graffiti, graffiti
24CB1107	P	E	Historic graffiti
24CB1108	VG	E	Fine incised line anthropomorph

TABLE 2. ROCK ART SITES WITHIN PROPOSED DESIGNATION AREA (concluded)

Site Number	Condition	Subsurface Potential	Rock Art Styles Present
24CB1109	VG	P	Historic graffiti
24CB1110	E	E	Tool grooves
24CB1112	E	G	Incised bear claws, abstract fine incised line
24CB1116	VG	P	Historic graffiti
24CB1124	VG	P	Graffiti
24CB1129	VG	P	Historic Graffiti
24CB1130	G	P	Abraded anthropomorph, historic graffiti
24CB1133	VG	E	Pictograph anthropomorph, incised vulva-form, prepared shield-bearing warrior, abstract fine incised line
24CB1157	VG	E	En-toto pecked anthropomorphs, geometric anthropomorphs, V-necked anthropomorphs, simple incised anthropomorphs, geometric pecked lines, abstract fine incised line, tool grooves, historic graffiti, graffiti
24CB1158	VG	E	Simple incised anthropomorph, incised feather-forms, tool grooves, abstract fine incised lines
24CB1159	G	P	Historic graffiti
24CB1160	E	E	Geometric anthropomorph, vertical series
24CB1161	E	P	Historic graffiti
24CB1162	P	P	Incised horse
24CB1163	VG	P	Incised horses
24CB1164	G	P	Incised shield-bearing warrior, fine incised line anthropomorphs
24CB1165	VG	E	Incised shield-bearing warriors, fine incised line anthropomorphs
24CB1166	P	P	Abstract fine incised line
24CB1187	E	E	Fine incised line phalli, fine incised line zoomorphs, feather-forms, abstract fine incised line

TABLE 3. OTHER SITES WITHIN PROPOSED DESIGNATION AREA

Site Number	Condition	Subsurface Potential	Cultural Affiliation
24CB219	VG	E	Late Period open occupation
24CB408	VG	E	Unknown prehistoric open occupation
24CB630	VG	E	Unknown prehistoric open occupation
24CB1094	VG	E	Late Period open occupation
24CB1102	VG	E	Unknown prehistoric open occupation
24CB1103	E	E	Unknown prehistoric open occupation
24CB1111	E	E	Unknown prehistoric open occupation
24CB1113	P	P	Late Period open occupation
24CB1114	E	E	Unknown prehistoric open occupation
24CB1117	G	G	Unknown prehistoric open occupation
24CB1118	VG	E	Unknown prehistoric open occupation
24CB1120	VG	E	Middle Period, Late Period Open Occupation
24CB1122	VG	E	Unknown prehistoric open occupation
24CB1127	VG	E	Unknown prehistoric, historic open occupation
24CB15	VG	P	Vision quest structure
24CBNNII	VG	E	Rock shelter: contains ethnographic wooden and rock structures

TABLE 4. OTHER SITES OUTSIDE DESIGNATION AREA BOUNDARIES

Site Number	Condition	Subsurface Potential	Rock Art Styles Present or Cultural Affiliation
24CB209	G	E	Unknown prehistoric hearth
24CB210	P	P	Unknown prehistoric hearth
24CB213	G	E	Unknown prehistoric open occupation
24CB215	VG	G	Historic homestead
24CB216	VG	E	Unknown prehistoric open occupation, Rock Art: Feather-forms, fine incised line anthropomorph, incised shield-bearing warrior, abstract fine incised line
24CB217	P	P	Unknown hearth
24CB218	P	P	Historic homestead, unknown prehistoric open occupation
24CB466	E	E	Rock shelter with ethnographic wooden structure
24CB1090	E	E	Rock Art: En-toto pecked anthropomorphs, incised and abraded bears, fine incised line zoomorphs, abstract fine incised line, abstract pictograph, historic graffiti
24CB111	G	G	Besant open occupation
24CB1118	P	P	Unknown prehistoric open occupation
24CB1121	VG	P	Historic sheepherder monument
24CB1123	F	F	Late Period open occupation
24CB1125	E	P	Rock Art: Historic graffiti
24CB1126	E	E	Rock shelter
24CB1128	E	P	Rock Art: Historic graffiti
24CB1156	P	VG	Rock Art: Incised shield-bearing warrior
24CB1168	G	P	Rock Art: Incised line horse, Vertical series, abstract fine incised line, historic graffiti
24CB1169	G	P	Rock Art: Historic graffiti
24CB1170	VG	G	Rock Art: Identity petroglyph, fine incised line zoomorphs, vertical series, historic graffiti
24CB1171	VG	E	Rock Art: Incised line horse, vertical series, historic graffiti
24CB1172	G	E	Rock Art abraded and incised line anthropomorph

Paleontology

No vertebrate paleontological remains have been identified within the affected environment. The Eagle Formation produces marine Cretaceous fauna generally only in the middle shale member. The most common species found in this fauna is crocodile (*Crocadilus* sp.). Plant fossils are found associated with the coal bed and worm tube casts are present in the Upper Eagle Sandstone member.

Recreation

Traditional recreation use has been hunting. During recent years, viewing rock art sites has developed as a significant form of recreation. Uncontrolled use has damaged two rock art sites within the Weatherman Draw Rock Art Complex, one seriously. No significant disturbance has occurred since implementation of the Weatherman Draw Locality CRMP, however. ORV use has been minor because of the rugged topography, and increased use would cause erosion of the fragile soils, leading to the potential damage of cultural resources. The area is accessible through a number of rough vehicle trails, but ongoing erosion of the traditional access route will close it if not repaired. The affected environment has not been evaluated within visual resource management classes in the Billings RMP. The affected environment does, as a whole, meet criteria set for Class III (good) rating. One canyon and butte meet Class II (excellent) rating. No wilderness values were found on the affected environment, probably because of the area's small size and the number of roads and trails.

Other

The air space has been used as a low level training flight course by the U.S. Air Force. At the present time the course is used by B-52 and B-1B bombers. The sonic effect of B-52 overflights is minor. However, the overflights from the B-1B type aircraft result in actual ground vibration. The U.S. Air Force has now agreed to move the training flight course to a non-impacting area.

ENVIRONMENTAL CONSEQUENCES

Introduction

This section explains the environmental consequences of the two alternatives discussed in Section II. Environmental aspects are analyzed to determine the impact of each alternative.

General Impacts

The impacts described in this section generally apply to both alternatives and are discussed separately.

Climate - Not affected.

Air Quality - Not affected.

Geology and Topography - No effects to topography, coal, or industrial minerals will occur as a result of oil and gas activities. No Surface Occupancy stipulations will be applied to all 2,250 acres of the ACEC for oil and gas activities. Currently, 600 acres are withdrawn from other mineral entry. The remaining 1,650 acres may also be withdrawn from other mineral entry. No impacts would occur to other resources as a result of mineral withdrawal. Any minerals withdrawn would not be mined.

Soils/watershed - Soils classifications, wild and scenic rivers and riparian-wetlands will not be affected.

Vegetation - No significant impacts to native vegetation or grazing systems will occur under either alternative. The loss of range vegetation through limited enclosure fencing to prevent damage to rock art panels from cattle rubbing is insignificant and common to both alternatives.

Wild horses - Not affected.

Wildlife - Not affected.

Recreation - Wilderness values will not be affected. Minor ORV restrictions will occur.

Cultural Resources - Continued inventory of high probability areas for the presence of additional rock art sites will continue. Fencing of endangered sites will be accomplished.

Paleontology - Not affected.

Other - Not affected.

Continuation of Existing Management Alternative

Management of rock art sites within the Weatherman Draw Rock Art Complex will continue under the Weatherman Draw Locality CRMP.

> "This CRMP is intended to meet three goals: the first is to maintain the existing state of preservation of most of the known pictograph panels; the second is to manage certain petroglyph and pictograph panels such

that scientific research may continue to be conducted on the archaeology of the rock art, and on methodological experiments intended to maintain or enhance the preservation of the rock art panels themselves. The third goal is to create a means for continued survey of the Cottonwood Creek drainage. Continued survey is intended to demonstrate the presence or absence of additional rock art and other cultural resource values, to evaluate those values both individually and collectively, and to provide baseline data for determining whether: a) the level of management proposed in this plan is appropriate, or b) whether other resource management alternatives would better serve to meet the Bureau's cultural resource management mandates set out in Section 110 of the National Historic Preservation Act, and the Federal Land Policy and Management Act."

Implementation of planned activities will lead to the mineral withdrawal of 1,650 additional acres. After continued monitoring demonstrates degradation from visitor use, partial or complete closure will be implemented and enforced. Continued monitoring will be conducted by the Billings Resource Area archeologist or volunteers. If necessary, an environmental analysis will be prepared to identify and evaluate alternative measures.

Geology and Topography

The entire area of the Weatherman Rock Art Complex will be given NSO designation for oil and gas leasing. This may lead to increased drilling costs but will not lead to the loss of royalty revenue and removal of a strategic resource.

Soils/Watershed

ORV closure will be implemented only through identification of vandalized cultural resources. The decisionmaking process for ORV closure may take additional time while cultural resources and sensitive soils continue to degrade. No provision for ORV closure is present within the Weatherman Draw CRMP to protect the natural setting within which these sites rest. Enhanced opportunities for the acquisition of portions of the Cottonwood Creek flood plain and drainage floor for riparian management will be forgone.

Lands

Termination of C&MU classification by issuing of the Opening Order will be offset by withdrawal from mineral leasing. No additional highlighting of the area will occur to place a higher priority for acquisition of private lands along Cottonwood Creek for the purpose of access and riparian management.

Recreation

Developing trends of rock art viewing will be directed to sites with generally little impact which are not commonly known to the public. One that is readily accessible has poor visual qualities. The others are accessible only through a steep and dangerous four wheel drive track. De-emphasis and potential closure will be implemented for the two well-known and more accessible sites. This decision is incompatible with the Recreation 2000 program.

ORV use of the Weatherman Draw area may suddenly increase, especially with its ruggedness being interpreted as a challenge to some riders. Such use would quickly lead to damage of the sensitive soils and would increase erosion. Some cultural sites may be damaged by ORV users. Cumulative impacts could easily develop before ORV designation decisions are made and implemented.

Total closure is specified as a management alternative in the Weatherman Draw Locality CRMP. Such a closure would be incompatible with multiple use, although extremely effective in limiting damage to cultural resources. However, such a closure would be extremely hard to enforce and individuals violating the closure would be predisposed to damaging sites. Continuing erosion of the access route to the well-known sites may effectively create a road closure.

Case-by-case visual resource management prescriptions will continue to be made without reference to a central plan. This may create visual impacts to the cultural landscape around specific rock art sites and thus to the Weatherman Draw Rock Art Complex as a whole.

