

ERRATA

OIL AND GAS LEASING FINAL ENVIRONMENTAL IMPACT STATEMENT  
WITH APPENDICES

PIKE AND SAN ISABEL NATIONAL FORESTS  
CIMARRON AND COMANCHE NATIONAL GRASSLANDS

Chapter II

- Page II-32 Last paragraph, last sentence, change 135,031.95 acres to 290,397 acres. The original number reflected only acres currently leased on the grasslands and did not include those currently leased on the forest.
- Page II-33 Table II-10: Replace with attached Table II-10: Acres shown for NFS lands currently leased did not include those on the Forest. Acres shown for split-estate lands currently leased erroneously included pending lease applications.
- Page II-35 Table II-11: Change title to read, "Availability of NFS Lands for Leasing Leasing by Alternative".
- Page II-35 Add attached Table II-11a. Split-estate lands were erroneously omitted in Table II-11.

APPENDIX D

A No Surface Occupancy Stipulation was inadvertently shown on map for the following Special Use Sites. Special Use Sites are covered under Standard Lease Terms with an attached Lease Notice for protection of prior rights.

<u>Site Name</u>	<u>Location</u>
Jackson Creek Summer Home Group	T9S,R69W,S26
Bell Rock Summer Home Group	T10S,R70W,S25
Payne Gulch Summer Home Group	T7S,R73W,S36
Campo Sportsmen Target Range	T33S,R46W,S34
Buffalo Creek Gun Club	T8S,R71W,S19,20
Columbine Bowmen Target Range	T8S,R69W,S8,9
Cimarron Sportsmen Target Range	T35S,R42W,S10
Springfield TV Translator	T31S,R46W,S7

Note: None of these changes affect the decision being made in the Record of Decision.

**Table II-10**  
**Alternative IV - Land Distribution by Management Requirement**  
**National Forests and National Grasslands**

Management Requirement	Acres Leased
Total acres available for Oil and Gas Leasing	0
NFS Acres Currently Leased	290,397
Split-Estate Acres Currently Leased	
Federal Land/Private Minerals	6,476
Federal Minerals/Private Land	6,529
Total Acres Currently Leased	303,402

**Table II-11a  
Availability of Lands for Leasing by Alternative**

<b>PROPOSED CONSTRAINTS SPLIT-ESTATE LANDS</b>	<b>Alt. I Acres</b>	<b>Alt. II Acres</b>	<b>Alt. III Acres</b>	<b>Alt. IV Acres</b>
<b>Standard Lease Terms</b>	107,937	107,937	60,326	0
<b>Supplemental Stipulations</b> Controlled Surface Use Timing Limitation No Surface Occupancy			40,589 23,553 1,063	
<b>Total Supplemental Stipulations *</b>	0	0	65,205	0
<b>Discretionary No Lease</b>	0	0	0	0
<b>Total Acres Available for Oil and Gas Leasing</b>	107,973	107,973	107,973	0

Note: \* Some stipulations overlap, therefore, the total may add up to more than the total acres administratively available.



United States  
Department of  
Agriculture

**FOREST SERVICE**  
Pueblo, Colorado



# FINAL *OIL and GAS LEASING* ENVIRONMENTAL IMPACT STATEMENT

PIKE and SAN ISABEL NATIONAL FORESTS  
COMANCHE and CIMARRON NATIONAL GRASSLANDS



Cooperating Agency:  
USDI BUREAU OF LAND MANAGEMENT

**DECEMBER 1991**

## **FINAL ENVIRONMENTAL IMPACT STATEMENT**

### **Oil and Gas Leasing on the Pike and San Isabel National Forests Cimarron and Comanche National Grasslands**

Clear Creek, Douglas, Jefferson, Chaffee, Custer, Fremont, Lake, Park, El Paso, Pueblo, Teller, Huerfano, Baca, Las Animas, Otero Counties in the State of Colorado. Morton and Stevens Counties in Kansas.