Cultural Resources

Implementation of major further inventory stages of the Weatherman Draw Locality CRMP has made major portions of the plan irrelevant. Although protection and further test excavation of the six rock art sites originally identified is fully justified and necessary, it is now known that the sites are not only not unique, but are also not the best and most pristine representatives of their style. This holds true both for the visual aspects of the art and the information potential of their associated subsurface deposits.

The existing CRMP identified six sites within 600 acres of a locality. Its implementation realized 40 sites within 2,250 acres of a full blown complex. Additional rock art sites are certain to exist within high probability areas recognized through predictive modeling after Class II inventory. Con-

tinuation of the existing management alternative is not justified because it does not fulfill the public outreach opportunities of ARPA and Recreation 2000 or the specific management direction needs specified by FLPMA for areas meeting ACEC relevance and importance criteria.

Proposed Alternative (Action)

Under the proposed alternative, the management of rock art sites within the Weatherman Draw Rock Art complex will take into account the extremely unique nature of the complex as a whole, and focus less on the management of individual cultural properties.

The in-place preservation of rock art panels will continue, as well as emphasis on petroglyphs and combination petroglyph/pictograph panels in addition to pictograph panels. Studies on individual sites will continue, but with an understanding of their placement within a behavior complex which extended over a thousand year period. With some exceptions, the individual sites and panel areas will be managed for conservation use. Sites will be preserved in place and scientific use will be directed to similar sites elsewhere which are not a part of the complex. The Weatherman Draw Rock Art Complex will be conserved as a bank of future information to be used only when unique information is required within a strong research framework. Continued inventory will be required as a low priority and as an adjunct to use-monitoring, primarily directed toward the verification of the predictive model generated through the Class II inventory.

Implementation of planned activities will lead to an NSO stipulation for 2,250 acres in oil and gas leasing. Six hundred acres of the proposed ACEC have been withdrawn from other mineral entry. The BLM would pursue an additional withdrawal from mineral entry on the remaining 1,650 acres of the proposed ACEC. ORV closure will be made and monitored, along with the condition of component sites, especially those interpreted to the general public. A BLM ranger will be part of the monitoring team. No further environmental analyses will be required after ACEC designation of the Weatherman Draw Rock Art Complex for the lifetime of the Billings RMP.

Geology and Topography

A total of 2,250 acres will be given a No Surface Occupancy stipulation. This will protect surface features yet permit oil and gas development through slant or other acceptable drilling techniques. Visual measures mitigating Class I and II designation will not impact either the cultural resource historic landscape or drilling operations significantly.

Soils/Watershed

ORV closure at this time will prevent additional soils damage. ORV monitoring and enforcement will be implemented as part of a regular monitoring/surveillance effort throughout the Weatherman Draw Rock Art Complex ACEC.

Access needs for the Weatherman Draw Rock Art Complex ACEC will place a higher priority on land or easement acquisition along Cottonwood Creek. If land is acquired, active riparian-wetlands management can occur. Such management was an objective of the Cottonwood Allotment Management Plan which has never been met.

Lands

Termination of C&MU classification by publishing an opening order in the Federal Register will be offset by NSO stipulations. A waiver to such stipulations may be made if a proposed action is determined to be non-impacting in terms of its physical or visual effect.

The access needs for monitoring, and visitor use of the Weatherman Draw Rock Art Complex ACEC highlight the needs for land acquisition and exclusive road easements at several locations.

Recreation

Public interpretation will take place at three rock art sites pending acquisition of fee lands for access and the development of a parking area. The three sites recommended for public use are 24CB408, 24CB630, and 24CB1023. Also prior to public use, it is necessary to complete photographic documentation and limited excavation and to analyze associated subsurface remains. Minimal fencing will be required around specific panels; however, if adverse trends develop, more complete chain link fences will be necessary.

Pedestrian access to the three sites along a signed trail and a foot bridge across Cottonwood Creek will be necessary. Brochures will provide onsite interpretation.

ORV closure will occur throughout the ACEC. This will constrain erosional impacts to existing roads and trails and contain visitor use, thus limiting public exposure to cultural properties allocated for scientific use. It will be necessary to decide whether or not to close the lower Weatherman Draw trail when erosion makes it impossible to travel by conventional vehicles.

Establishment of all of the ACEC except one locality as VRM Class II enables the stipulation of mitigative measures to avoid visual impacts within the area. One land parcel meets VRM Class I standards of outstanding visual characteristics.

Cultural Resources

Designation of the Weatherman Draw Rock Art Complex CRMP represents the culmination of the objectives. Inventory has determined that additional cultural resource properties are present and has collectively evaluated these properties. It is determined that the CRMP was inappropriate for the greater complex and that ACEC designation is the most practical resource management alternative under FLPMA.

The outstanding relevance and importance of the Weatherman Draw Rock Art Complex relates to the complexity of the rock art present, its intense distribution through the designated area, and the high degree of preservation seen at most panels. A full stylistic range from the En-toto Pecked style of A.D. 850 into the early historic period occurs, and permits the comparative study through time as evidenced by superimpositioning and relative weathering. At several sites these studies can be done on single panels, while at others the art represents a single behavioral event.

The high degree of preservation relates not only to the visual characteristics of the rock art, but also to the integrity of associated subsurface remains. A limited two-meter test excavation at the Polychrome Warriors panel of the Valley of the Shields site, 24CB1094, definitively dated the shield-bearing warrior art style to A.D. 1105. This represents the first absolute date on this style of art. The excavations also recovered and dated horse dung to A.D. 1650, establishing the presence of the horse in Montana fully 80 years earlier than previously thought and having great implications to ethnographic studies. This degree of data potential holds for many of the sites within the complex.

The Weatherman Draw Rock Art Complex represents an outstanding laboratory for understanding most of the known rock art styles of the Northwestern Plains region. Due to this high degree of significance, conservation for future use is the best and highest use allocation for most of the sites. Limited current scientific use of component sites at some panels is required to establish baseline information. No further work at the sites other than integrity maintenance would occur unless absolutely necessary. Studies instead would be directed to other similar sites not within the complex. This use allocation is designed to preserve the sites for future work.

APPENDIX F
BIOLOGICAL ASSESSMENT
Miles City District
Oil and Gas RMP/EIS Amendment

INTRODUCTION

The objective of this biological assessment is to determine the effects, if any, on threatened, endangered or sensitive wildlife species as a result of any of the activities associated with the exploration for or development of oil and gas resources in the Miles City District of the Bureau of Land Management.

The assessment is based on existing information identified in the Environmental Assessment for the proposed action, current research findings for the species involved, applicable information in district wildlife files and maps, and thorough consultation with Montana Department of Fish, Wildlife and Parks personnel, South Dakota Department of Game, Fish and Parks personnel, and biologists associated with the U.S. Fish and Wildlife Service.

This assessment is in response to the requirements of Section 7(c) of the Endangered Species Act (ESA) as amended.

The assessment is a summary of the Draft RMP/EIS Amendment, and detailed descriptions of alternatives and other factors put forth in the document will not be extensively duplicated here.

The wildlife values affected are described in Chapter 3, pages 39 to 44, of the Draft RMP/EIS Amendment and anticipated effects are given on pages 69 to 71 in Chapter 4.

The area affected by this document includes all of the Miles City District with the exception of the Big Dry Resource Area. The specific acreages involved can be found on page 3 of Chapter 1.

Four alternatives have been developed to analyze impacts and to address issues related to the leasing and production of oil and gas in the planning area.

The Preferred Alternative (Alternative D) allocates lands for leasing or no leasing in the following categories:

- Open to leasing, subject to Lease Terms only (2,840,000 acres)

- Open to leasing, subject to Seasonal or other minor constraints (2,162,000 acres)

- Open to leasing, subject to No Surface Occupancy and Similar Major Constraints (108,000 acres)

- Closed to Leasing (60,000 acres)

Note: Stipulations designed to protect different resources overlap in some locations, so the total acres of the categories above may exceed the actual total acres of Federal lands administered by the BLM in the planning area.

The amendment will provide a master plan for leasing lands for oil and gas within the planning area for approximately 15 years. Using lease stipulations, it identified resource values that will be protected or the impacts that will be mitigated during the conduct of oil and gas activities. Lands subject to lease stipulations, lands closed to oil and gas leasing, and lands protected only by regulations and the terms of the lease are identified. (See Section 6 of Lease Terms on Form 3100-11 in Appendix B.)

Most land use decisions for resources other than oil and gas will remain unchanged in the RMP/EIS being amended. Current leasing procedures for oil and gas will include the identification of stipulations before the lease sale. This procedure is being revised to conform to new policy. The cumulative impacts for oil and gas development are based on the Reasonably Foreseeable Development (RFD). This is a projection of future oil and gas activity anticipated in the planning area within the next 15 years.

The decisions which result from this amendment will supersede all previous planning decisions for oil and gas in the three RMP/EIS documents. It will establish the purpose and areas of stipulations and the actions being restricted. All lease stipulations will be identified and published in the lease sale notice to inform prospective lessees of the requirements to be met when developing a specific Federal oil and gas lease.

This document also fulfills a need to establish 2 Areas of Critical Environmental Concern (ACEC). These are the proposed Meeteetse Spires ACEC and the proposed Weatherman Draw ACEC. These areas would be approved and designated as ACECs under Alternatives B, C, and D.

AFFECTED SPECIES

As identified in a letter from the U.S. Fish and Wildlife Service (FWS), dated May 14, 1991, the following list of Threatened and Endangered (T&E) species may be present in the planning area.

Listed Species - Montana	**Expected Occurrence**	**Status**
Bald Eagle (*Haliaeetus leucocephalus*)	Migrant, winter resident, nesting	Endangered
Whooping crane (*Grus americana*)	Migrant	Endangered
Peregrine falcon (*Falco peregrinus*)	Migrant, nesting	Endangered
Piping plover (*Charadrius melodus*)	Migrant, nesting	Threatened
Least Tern (*Sterna antillarum*)	Migrant, nesting	Endangered
Black-footed ferret (*Mustela nigripes*)	Potential residents in prairie dog (*Cynomys spp.*) towns	Endangered
Pallid sturgeon (*Scaphirynchus albus*)	Missouri and Yellowstone Rivers	Endangered
Listed Species - South Dakota	**Expected Occurrence**	**Status**
Bald Eagle (*Haliaeetus leucocephalus*)	Migrant, winter resident	Endangered
Whooping crane (*Grus americana*)	Migrant	Endangered
Peregrine falcon (*Falco peregrinus*)	Migrant	Endangered
Piping plover (*Charadrius melodus*)	Migrant, summer breeding	Threatened
Least Tern (*Sterna antillarum*)	Migrant, summer breeding	Endangered
Black-footed ferret (*Mustela nigripes*)	Potential residents in prairie dog (*Cynomys spp.*) towns	Endangered
Eskimo curlew (*Numenius borealis*)	Rare migrant	Endangered
Pallid sturgeon (*Scaphirynchus albus*)	Missouri River	Endangered

A description of the occurrence of these species can be found on pages 42-44 in the Draft RMP/EIS Amendment. The following is a summary of that information.

Bald Eagle

Bald eagles migrate through the area and winter along the Yellowstone, Clarks Fork, Tongue, Little Missouri, Belle Fourche, Cheyenne, Missouri, and Bad Rivers, Redwater Reservoir, and Bear Butte Creek where nesting habitat exists. Bald eagles nesting along the rivers in the planning area have increased in number over the past 10 years.

Peregrine Falcon

Historic peregrine falcon nest sites occur on public land but no active nesting sites have been located to date. Recent sightings have identified the peregrine falcon only as a migrant. The abundance of rocky cliffs and outcrops provide roosting and nesting habitat. Large expanses of open grassland and shrub-grassland vegetation types offer excellent potential habitat for prey species. The BLM is continuing to monitor and evaluate potential reintroduction sites to support the peregrine falcon recovery plan.

Piping Plover

Piping plovers are migratory shorebirds that spend approximately 3 to 4 months on breeding sites in the northern United State and southern Canada (Haig and Oring, 1985). They are Federally listed as threatened in Montana and South Dakota. Breeding pairs are known to occur on islands along the lower Missouri River and in riparian-wetlands. They commonly nest in close proximity to colonies of least terns. There is habitat for plovers along the Yellowstone River, but no colonies have been identified on public land in the planning area.

Interior Least Tern

The interior least tern is a Federally listed endangered species. They are migratory and travel in small, loose flocks. They nest on beaches along river banks and reservoirs. Currently colonies are known to nest on sandbars and islands along the lower Yellowstone River.

Whooping Cranes

Whooping cranes migrate through South Dakota and eastern Montana and occasionally are seen on stock reservoirs.

Eskimo Curlew

Potential habitat for the Eskimo curlew exists throughout the prairie in South Dakota.

Black-Footed Ferret

Black-footed ferrets have not been observed since periodic searches have begun in recent years. Ferrets are essentially obligate species in that their existence is closely tied to the occurrence of prairie dog colonies. Prairie dogs play an important role in the grassland ecosystem by creating islands of unique habitat. They provide a source of food for numerous predators and their burrows provide homes for a variety of species including burrowing owls and black-footed ferrets. The prairie dog colonies that occur in the area could provide habitat for ferrets. The BLM is participating in the USFWS's Black-footed Ferret Recovery Program. Several potential reintroduction sites have been identified for the black-footed ferret in the Powder River Resource Area.

Pallid Sturgeon

The pallid sturgeon is a large fish known to occur only in the Missouri River, the Mississippi River downstream of the Missouri River, and the Yellowstone River. The species is threatened through habitat modification, apparent lack of natural reproduction, commercial harvest, and hybridization in parts of its range.

MITIGATING MEASURES

The primary objective of the Wildlife Habitat Management Program in the BLM is to maintain and enhance suitable habitat for all species of wildlife.

The emphasis for habitat maintenance and development will be on present and potential habitat for sensitive, threatened and/or endangered species, nesting waterfowl, crucial winter ranges, non-game habitat and fisheries.

BLM will consult with the FWS when any action may affect a threatened or endangered species or its habitat.

No action will be initiated on BLM land which will jeopardize any candidate or federally listed threatened and endangered (T&E) plant or animal. Impacts to state designated species of special interest will be evaluated and applicable mitigation developed prior to the initiation of any action on BLM land.

BLM will cooperate with the FWS to recover threatened and endangered species, including reintroduction efforts.

Currently there are no known peregrine falcon, piping plover nesting sites or black-footed ferrets on BLM land in this planning area. However, if a nesting site were discovered or a reintroduction proposed, BLM will adhere to the species specific approved recovery plan and guidance.

A discussion of the stipulations proposed under the preferred alternative to protect T&E species habitat values in the planning area can be found in Appendix B, pages 120 to 124 of the Draft RMP/EIS Amendment.

Black-Footed Ferret

It should be noted that the stipulation presented here for potential reintroduction areas is the stipulation that will be presented in the printing of the final document and is different from the stipulation that occurs in the Draft RMP/EIS Amendment.

CONTROLLED SURFACE USE

Resource: Prairie dog towns within potential black-footed ferret reintroduction areas that have been determined to be essential for black-footed ferret recovery.

Stipulation: The "Draft Guidelines for Oil and Gas Activities in Prairie Dog Ecosystems Managed for Black-Footed Ferret Recovery," FWS, 1990, will be used as appropriate to develop site-specific conditions of approval to protect black-footed ferret reintroduction and recovery. Specific conditions of approval will depend on type and duration of proposed activity, proximity to occupied ferret habitat, and other site-specific conditions.

Objective: To maintain the integrity of designated black-footed ferret reintroduction area habitat for reintroduction and recovery of black-footed ferrets.

Exception: May be granted by the authorized officer for activities that are determined, through coordination with the MBFFCC, to have no adverse impacts on reintroduction and recovery of ferrets.

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in coordination with the MBFFCC, determines that portions of the area are no longer essential for ferret reintroduction and recovery.

Waiver: The stipulation may be waived if the authorized officer, in coordination with the MBFFCC, determines that the entire leasehold no longer contains habitat essential for the reintroduction and recovery of the ferret, or if the ferret is removed from protection under the Endangered Species Act.

A Controlled Surface Use (CSU) Stipulation on a lease that invokes the application of the draft guidelines allows the leaseholder to recognize the potential impacts to his proposed operations and the conservation community to know what to expect from our management. These guidelines require various constraints from very minor ones, such as speed limits on vehicles, to more serious ones, such as avoidance of specific areas or rerouting pipelines to prevent disruption of a colony. They allow BLM officers to apply consistent controls for different leaseholds.

CONTROLLED SURFACE USE

Resource: Potential black-footed ferret habitat (prairie-dog colonies and complexes 80 acres or more in size that are not designated as black-footed ferret reintroduction sites).

Stipulation: Prior to surface disturbance, prairie dog colonies and complexes 80 acres or more in size will be examined to determine the absence or presence of black-footed ferrets. The findings of this examination may result in some restrictions to the operator's plans or may even preclude use and occupancy that would be in violation of the Endangered Species Act (ESA) of 1973.

The lessee or operator may, at their own option, conduct an examination on the leased lands to determine if black-footed ferrets are present, or if the proposed activity will have an adverse effect, or if the area can be cleared. This examination must be done by or under the supervision of a qualified resource specialist approved by the Surface Management Agency (SMA). An acceptable report must be provided to the SMA documenting the presence or absence of black-footed ferret and its habitat. This stipulation does not apply to the operation and maintenance of production facilities.

Objective: To assure compliance with the Endangered Species Act (ESA) by locating and protecting black-footed ferrets and their habitat.

Exception: An exception may be granted by the authorized officer for surface-disturbing activities determined to have no adverse effect on black-footed ferrets and ferret habitat.

Modification: The boundaries of the stipulated area may be modified by the authorized officer if portions of the leasehold are cleared based on current and/or past ferret surveys.

Waiver: This stipulation may be waived if the entire leasehold is block cleared, or permanently cleared based on current and/or past ferret surveys, or if the ferret is declared recovered and no longer subject to the ESA.

Bald Eagle

NO SURFACE OCCUPANCY

Resource: Wildlife - Bald Eagle Nest Sites and Nesting Habitat.

Stipulation: Surface Occupancy and use is prohibited with 1/2 mile of known bald eagle nest sites which have been active within the past 7 years and within bald eagle habitat in riparian areas.

Objective: To protect bald eagle nesting sites and/or nesting habitat in accordance with the Endangered Species Act (ESA) and the Montana Bald Eagle Management Plan.

Exception: An exception may be granted by the authorized officer if the operator submits a plan which demonstrated that the proposed action will not affect the bald eagle or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area can be occupied without adversely affecting bald eagle nest sites or nesting habitat.

Waiver: This stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold can be occupied without adversely affecting bald eagle nest sites or nesting habitat, or if the bald eagle is declared recovered and is no longer protected under the ESA.

Peregrine Falcon

NO SURFACE OCCUPANCY

Resource: Wildlife - Peregrine Falcon.

Stipulation: Surface occupancy and use is prohibited within 1 mile of identified peregrine falcon nesting sites.

Objective: To protect the habitat of the peregrine falcon, and endangered species under the Endangered Species Act (ESA).

Exception: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the peregrine falcon

or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area no longer are critical to the peregrine falcon.

Waiver: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the peregrine falcon, or if the peregrine falcon is declared recovered and is no longer protected under the ESA.

Piping Plover

NO SURFACE OCCUPANCY

Resource: Wildlife - Piping Plover.

Stipulation: Surface occupancy and use is prohibited within 1/4 mile of wetlands identified as piping plover habitat.

Objective: To protect the habitat of the piping plover, a threatened species under the Endangered Species Act (ESA).

Exception: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the piping plover or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area are no longer critical to the piping plover.

Waiver: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the piping plover, or if the piping plover is declared recovered and is no longer protected under the ESA.

Interior Least Tern

NO SURFACE OCCUPANCY

Resource: Wildlife - Interior Least Tern.

Stipulation: Surface occupancy and use is prohibited within 1/4 mile of wetlands identified as interior least tern habitat.

Objective: To protect the habitat of the interior least tern, an endangered species under the Endangered Species Act (ESA).

Exception: An exception may be granted by the authorized officer if the operator submits a plan which demonstrates that the proposed action will not affect the interior lest tern or its habitat. If the authorized officer determines that the action may or will have an adverse effect, the operator may submit a plan demonstrating that the impacts can be adequately mitigated. This plan must be approved by BLM in consultation with the U.S. Fish and Wildlife Service (USFWS).

Modification: The boundaries of the stipulated area may be modified if the authorized officer, in consultation with USFWS, determines that portions of the area are no longer critical to the interior least tern.

Waiver: The stipulation may be waived if the authorized officer, in consultation with USFWS, determines that the entire leasehold no longer contains habitat critical to the interior least tern, or if the interior least tern is declared recovered and is no longer protected under the ESA.

Whooping Crane, Eskimo Curlew, Pallid Sturgeon

All three of the above named species are covered by standard lease terms as identified on page 127 of Appendix B in the Draft RMP/EIS Amendment. Section 6 of the least terms states specifically:

"Prior to disturbing the surface of the leased lands, lessee shall contact lessor to be appraised of procedures to be followed and modifications or reclamation measures that may be necessary. Areas to be disturbed may require inventories or special studies to determine the extent of impacts to other resources. Lessee may be required to complete minor inventories or short-term special studies under guidelines provided by lessor. If in the conduct of operations, threatened or endangered species, objects of historic or scientific interest, or substantial unanticipated environmental effects are observed, lessee shall immediately contact lessor. Lessee shall cease any operations that would result in the destruction of such species or objects."

DETERMINATION OF EFFECT

It is our opinion that we could possibly have a "may effect (beneficial)" as it regards black-footed ferret habitat. With regard to all of the other listed species in the planning area, we feel that the proposed action will have "no effect" on them or their habitats.

CONSULTATION WITH OTHERS

Dennis Flath, Wildlife Biologist, Montana Department of Fish, Wildlife and Parks, Personal Communication.

Eileen Dowd, Wildlife Biologist, South Dakota Department of Game, Fish and Parks, Personal Communication.

LITERATURE CITED

Clark, T., Grensten, J., Gorges, M., Crete, R. and Gill, J., 1986, Analysis of black-footed translocation sites in Montana: Prairie Naturalist 19(1):43-56. 1987.

Flath, D.L., 1991, Species of special interest or concern (draft report): Montana Department of Fish, Wildlife and Parks, 7 p.

Haig, S.M., and Oring, L.W., 1985, Distribution and status of the piping plover (*Charadius melodus*) throughout the annual cycle: Journal of Field Ornithology, 56(4):334-345.

Houtooper, W.C., Ode, D.J., Pearson, J.A., and Vandel III, G.M., 1985, Rare animals and plants of South Dakota: Prairie Naturalist, 17(3):143-165.

Ode, D.J., 1991, State or Federally threatened, endangered or candidate species listed for South Dakota (database): South Dakota Department of Game, Fish and Parks, Pierre, South Dakota.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE ENHANCEMENT
FEDERAL BUILDING, US COURTHOUSE
301 S PARK
P O BOX 10023
HELENA MT 59626

IN REPLY REFER TO

FWE-61130-Billings
M.02-BLM (EIS/RMP Amendment
(Miles City Dist.)

August 5, 1992

MEMORANDUM

TO: District Manager, Bureau of Land Management, Miles City District, Miles City, Montana

FROM: Montana State Supervisor, Fish and Wildlife Enhancement, USFWS, Helena, Montana

SUBJECT: Biological Assessment for Oil and Gas Final Environmental Impact Statement/Resource Management Plan Amendment

Based on information in the biological assessment for the Final Oil and Gas Management, Billing - Powder River - South Dakota Resource Management Plan/Environmental Impact Statement, the U.S. Fish and Wildlife Service (Service) concurs in the "no effect" determination for bald eagle, whooping crane, peregrine falcon, piping plover, least tern, black-footed ferret, Eskimo curlew and pallid sturgeon in South Dakota. The Service also concurs in the "no effect" determination for bald eagle, whooping crane, peregrine falcon, piping plover, least tern and pallid sturgeon and with "may affect (beneficial)" determination for the black-footed ferret in Montana. The Service has determined, pursuant to S402.13(a) of 50 CFR, that formal consultation for the black-footed ferret in Montana is not warranted.

DMC\jf

cc: State Supervisor, FWE, Pierre, SD
Billings Suboffice, USFWS, FWE, Billings, MT

GLOSSARY

ACCELERATED EROSION. Erosion processes increased by the activities of man. See Natural geologic erosion.

ACQUIRED LANDS. Those lands that have been reconveyed to the United States under authorities which do not expressly provide that the lands become subject to the public land laws (land, mineral and leasing) upon acquisition, such as the Bankhead-Jones Farm Tenant Act, the National Industrial Recovery Act, and others.

ACTIVITY. A specific deed, action, function, or sphere of action.

ACTIVITY PLANNING. Site-specific planning which precedes actual development. This is the most detailed level of BLM planning.

ALIQUOT PARTS. Legal subdivisions, except fractional lots, or further subdivision of any smaller legal subdivision, except fractional lots, by division into halves or fourths ad infinitum.

ALKALINITY. The quantity and kinds of compounds present in water that collectively shift the pH to the alkaline side of neutrality. See Salinity.

ALLOTMENT MANAGEMENT PLAN (AMP). A written program of livestock grazing management, including range development if required; designed to attain specific management goals in a grazing allotment.

ALLUVIUM. General term for debris deposited by streams on river beds, floodplains, and alluvial fans, especially a deposit of silt or silty clay laid down during a flood. Applies to stream deposits of recent time. Does not include subaqueous sediments of seas and lakes.

ANIMAL UNIT MONTH (AUM). A standardized measurement of the amount of forage necessary for the complete sustenance of one animal for one month; also, the measurement of the privilege of grazing one animal for one month.

AQUIFER. A body of rock that is sufficiently permeable to conduct ground water and to yield economically significant quantities of water to wells and springs.

AREA OF CRITICAL ENVIRONMENTAL CONCERN (ACEC). An area which needs special management attention to preserve historic, cultural, and scenic values; to protect fish and wildlife resources or other natural systems or processes; and to protect life and provide safety from natural hazards.

ATTAINMENT (AIR QUALITY). A geographic area in which the quality of the air is better than federal air pollution standards.

BASIN. A closed geologic structure in which the beds dip toward the center; the youngest rocks are at the center of a basin and are partly or completely ringed by progressively older rocks.

BITUMINOUS. The most abundant rank of coal (synonymous with soft coal). It is dark brown to black and burns with a smoky flame.

BLOOEY PIT. The pit that receives cuttings and other discharges from a well drilled with air.

BLOWOUT. An uncontrolled expulsion of gas, oil, or other fluids from a well.

BREAKS. Tract of rough or broken land dissected by ravines and gullies. Any sudden change in topography.

BROWSE. As a verb, to consume or to feed on (as a plant); as a noun, the tender shoots, twigs, and leaves of trees and shrubs, often used as food by cattle, deer, elk, and other animals.

CANOPY COVER. The percentage of ground area under an overstory vegetation that would not be impacted by raindrops falling straight down.

CHANNEL. An open conduit either naturally or artificially created which periodically or continuously contains moving water or forms a connecting link between two bodies of water.

CHANNEL STABILITY. A relative term describing erosion or movement of the channel walls or bottom due to waterflow.

CHARACTERISTIC LANDSCAPE. The established landscape in an area, not necessarily a natural area. It could refer to a farming community, urban area, or any other landscape which has an identifiable character.

CHERRY-STEMMED ROAD. A road that enters but does not pass completely through a wilderness study area.

CLAYEY. A soil containing more than 35 percent clay. The textural classes are sandy clay, silty clay, clay, clay loam, and silty clay loam.

CLAYPAN. A dense, compact layer in the subsoil having a much higher clay content than the overlying material from which it is separated by a sharply defined boundary.

CLIMAX. The highest ecological development of a plant community capable of perpetuation under the prevailing climatic and soil conditions.

CLINKER. Any rock which has been baked during the combustion of underlying coal beds.

COALIFICATION. The process in which vegetable matter becomes converted into coal of increasingly higher rank with anthracite as the final product.

COMPACTION. The process of packing firmly and closely together; the state of being so packed; for example, mechanical compaction of soil by livestock or vehicular activity. Soil compaction results from particles being pressed together so that the volume of the soil is reduced. It is influenced by the physical properties of the soil, moisture content, and the type and amount of compactive effort.

CONDITION OF APPROVAL (COA). Conditions or provisions (requirements) under which an Application for a Permit to Drill or a Sundry Notice is approved.

CONTROLLED SURFACE USE (CSU). Use or occupancy is allowed (unless restricted by another stipulation), but identified resource values require special operational constraints that may modify the lease rights. CSU is used for operating guidance, not as a substitute for the NSO or Timing stipulations.

CORRIDOR. A strip of land through which one or more existing or potential facilities may be located.

COW-CALF OPERATION. A livestock operation in which a basic breeding herd of cows, heifers, and bulls is maintained. The operation keeps some heifer calves from each crop for breeding herd replacements and sells the rest of the calf crop between the ages of 6-12 months along with old or nonproductive cows and bulls.

CRITICAL WILDLIFE HABITAT. The area of land, water, and airspace required for the normal needs and survival of an endangered species.

CRUCIAL WILDLIFE HABITAT. Parts of the habitat necessary to sustain a wildlife population at critical periods of its life cycle. This is often a limiting factor on the population, such as breeding habitat and winter habitat.

CUESTA. A long gentle slope terminated on one side by a steep or clifflike face.

CULTURAL RESOURCES. A term that includes items of historical, archeological, or architectural significance which are fragile, limited, and nonrenewable portions of the human environment.

CULTURAL PROPERTIES. Any location that includes prehistoric and/or historic evidence of human use.

DECIBEL OR dB. A unit for measuring sound intensity. Usually measured on the decibel A weighted scale (dBA) which approximates the sounds heard by the human ear at moderate sound levels.

DESIGNATED RIGHT-OF-WAY CORRIDOR. A parcel of land identified by law, by Secretarial Order, through the land use planning process, or by other management decision as being a preferred location for existing and future right-of-way grants and suitable to accommodate more than one type of right-of-way or one or more rights-of-way that are similar, identical, or compatible.

DIRECTIONAL DRILLING. The intentional deviation of a wellbore from vertical to reach subsurface areas off to one side from the drilling site.

DISCRETIONARY CLOSURE. Areas where the Bureau has determined that energy and/or mineral leasing, entry or disposal, even with the most restrictive stipulations or conditions, would not be in the public interest.

DISTRIBUTION. The dispersion of livestock grazing over a range area. Distribution is affected by the availability of water, topography, and type and palatability of vegetation as well as other factors.

DRAINAGE (Geomorphic). A collective term for all the water bodies by which a region is drained; or, all the water features shown on a map.

DRAINAGE (OIL AND GAS). The uncompensated loss of hydrocarbons from Federal, Indian tribal or Indian-allotted mineral lands from wells on adjacent non-jurisdictional lands or jurisdictional lands with lower participation, allocation, royalty rate, or distribution of funds, resulting in revenue losses to the Federal or Indian lessors.

DRY HOLE. Any well not capable of producing oil or gas in commercial quantities. A dry hole may produce water, gas,or even oil, but not enough to justify production.

ECOLOGY. A study of the relationship between animals and plants and their environment.

ENDANGERED SPECIES. Those species of plants or animals classified by the Secretary of the Interior or the Secretary of Commerce as endangered pursuant to Section

4 of the Endangered Species Act of 1973, as amended. See Threatened and endangered species.

ENVIRONMENTAL ASSESSMENT (EA). An analysis of site-specific BLM activities used to determine whether such activities have a significant effect on the quality of the human environment, and whether a formal environmental impact statement is required.

ENVIRONMENTAL IMPACT STATEMENT (EIS). A written analysis of the impacts of a proposed project on the environment (for example, an oil and gas drilling program).

EPHEMERAL STREAM. A stream that flows only after rains or during snowmelt and whose channel is at all times above the water table.

EROSION SUSCEPTIBILITY. The susceptibility of a soil to erosion when no cover is present. The rate of soil displacement depends on the physical properties of the soil, rainfall intensity, and slope gradient.

ESCAPE COVER. Vegetation or other obstacles that provide an area where small mammals may escape from predators or inclement weather.

EXCEPTION. Case-by-case exemption from a lease stipulation. The stipulation continues to apply to all other sites within the leasehold to which the restrictive criteria apply.

EXPOSURE. Direction of slope with respect to points of the compass.

FAULT. A fracture surface in rocks along which movement of rock on one side has occurred relative to rock on the other side.

FEDERAL LAND POLICY AND MANAGEMENT ACT OF l976 (FLPMA). Public Law 94-579, October 21, 1976, often referred to as the BLM's "Organic Act", which provides the majority of the BLM's legislated authority, direction, policy, and basic management guidance.

FEDERAL ONSHORE OIL AND GAS LEASING REFORM ACT OF l987 (FOOGLRA). Public Law 100-203, December 22, l987. Changed the way in which Federal lands are leased for oil and gas, abolishing the simultaneous leasing system and eliminating the need to do Known Geologic Structure determinations to classify lands for competitive leasing.

FLARE. The piping and burners used to dispose (by burning) of vapors from a well or collection plant. Flaring of oil field gas is regulated in Montana by the Montana Board of Oil and Gas Conservation and in South Dakota by the Department of Water and Natural Resources.

FLOODPLAIN. The relatively flat area or lowlands adjoining a body of standing or flowing water which has been or might be covered by floodwater.

FLOW LINE. A small diameter pipeline through which fluids move on lease before being sold.

FORB. A broad-leaved herb that is not grass or grasslike.

FOREST LAND. Land which is now, or is capable of being, at least 10 percent stocked by forest trees and is not currently developed for nontimber use.

FORMATION. A body of rock strata that consists dominantly of a certain lithologic type or combination of types; a lithologically distinct, mappable body of igneous, metamorphic, or sedimentary rock.
GEOMORPHIC. Pertaining to the form of the earth or its surface features.

GRANDFATHERED ACTIVITY. For wilderness purposes, any land surface disturbance or alteration that occurred within a wilderness study area prior to the passage of FLPMA (October 2l, l976). See Pre-FLPMA leases.

GRAZING SYSTEM. The manipulation of livestock grazing to accomplish a desired result.

GROUND COVER. Vegetation, mulch, litter, or rocks.

GROUND WATER. Subsurface water that is in the zone of saturation. The top surface of the ground water is the "water table". Source of water for wells, seepage, springs.

GUN BARREL. A settling tank used to separate oil and water in the field.

HABITAT. In wildlife management, the major elements of habitat are considered to be food, water, cover, and living space.

HEATER-TREATER. A container that heats the oil, gas, or water/oil emulsion to remove the water and gas and make the oil acceptable for pipeline transmission.

H2S. Hydrogen sulfide. A colorless, inflammable, cumulatively poisonous gas which smells like rotten eggs. Produced by some oil or gas wells.

HYDROLOGY. The science dealing with the behavior of water as it occurs in the atmosphere, on the surface of the ground, and underground.

IGNEOUS ROCKS. Rocks formed by solidification of molten earth materials. Intrusive igneous rocks such as granite solidify beneath the surface of the earth; extrusive

igneous rocks such as lava emerge at the surface as molten material before solidifying.

IMPACT. The result of an action in comparison to the present condition or a baseline condition. It can be either beneficial or detrimental.

INFILTRATION. The flow of a fluid into a solid substance through pores or small openings; specifically, the movement of water into soil or porous rock.

INHOLDINGS. State or privately owned lands inside a wilderness study area.

INTERIM MANAGEMENT POLICY AND GUIDELINES FOR LANDS UNDER WILDERNESS REVIEW (IMP). A BLM document, dated December 12, 1979, which defines the policy for management of Wilderness Study Areas until a final determination on wilderness designation is made by Congress.

INTERMITTENT STREAM. A stream which flows most of the time but occasionally is dry or reduced to pool stage when losses from evaporation or seepage exceed the available streamflow.

KARST. A type of topography that is formed over limestone, dolomite, or gypsum by dissolution, characterized by sinkholes, caves, and underground drainage.

KICK(S). Entry of water, gas, or oil under pressure into the wellbore which may result in a blowout if not controlled.

KNOWN GEOLOGIC STRUCTURE. Areas known to contain producible oil and gas deposits classified under provisions of the Mineral Leasing Act of 1920. Prior to passage of FOOGLRA, KGS lands were leased only by competitive bidding.

LAND TREATMENT. All methods of artificial range improvement and soil stabilization such as reseeding, brush control, pitting, furrowing, and water spreading. See Mechanical treatment.

LEASABLE MINERALS. Federal minerals subject to lease under the Mineral Leasing Act of 1920 as amended and supplemented. Includes minerals such as oil, gas, coal, geothermal, tar sands, oil shale, potassium, phosphate, sodium, asphaltic materials.

LEASE NOTICE. Provides more detailed information concerning limitations that already exist in law, lease terms, regulations, or operational orders. A lease notice also addresses special items the lessee should consider when planning operations, but does not impose new or additional restrictions. Lease notices attached to leases should not be confused with NTLs (Notices to Lessees).

LEK. A traditional breeding area for grouse species where territorial males display and establish dominance. See Strutting grounds.

LOCATABLE MINERALS. Minerals or materials subject to disposal and development through the Mining Law of l872 (as amended). Generally includes metallic minerals such as gold and silver and other materials not subject to lease or sale.

LONG-TERM IMPACTS. Impacts that occur or remain beyond 25 years (the short term) from the initiation of a project or action. In this document it refers to impacts that remain after the average 25 year life span of an oil and gas well.

LOT. A subdivision of a section which is not described as an aliquot part of the section, but which is designated by number, e.g., LOT 2. A lot may be regular or irregular in shape and its acreage varies from that of regular subdivisions.

MANAGEMENT FRAMEWORK PLAN (MFP). A planning decision document prepared before the effective date of the regulations implementing the land use planning provisions of FLPMA. Until replaced by RMPs, MFPs were used as a basis for management action as provided for in 43 CFR 1610.8.

MECHANICAL TREATMENT. Treatment of a range area by mechanical means, such as contour furrowing, pitting, plowing and seeding, chiseling, scalping, and water spreading.

MESIC AREA. A habitat having a moderate amount of moisture available for the support of plant life.

MINERAL ENTRY. The location of mining claims by an individual to protect the right to a valuable locatable mineral.

MINERAL MATERIAL. Widespread deposits of common clay, sand, gravel, or stone which are not subject to disposal under the l872 Mining Law, as amended. See Salable minerals.

MITIGATION MEASURES. Methods or procedures developed for the purpose of reducing or lessening the impacts of an action.

MODIFICATION. Fundamental change to the provisions of a lease stipulation, either temporarily or for the term of the lease. A modification may include an exemption from or alteration to a stipulated requirement. Depending on the specific modification the stipulation may or may not apply to all other sites within the leasehold to which the restrictive criteria applied.

MULTIPLE USE MANAGEMENT. Coordinated management of the various surface and subsurface resources, without permanent impairment of the productivity of the land, that will best meet the present and future needs of the people.

NATURAL GEOLOGIC EROSION. The wearing away of the land's surface by running water, wind, ice, or other geological agents, unaffected by human activities.

NO SURFACE OCCUPANCY (NSO). Use or occupancy of the land surface for fluid mineral exploration or development is prohibited in order to protect identified resource values. The NSO stipulation includes stipulations which may have been worded as "No Surface Use/Occupancy", "No Surface Disturbance", "Conditional NSO", and "Surface Disturbance or Surface Occupancy Restriction (by location)".

NONDISCRETIONARY CLOSURES. Areas specifically closed to energy and/or mineral leasing, entry or disposal by law, regulation, Secretarial decision or Executive Order.

NOTICE TO LESSEES (NTL). The NTL is a written notice issued by the Authorized Officer. NTLs implement regulations and operating orders, and serve as instructions on specific item(s) of importance within a State, District, or Area.

OFF-ROAD VEHICLE (ORV). Any motorized track or wheeled vehicle designed for cross-country travel over any type of natural terrain. These vehicles are subject to designated area and trail use (open, limited, and closed).

OUTSTANDING. Superior to or standing out among others of its kind; conspicuous, prominent, distinguished; excellent, as used in the description of wilderness characteristics.

OVERSTORY. The upper canopy or canopies of plants. Usually refers to trees, tall shrubs, and vines.

OVERTHRUST BELT. In Montana, the Rocky Mountain Front. The Overthrust Belt does not occur in the Miles City District.

PARTICULATES. Finely divided solid or liquid particles in the air or in an emission, including dust, smoke fumes, mist, spray, and fog.

PEAK DISCHARGE. The highest stage or channel flow attained by a flood, usually expressed as the volume of water in cubic feet passing a given point in a one-second time period, hence, cubic feet/second.

PERENNIAL (PERMANENT) STREAM. A stream which flows 9 or more months out of the year.

PETROGLYPH. A carving or inscription on a rock.

pH. A measure of acidity or alkalinity. A solution with a pH of 7 is neutral, pH greater than 7 (to 14) is alkaline, and a pH less than 7 (to 0) is acidic.

PICTOGRAPH. An ancient or prehistoric drawing or painting on a rock wall.

POST-FLPMA LEASES. Oil and gas leases issued after the passage of the Federal Land Policy and Management Act of 1976. Where occurring in WSAs, these leases have no valid existing rights and could not impair wilderness values.

PPM. Parts per million. A measurement to identify the amount of particulates in air or water.

PRE-FLPMA LEASES. Oil and gas leases issued prior to the passage of the Federal Land Policy and Management Act of l976. Where occurring in Wilderness Study Areas, these leases have valid existing rights which allow development even if wilderness values may be impaired.

PROPOSED PLAN. The plan alternative(s) in the final EA or EIS which management selects as the Bureau's choice. The plan is not approved until a Record of Decision is signed by the State Director.

PUBLIC LANDS. Any land and interest in land (outside Alaska) owned by the United States and maintained by the Secretary of the Interior through the Bureau of Land Management.

PUBLIC PARTICIPATION. Part of BLM's planning system that provides the opportunity for citizens, as individuals or groups, to express local, regional, and national perspectives and concerns. This includes public meetings or hearings that review resource management proposals and offer suggestions or criticisms for the various alternatives considered.

RANGE CONDITION CLASS (ECOLOGICAL). One of a series of arbitrary categories used to classify range condition, usually expressed as either excellent, good, fair, or poor.

RANGE DEVELOPMENT (IMPROVEMENT). A structure, excavation, treatment, or development to rehabilitate, protect, or improve the condition of the range on public lands.

RANGE SITE. A distinctive kind of rangeland in its ability to produce a characteristic natural plant community. A range site is the product of all the environmental factors responsible for its development. It is capable of supporting a native plant community typified by an association of

species that differs from that of other range sites in the kind or proportion of species or in total production.

RAPTORS. Birds of prey such as eagles, hawks, owls, and vultures which have sharp talons and strongly curved beaks.

RECLAMATION. Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation, and other work necessary to restore it for use.

RECORD OF DECISION (ROD). A brief statement which, when signed and dated by the State Director, approves and completes a plan or amendment for an EIS.

RESOURCES. All of the products and physical values produced or contained within the BLM lands, including natural resources such as timber, coal, and oil.

RESOURCE MANAGEMENT PLAN (RMP). A multiple-use management plan and associated Environmental Impact Statement covering one or more BLM Resource Areas.

RIPARIAN-WETLAND AREA. An area of land directly influenced by permanent water. It has visible vegetation or physical characteristics reflective of permanent water influence. Lakeshores and streambanks are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil.

RUNOFF. Water that flows across the land surface in response to rainfall or snowmelt, becoming streamflow when it reaches an intermittent or perennial watercourse.

SALABLE MINERALS. Common varieties of mineral materials such as sand, gravel, and stone, as well as petrified wood. Common mineral materials may be sold or disposed of through free use permits under the provision of the Materials Act of July 3l, l947, amended July 23, l955, and September 25, l962.

SALINITY. A measure of the salts dissolved in water. See alkalinity.

SANDY. A soil containing a large amount of sand. Textural classes are sand and loamy sand.

SCENIC QUALITY. The relative worth of a landscape from a visual perception point of view.

SEASON OF USE. The time of livestock grazing on a range area based on type of vegetation or stage of vegetative growth.

SEASONAL (SEASON LONG) GRAZING. Grazing use throughout a specific season.

SEDIMENT. Soil, rock particles, and organic or other debris carried from one place to another by wind, water, gravity, ice, or other geologic agent.

SEDIMENTARY ROCK. A layered rock resulting from the consolidation of sediment, such as shale, sandstone, and limestone.

SEDIMENTATION. The transposition and deposition of soil and rock particles by water, wind, or ice.

SHUT IN. To close the valves on a well so it ceases production.

SHORT-TERM IMPACTS. Impacts predicted to occur for a duration up to 25 years (the life cycle of a typical oil well) after a management project or action is initiated. See Long-term impacts.

SHRUB. A low, woody plant, usually with several stems; may provide food and/or cover for wildlife.

SIMULTANEOUS LEASING (OG SIM). Oil and gas estates on public lands leased through lottery-type drawings. Some valid leases are OG SIM but the program was abolished by FOOGLRA.

SITE SPECIFIC. Denotes a specific geographic area.

SODIUM-AFFECTED SOIL. A nontechnical term for sodic soil (also called alkali soil) that contains sufficient sodium to interfere with the growth of most crop plants and in which the exchangeable sodium percentage is 15 or higher. It is also a generic way of describing nonsaline-alkali soil or saline-alkali soil.

SOIL DEPTH CLASSES. Classes overlap from 0 to 60 or more inches with specific depths as follows: very shallow 0-10 inches, shallow from 5-30 inches, moderately deep from 20-50 inches, deep from 30-60 inches, and very deep from 50 to more than 60 inches.

SOIL SERIES. The lowest category of soil classification, being a subdivision of a family and consisting of soils which are essentially alike in all major profile characteristics except in the texture of the "A" horizon (or surface layer).

SOLITUDE. The state of being alone or remote from habitations; isolation or a lonely, unfrequented, or secluded place as used in describing wilderness opportunities.

SO_2. Sulfur dioxide. A colorless suffocating gas formed when sulfur burns.

SOUR WELL. A condition caused by the presence of hydrogen sulfide or another sulfur compound in an oil or gas well.

SPECIES OF SPECIAL INTEREST OR CONCERN. Animals not yet listed as endangered or threatened but which are undergoing status review by a Federal or state agency. This may include animals whose populations could become extinct by any major habitat change. A species that is particularly sensitive to some external disturbance factors.

STANDARD METROPOLITAN STATISTICAL AREA (SMSA). A county containing at least one city with 50,000 inhabitants plus any adjacent urban territory.

STEP OUT WELL. A well drilled some distance from a proven well to determine the limits of the oil or gas reservoir.

STIPULATION. A provision that modifies standard lease rights and is attached to and made part of a lease.

STREAMBANK (AND CHANNEL) EROSION. This is the removal, transport, deposition, cutting, and bed-load movement of material by concentrated flows.

STRUTTING GROUNDS. Synonymous with the term "lek."

SUBBITUMINOUS. A black coal, intermediate in rank between lignite and bituminous coal. Distinguished from lignite by higher carbon and lower moisture content.

SURFACE MANAGEMENT AGENCY (SMA). The Federal agency with jurisdiction over the surface of Federally owned lands that contain mineral resources.

SWEET WELL. An oil or gas well lacking sulfur and any significant amount of hydrogen sulfide or other sulfur compounds.

TACK-ON. Public lands with wilderness characteristics smaller than 5,000 acres in size and adjacent to other public lands designated either as wilderness or wilderness study areas.

THERMAL COVER. Vegetation or topography that prevents radiational heat loss, reduces wind chill during cold weather, and intercepts solar radiation during warm weather. Generally, a minimum thermal stand consists of tree heights averaging 40 feet or more and crown closure of 70 percent or more.

THREATENED AND ENDANGERED SPECIES (T&E). Those species of plants or animals classified as threatened or endangered pursuant to Section 4 of the Endangered Species Act. Any species which is in danger of extinction, or is likely to become so within the foreseeable future. Category 1 - substantial biological information on file to support the appropriateness of proposing to list as endangered or threatened. Category 2 -current information indicates that proposing to list as endangered or threatened is possibly appropriate, but substantial biological information is not on file to support an immediate ruling (USFWS status).

TIMING LIMITATION (SEASONAL RESTRICTION). Prohibits surface use during specified time periods to protect identified resource values. This stipulation does not apply to the operation and maintenance of production facilities unless the findings of analysis demonstrate the continued need for such mitigation and that less stringent, project-specific mitigation measures would be insufficient.

TOPOGRAPHY. The physical features and surface configuration of a place or region; the detailed and accurate description of the landforms of a place or region.

TOTAL DISSOLVED SOLIDS (TDS). The dry weight of dissolved material, organic and inorganic, contained in water.

TOTAL SUSPENDED PARTICULATES (TSP). All particulate solid and liquid matter, except water, suspended in the atmosphere; includes dusts, smoke and pollen particles, and liquid and solid aerosols.

TRACT. Generally, a metes and bounds survey of an area at large within a township. In modern public land surveys the term is used specifically to mean a parcel of land that lies in more than one section or that cannot be identified completely as a part of a particular section. Tract numbers begin with the next higher number of the numerical designation within a township, for example; if there is an old Mineral Lot No 37, the tract would be Tract No 38. If a tract falls across a township line it is given a separate number in each township. See Lot.

TRANSMISSION LINE. A large diameter pipeline through which oil or gas moves off lease after being sold.

TURBIDITY. An interference to the passage of light through water due to insoluble particles of soil, organic material, micro-organisms, and other materials.

UNCLASSIFIED AREAS (AIR QUALITY). A geographic area in which attainment or nonattainment has not been determined. Unclassified areas are exempt from Clean Air Act offset provisions, retrofit controls, and new source control requirements.

UNDERSTORY VEGETATION. Plants, usually grasses, forbs, and low shrubs, growing beneath the canopy of other plants.

UNIT RESOURCE ANALYSIS (URA). A comprehensive display of physical resource data and an analysis of the current use, production, condition, and trend of the resources and the potentials and opportunities within a planning unit, including a profile of ecological values. Generally part of the MFP documents.

VEGETATION (GROUND) COVER. The percent of land surface covered by all living vegetation (and remnant vegetation yet to decompose) within 20 feet of the ground.

VISUAL RESOURCES. The visible physical features on a landscape (land, water, vegetation, animals, structures, and other features).

VISUAL RESOURCE MANAGEMENT (VRM) CLASSES. Categories assigned to public lands based on scenic quality, sensitivity level, and distance zones. There are four classes. Each class has an objective which prescribes the amount of change allowed in the characteristic landscape.

VISUAL RESOURCE MANAGEMENT OBJECTIVES.

Class I Objective - The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II Objective - The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the causal observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominate natural features of the characteristic landscape.

Class III Objective - The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV Objective - The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

WAIVER. Permanent exemption from a lease stipulation. The stipulation no longer applies anywhere within the leasehold.

WATER QUALITY. The chemical, physical, and biological characteristics of water with respect to its suitability for a particular use.

WATERSHED. All lands which are enclosed by a continuous hydrologic drainage divide and lie upslope from a specified point on a stream.

WATERSHED COVER. The material (vegetation, litter, rock) covering the soil and providing protection from, or resistance to, the impact of raindrops and the energy of overland flow, and expressed in percent of the area covered.

WETLANDS. See RIPARIAN-WETLAND AREA

WILDERNESS. An area formally designated by Congress as a part of the National Wilderness Preservation System.

WILDERNESS CHARACTERISTICS. The definition contained in Section 2(c) of the Wilderness Act (78 STAT. 891).

WILDERNESS STUDY AREA (WSA). An area determined to have wilderness characteristics. WSAs are submitted to the President and Congress for wilderness designation. These areas are an interim designation, valid until either designated as wilderness or released to multiple-use management.

WINDOW. A short segment of a designated right-of-way corridor which would enable an authorization allowing passage through a restricted area.

WINTER RANGE. Areas used by wildlife during the winter months.

WITHDRAWAL. Segregating an area of Federal land, under some or all of the general land laws, for the purpose of limiting activities under those laws in order to maintain other public values or reserve the area for a particular purpose.

REFERENCES

Achuff, P. L., 1991, Plant species of special concern, May 1991: Montana Natural Heritage Program, Helena, Montana.

Agnew, A. F., and Tychsen, P. C., l965, A guide to the stratigraphy of South Dakota: South Dakota State Geological Survey Bulletin 14, 195 p.

American Petroleum Institute, 1981, Recommended practices for occupational safety and health for oil and gas well drilling and servicing operations - API Recommended Practices 55: American Petroleum Institute, Washington, D. C.

_____, 1984, Recommended practices for blowout prevention equipment systems for drilling wells - API Recommended Practices 53 (2d ed): American Petroleum Institute, Washington, D. C.

_____, 1987a, Recommended practices for safe drilling of wells containing hydrogen sulfide - API Recommended Practices 49: American Petroleum Institute, Washington, D. C.

_____, 1987b, Recommended practices for well control operations - API Recommended Practices 59: American Petroleum Institute, Washington, D. C.

Andrews, Richard, Dietrich, Stan, Glaze, Robert, Ordonez, Steve, and Ruddiman, Bill, 1986, Stratigraphic nomenclature chart *in* Noll., J. H., ed., Rocky Mountain oil and gas fields: Wyoming Geological Association, l986 Symposium, Casper, Wyoming, 8 p.

Autenrieth, R. E., 1978, A study of birth sites selected by pronghorn does and the bed sites of fawns, Proceedings: Seventh Biennial Pronghorn Antelope Workshop, 7:127-134.

Balster, C. A., editor, 1971, Catalog of stratigraphic names for Montana: Montana Geological Society and Montana Bureau of Mines and Geology Special Publication 54, 448 p.

_____, compiler, 1980, Stratigraphic nomenclature chart for Montana and adjacent areas (3d ed): Montana Bureau of Mines and Geology GM 8, 1 sheet.

Bates, R. L., and Jackson, J. A., editors, 1984, Dictionary of geological terms (3d ed), American Geological Institute: Doubleday Anchor Press, New York, 571 p.

Billings Geological Society, 1951, The well that focused national attention on Montana's vast unexplored oil potentialities *in* Second Annual Field Conference, p. 67.

Bolyard, D. W., 1969, Muddy sand potential in South Dakota, *in* Eastern Montana Symposium: Montana Geological Society 20th Annual Field Conference, p. 85-94.

Brostuen, E. A., 1981, Petroleum - A primer for North Dakota, Educational Series 13: North Dakota Geological Survey.

Brown, C. J. D., 1971, Fishes of Montana: Big Sky Books, Bozeman, Montana.

Campen, Betsy, 1990, Exploring the coalbeds of Montana *in* Western Oil World, July 1990, p. 24-26.

Choate, Raoul, Johnson, C. A., and McCord, J. P., 1984, Geologic overview, coal deposits, and potential for methane recovery from coalbeds—Powder River Basin *in* Rightmire, C. T., Eddy, G. E., and Kirr, J. N., eds., Coalbed methane resources of the United States: AAPG Studies in Geology, Ser. 17, p. 335-351.

Couey, F., and Schallenberger, A., 1971, Bighorn sheep *in* Mussehl, T. W., and Howell, F. W., eds., Game management in Montana: Montana Department of Fish and Game, p. 97-106.

Dames and Moore, 1986, Environmental assessment AMOCO Production Company's proposed Beartooth exploration well, Report prepared for Bureau of Land Management, Miles City, Montana and AMOCO Production Company, Denver, Colorado, 118 p.

Darrow, George, 1954, The Bearcreek coal field *in* Richards, P. W., ed., 1954, Pryor Mountains-Northern Bighorn Basin, Montana Fifth Annual Field Conference: Billings Geological Society Guidebook, September 9-11, 1954, p. 130-132.

Darton, N. H., 1909, Geology and water resources of the northern portion of the Black Hills and adjoining areas: U.S. Geological Survey Professional Paper 65, 105 p.

_____, 1918, Artesian waters in the vicinity of the Black Hills, South Dakota: U.S. Geological Survey Water-Supply Paper 65, 105 p.

_____, 1951, Geologic map of South Dakota: U.S. Geological Survey, scale l:500,000, 1 sheet.

Deaver, Sherri, and Deaver, Ken, 1988, Prehistoric cultural overview of southeast Montana - report prepared by Ethnoscience, Billings, Montana for BLM, Miles City District, December 1988, 2 Vols.

DeWitt, Ed, Redden, J. A., Wilson, A. B., and Buscher, David, 1986, Mineral resource potential and geology of the Black Hills National Forest, South Dakota and Wyoming: U.S. Geological Survey Bulletin 1580, 135 p.

Dobbin, C. E., and Erdmann, C. E., 1955, Structure contour map of the Montana plains: U.S. Geological Survey Oil and Gas Investigation Map OM-178A.

Dusek, G. L., 1978, Bull Mountains coal field study: Final Report: Montana Department of Fish and Game.

Edminster, F. C., l954, American game birds of field and forest; their habitats, ecology, and management: Charles Scribner's Sons, New York, p. 135-167.

Energy Resources Conservation Board, 1987, Alberta's recommended practices for drilling critical sour wells: Energy Resources Conservation Board, Calgary, Alberta.

Environmental Research and Technology, Inc., 1983, Riley Ridge natural gas project, Wildlife and Fisheries Technical Report prepared for the Bureau of Land Management, Denver, Colorado.

Flath, D. L., 1991, Species of special interest or concern (draft report): Montana Department of Fish, Wildlife and Parks, 7 p.

Gill, R. B., 1965, Distribution and abundance of a population of sage grouse in North Park, Colorado: M.S. Thesis, Colorado State University.

Gilles, V. A., 1952, Notes on the early investigations of the Glendive-Baker or Cedar Creek Anticline *in* Third Annual Field Conference, Billings, l952, Guidebook: Billings Geological Society, p. 17-28.

Haig, S. M., and Oring, L. W., 1985, Distribution and status of the piping plover *Charadrius melodus* throughout the annual cycle: Journal of Field Ornithology, 56(4):334-345.

Hamlin, K. L., 1978, Population ecology and habitat relationships of mule deer and white-tailed deer in the prairie agricultural habitats of eastern Montana, Montana Deer Studies: Montana Department of Fish, Wildlife and Parks, Project W-120-R-10, Job Progress Report.

Hansen, Paul, Boggs, Keith, Pfister, Robert, and Joy, John, 1990, Classification and Management of Riparian and Wetland Sites in Central and Eastern Montana (Draft version 2): Montana Riparian Association, Montana Forest and Conservation Experiment Station, and School of Forestry, University of Montana.

Hedges, L. S., 1968, Geology and water resources of Beadle County, South Dakota: South Dakota Geological Survey Bulletin No. 18, 66 p.

Hedges, L.S., 1975, Geology and water resources of Charles Mix and Douglas Counties, South Dakota, Part I: South Dakota Geological Survey Bulletin No. 22, 43 p.

Houser, B. B., 1987, Southwestern bounding fault of the Sioux quartzite, South Dakota: U.S. Geological Survey Open-File Report 87-626, 11 p.

Houtcooper, W. C., Ode, D.J., Pearson, J. A., and Vandel III, G.M., 1985, Rare animals and plants of South Dakota: Prairie Naturalist, 17(3):143-165.

Hubbell, W. S., 1990, Cost assessment for cultural resource inventory for Cherry Creek Dam project - unpublished report: Miles City District, Montana.

Johnsgard, P. A., 1973, Grouse and quails of North America: University of Nebraska, p. 300-319.

Julander, O., 1966, How mule deer use mountain range in Utah: Utah Academy of Science Arts Letters, 43(2):22-28.

Keene, J. R., 1973, Ground water resources of the western half of Fall River County, South Dakota: South Dakota State Geological Survey Report of Investigations No. 109, 82 p.

Kohn, S. C., 1976, Sharp-tailed grouse nesting and brooding habitat in southwest North Dakota: M.S. Thesis, South Dakota State University, 66 p.

Layton, D., and Cederwall, R., 1987, Predicting and managing the health risks of sour-gas wells: Journal of Air Pollution Control Assoc. 37(l0):1185-1190.

Layton, D., Cederwall, R., Ricker, Y., Shinn, J., and O'Banion, K., 1983, Accidental releases of sour gas from wells and collection pipelines in the Overthrust Belt: Calculating and assessing potential health and environmental risks. UCRL-53411: Lawrence Livermore National Laboratory, Livermore, California.

Lesica, P., and Shelly, J.S., 1988, Report on the conservation status of *Shoshonea pulvinata*, a candidate of threatened species: Report prepared for U.S. Fish and Wildlife Service, Office of Endangered Species, Denver, CO.

Lesica, P., and Shelly, J.S., 1991, Sensitive, threatened and endangered vascular plants of Montana: Montana Natural Heritage Program, Montana State Library, Helena, Montana.

Long, G. I. W., Campbell, M. C., and Hansen, W. B., 1989, Unpublished reports on oil and gas development potential to accompany panel maps showing drilling activity in the State of Montana: Bureau of Land Management files, 8 reports and 8 maps.

Long, G. I. W., Campbell, M. C., Hansen, W. B., and McKay, J. R., 1989, Unpublished reports on oil and gas development potential to accompany county maps showing drilling activity in the State of South Dakota: Bureau of Land Management files, reports, and maps for the 67 counties.

Luedke, R. G., and Smith, R. L., 1983, Map showing distribution, composition, and age of late Cenozoic volcanic centers in Idaho, western Montana, west-central South Dakota, and northwestern Wyoming: U. S. Geological Survey Miscellaneous Investigation Map I-1091-E, scales 1:1,000,000 and 1:500,000.

Mallory, W. W., editor, 1972, Geologic atlas of the Rocky Mountain region: Rocky Mountain Association of Geologists, p. 30, 34, 37-39, and 56.

Martin, N. S., 1970, Sagebrush control related to habitat and sage grouse occurrence: Journal of Wildlife Management, 34:313-320.

Montana Board of Oil and Gas Conservation, 1984, General rules and regulations relating to oil and gas, Administrative Rules of Montana, Part 36, Chapter 22, Billings, Montana.

_____, 1985, Preliminary environmental review, SOHIO Moats #1-3 Well, Gallatin County, Montana: Montana Board of Oil and Gas Conservation, Billings, Montana.

_____, 1988a, Annual Review for the year 1987 relating to oil and gas: Montana Department of Natural Resources and Conservation, v. 31.

_____, 1988b, Montana Oil and Gas Statistical Bulletin, v. 36, v. 37, nos. 1-4.

_____, 1989a, Oil and gas drilling production in Montana, Draft and Final EIS.

_____, 1989b, Oil and gas drilling production in Montana, Technical Appendix Volume, 292 p.

_____, 1989c, Annual Review for the year 1988 relating to oil and gas: Montana Department of Natural Resources and Conservation, v. 32.

_____, 1990, Annual Review for the year 1989 relating to oil and gas: Montana Department of Natural Resources and Conservation, v. 33.

Montana Bureau of Mines and Geology and U. S. Geological Survey, 1978, Groundwater of the Fort Union Region, Eastern Montana: Montana Bureau of Mines and Geology Special Publication 80, 47 p.

Montana Department of Commerce, Census and Economic Information Center, 1991, 1990 Census of population for governmental units: Montana.

Montana Department of Health and Environmental Sciences, 1981, Montana Air Quality Data and Information Summary for 1979-1980.

Montana Department of Labor and Industry, Research and Analysis Bureau, 1989, Montana annual average 1988 employment, wages and contributions.

Montana Department of Revenue, 1989, Biennial Report of the Montana Department of Revenue: 1986-1988.

Montana Oil Journal, 1991, Montana drilling wells, Carbon County: Montana Oil Journal, 71(21) (May 24, 1991), p. 7.

Muffler, L. J. P., editor, 1979, Assessment of geothermal resources of the United States-1978: U. S. Geological Survey Circular 790, 163 p.

Ode, D. J., 1991, State or Federally threatened, endangered or candidate species listed for South Dakota (database): South Dakota Department of Game, Fish and Parks, Pierre, South Dakota.

Office of the Federal Register, 1990, Code of Federal Regulations, (CFR) Titles 36, 40, and 43.

Patterson, R. L., 1952, The sage grouse in Wyoming: Sage Books, Inc., Denver, Colorado.

Perry, E. S., 1962, Montana in the geologic past: Montana Bureau of Mines and Geology Bulletin 26, 78 p.

Petres, A. K., 1989, Identifying South Dakota hydrocarbon potential: Oil and Gas Journal, 87(13): 75-78.

Petroleum Association for the Conservation of the Canadian Environment, l985, Review of ambient hydrogen sulphide standards in Canada, Report No. 85-5, December 1985: prepared by Concord Scientific Corporation, Downview, Ontario.

Rioux, R. P., and Dodge, K. A., 1980, Hydrologic data from the Bull Mountains area, south-central Montana: U. S. Geological Survey in cooperation with the Montana Bureau of Mines and Geology and U.S. Bureau of Land Management.

Ross, C. P., Andrews, D. A., and Witkind, I. J., 1955, Geologic map of Montana: U. S. Geological Survey, scale 1:500,000, 2 sheets.

Rothrock, E. P., 1937, Structural conditions in Harding County: South Dakota State Geological Survey Report of Investigations No. 28, 35 p.

Sammel, E. A., 1979, Occurrence of low-temperature geothermal waters *in* the United States in Muffler, L. J. P., ed., Assessment of geothermal resources of the United States—1978: U.S. Geological Survey Circular 790, p. 86-100, 112, 113, 128, 129, 131.

Schoon, R. A., and McGregor, D. J., 1974, Geothermal potentials in South Dakota: South Dakota Geological Survey Report of Investigations 110, 76 p.

Searight, W. V., 1934, The geology of central Perkins County, South Dakota: South Dakota State Geological Survey Report of Investigations No. 21, 52 p.

Shurr, G. W., Nelson, C. L., and Jenkins, J. T., Jr., 1988, Prediction of sandstone geometry in the Upper Cretaceous Shannon Sandstone in the Northern Powder River Basin *in* Diedrich, R. P. and others (eds.), Eastern Powder River Basin-Black Hills Guidebook: Wyoming Geological Association 39th Annual Field Conference, p. 217-228.

Sittig, Marshall, 1979, Hazardous and toxic effects of industrial chemicals: Noyes Data Corporation, Park Ridge, New Jersey.

Slagle, S. E. and others, 1983, Hydrology of Area 49, Northern Great Plains and Rocky Mountain coal provinces, Montana and Wyoming: U. S. Geological Survey Water-Resource Investigations Open-File Report 82-682, 94 p.

_____, 1986, Hydrology of Area 48, Northern Great Plains and Rocky Mountain coal provinces, Montana and Wyoming: U. S. Geological Survey Water-Resource Investigations Open-File Report 84-141, 91 p.

Sohio Petroleum Company, 1986, Blowout prevention well training course, addendum submitted as evidence at hearing by Bridger Canyon Planning and Zoning Commission, Gallatin County, Bozeman, Montana.

Sonderegger, J. L., and Bergantino, R. N., 1981, Geothermal resources map of Montana: Montana Bureau of Mines and Geology Hydrogeologic Map 4, 1 plate (scale 1:1,000,000), 4 tables.

South Dakota Department of Labor, Labor Market Information Center, 1989, Employment and earnings, 1988.

_____, 1990, Unpublished report compiled by the state data center from the P. L. 94-171 census files.

South Dakota Department of Water and Natural Resources, 1987, South Dakota air monitoring network review.

_____, 1990, Oil, gas and water production figures for South Dakota, 1989: Western Field Office, Rapid City, South Dakota, 89 p.

Steece, F. V., 1961, Precambrian surface of South Dakota: South Dakota Geological Survey Mineral Resource Investigation Map No. 2, scale: 1 inch = 30 miles.

Steece, F. V., 1965, Geology and ground water supplies in Sanborn County, South Dakota: South Dakota Geological Survey Bulletin No. 17., 182 p.

Stern, A. C., 1976, Air Pollution (3d ed): Academic Press, Inc., New York, New York.

Stern, A., Boubel, R., Turner, D., and Fox, D., 1984, Fundamentals of air pollution (2d ed): Academic Press, Orlando, Florida.

Swank, W. G., 1958, The mule deer in Arizona chaparral: Arizona Game and Fish Department Wildlife Bulletin No. 3.

Thomas, J. W., Maser, C., and Rodiek, J. E., 1979, Riparian zones in managed rangelands - their importance to wildlife *in* Cope, O. B., Forum - Grazing and riparian/stream ecosystems: Trout Unlimited.

Tonnsen, J. J., editor, 1985, Montana Oil and Gas Fields Symposium 1985: Montana Geological Society, Billings, Montana, 2 volumes, 1,250 p.

U. S. Department of Agriculture Soil Conservation Service, 1973, Habitat management for white-tailed deer: Soil Conservation Service, Bozeman, Montana, 4 p.

_____, 1980, Standardized plant names for Montana: Plant Sciences Staff, Bozeman, Montana, 175 p.

_____, 1981, Land resource regions and major land resource areas of the United States: Agriculture Handbook 296, revised: Washington, D. C.

U. S. Department of the Interior Bureau of Land Management, 1978, Missouri Breaks grazing draft and final EIS: Miles City and Lewistown Districts, Montana.

_____, 1980a, Oil and gas environmental assessment of BLM leasing program: Miles City District, Montana, 285 p.

_____, 1980b, Buffalo Resource Area oil and gas environmental assessment: Casper District Office, Casper, Wyoming.

_____, 1981, Oil and gas environmental assessment of BLM leasing program: Lewistown District, Montana, 117 p.

_____, 1983, Resource management plan/EIS, draft and final, Billings Resource Area: Miles City District, Montana.

_____, 1984a, Herd management area plan, Pryor Mountain Wild Horse Range, Billings Resource Area: Miles City District, Montana.

_____, 1984b, Resource management plan/EIS, draft and final, Powder River Resource Area: Miles City District, Montana.

_____, 1985a, Final northwest area noxious weed control program EIS: Oregon State Office, Portland, Oregon.

_____, 1985b, Resource management plan/EIS, draft and final, South Dakota Resource Area: Miles City District, Montana.

_____, 1986a, Draft supplement to the northwest area noxious weed control program final EIS: Oregon State Office, Portland, Oregon.

_____, 1986b, Montana bald eagle management plan, prepared in cooperation with the Montana Bald Eagle Workshop Group: Montana State Office, Billings, Montana, 61 p.

_____, 1987a, Draft supplement to the northwest area noxious weed control program final EIS: Oregon State Office, Portland, Oregon.

_____, 1987b, Riparian area management policy: national policy statement, January 22, 1987.

_____, 1988, Final wilderness EIS for the Billings Resource Area, Billings, Montana: Miles City District, Montana.

_____, 1989, Final Powder River Wilderness EIS for the Powder River Resource Area: Miles City District, Montana.

_____, 1990a, Bull Mountains Exchange, final EIS: Miles City District, Montana, p. 72-76.

_____, 1990b, Draft Blackleaf EIS, Great Falls Resource Area: Lewistown District, Montana.

_____, 1991, Final EIS vegetation treatment on BLM lands in thirteen western states: Wyoming State Office, Cheyenne, Wyoming.

U. S. Department of the Interior Bureau of Land Management and U. S. Department of Agriculture Forest Service, 1983a, Riley Ridge natural gas project air resources technical report: Rock Springs District, Wyoming.

_____, 1983b, Riley Ridge natural gas project, draft EIS, Sublette, Lincoln, and Sweetwater Counties, Wyoming: Cheyenne, Wyoming.

_____, 1989a, Surface operating standards for oil and gas exploration and development (3d ed), "Gold Book": 45 p.

_____, 1989b, Rocky Mountain Regional Coordinating Committee, Uniform format for oil and gas lease stipulations: 16 p.

U. S. Department of the Interior Bureau of Land Management and North Dakota State Department of Health and Consolidated Laboratories, 1990, Williston Basin regional air quality study.

U. S. Department of the Interior Fish and Wildlife Service, 1978, Terrestrial habitat evaluation criteria handbook Ecoregion M3113, South Rocky Mountains.

_____, 1984, American peregrine falcon recovery plan (Rocky Mountain/southwest population), prepared in cooperation with the American Peregrine Falcon Recovery Team: Denver, Colorado, 105 p.

_____, 1989, internal report, Helena, Montana.

_____, 1990, Draft guidelines for oil and gas activities in prairie dog ecosystems managed for black-footed ferret recovery: Denver, Colorado, 29 p.

U. S. Department of the Interior Minerals Management Service, Royalty Management Program, 1991, County production reports for 1988, 1989, 1990 (unpublished).

U. S. Department of the Interior National Park Service, 1982, Lewis and Clark National Historic Trail comprehensive plan for management and use: 168 p.

U. S. Environmental Protection Agency, 1974, Information on levels of environmental noise requisite to protect public health and welfare with an adequate margin of safety, EPA 550/9-74-004: Environmental Protection Agency, Washington, D. C.

_____, 1987, Criteria document for sulfur dioxide: published in U. S. Federal Register, July l, pertaining to Code of Federal Regulations (40 CFR 50, 51, 52, 53, 58): Washington, D. C.

Wallestad, R. O., and Pyrah, D., 1974, Movement and nesting of sage grouse hens in central Montana: Journal of Wildlife Management, 38:630-633.

Wallestad, R. O., and Schladweiler, P., 1974, Breeding season movements and habitat selection of male sage grouse: Journal of Wildlife Management, 38:634-637.

Wallwork, S. J., and Johnson, Maxine, 1986, Natural resource development in Montana: University of Montana, Bureau of Business and Economic Research, 73 p.

Wing, M. E., 1938, A structural survey of the Pierre Gas Field, South Dakota: South Dakota State Geological Survey, Report of Investigations No. 29, 20 p.

Youmans, H. B., and Swenson, J. E., 1982, Winter distribution of habitat use by mule deer and white-tailed deer in southeastern Montana, Appendix to Big Game Survey and Inventory (Deer) Region Seven, Progress Report W-130-R-13, Job 1-7: Montana Department of Fish, Wildlife and Parks, 17 p.

INDEX