**Lead Agency:** USDA Forest Service

**Cooperating Agencies**

USDI Bureau of Land Management  
Canon City District Office  
3170 E. Main  
PO Box 2000  
Canon City, Colorado 81212

USDI Bureau of Land Management  
9522-H E. 47th Place  
Tulsa, Oklahoma 74145

**Responsible Official:** Jack Weissling, Forest Supervisor  
Pike and San Isabel National Forests  
Cimarron and Comanche National Grasslands  
1920 Valley Drive  
Pueblo, Colorado 81008

**For further information  
Contact:** Dan Bishop  
Soil, Water, Mineral, Engineering Staff Officer  
Pike and San Isabel National Forests  
Cimarron and Comanche National Grasslands  
1920 Valley Drive  
Pueblo, Colorado 81008

**Abstract:** The final Environmental Impact Statement documents the analysis of four alternatives developed for possible management of oil and gas leasing on the 2.7 million acres administered by the Pike and San Isabel National Forests, Cimarron and Comanche National Grasslands. The alternatives are: I) current Forest Plan direction which makes all lands available without the identification of supplemental protection needs until a lease is identified and further analyzed; II) leasing all currently available lands using standard lease terms; III) leasing approximately 829,000 acres using standard lease terms, 1,272,000 acres using supplemental stipulations, and discretionarily removing 100,000 acres from leasing; IV) removing all lands on the Unit from leasing. The document also discloses the information necessary for the Forest Supervisor to determine those specific lands that will be authorized for leasing. These decisions will be documented in a separate Record of Decision which will also amend the Forest Plan.

The appeal period is 45 days and begins the day the decision is published.

# **TABLE OF CONTENTS**

## TABLE OF CONTENTS

### CHAPTER I - PURPOSE AND NEED

Purpose	I-1
Decisions to be Made	I-2
Lands Involved	I-2
Oil and Gas Development, A Snapshot	I-5
Historical Program	I-5
Oil and Gas Field Development	I-7
Preliminary Investigations	I-7
Exploratory Drilling	I-7
Development	I-11
Production	I-14
Abandonment	I-14
Dry Hole Abandonment	I-14
Abandonment of Depleted Production Wells	I-14
Background	I-14
Lease	I-14
Competitive and Noncompetitive Leases	I-15
Competitive Leases	I-15
Noncompetitive Leases	I-16
Lease Restrictions	I-16
Standard Lease Terms	I-16
Supplemental Stipulations	I-17
Federal Oil and Gas Leasing Process	I-17
Prior to the 1987 Leasing Reform Act	I-17
After the Reform Act	I-17
The Regulations Implementing the Reform Act	I-18
The Staged Decision Process	I-22
Stage one, Lands Available for Leasing	I-23
Stage two, Leasing Decisions for Specific Lands	I-23
Stage three, Application for Permission to Drill	I-23
Stage four, Amendment to APD	I-23
Impacts of a Lease	I-24
NEPA Requirements	I-24
The Analysis Process	I-26
Identification and Mapping of the Surface Land	I-26
Alternative Land Availability Patterns	I-26
Projection of Reasonably Foreseeable Development	I-28
Land Availability Decision	I-28
Application of RFD	I-29
Lands Likely to be Developed	I-29
Lands Unlikely to be Developed	I-30
Consent	I-31
Application for Permit to Drill	I-31
The Need for These Decisions	I-32
Outstanding Requests for Lease	I-32
Renewal Decisions for Existing Leases	I-32
Anticipated Lease Requests	I-32
Context of the Decisions	I-33

Geographical Context	I-33
The Forest Plan Context	I-33
Programmatic versus Project, or Site-Specific	I-33
Standards and Guidelines	I-34
Tiering	I-34
Current Forest Plan Direction	I-34
Forest Plan Amendments	I-35
Current Bureau of Land Management Direction	I-35
Authority of the Forest Supervisor to Make the Decisions	I-36
General Mining Law of 1872	I-36
Mineral Resources on Weeks Law Lands	I-36
Reorganization Plan No. 3 of 1946	I-36
Mineral Leasing Act for Acquired Lands of August 7, 1947	I-37
Energy Security Act of June 30, 1980	I-37
The Federal Onshore Oil and Gas Leasing Reform Act	
of December 22, 1987	I-37
Organic Act	I-37
Multiple-Use Sustained-Yield Act	I-38
National Forest Management Act	I-38
National Environmental Policy Act	I-38
The Clean Air Act of 1970	I-38
The Endangered Species Act of 1973	I-38
Clean Water Amendments	I-39
Historic Preservation Act	I-39
Forest Service Role in Implementation	I-39
Sample Mapping Exercise	I-40
Public Notification and Public Involvement	I-51
Notification of the Proposed Actions	I-51
Scoping	I-51
Planning Record	I-52
Significant Environmental Issues	I-52
Notes	I-60

## **CHAPTER II - ALTERNATIVES**

Introduction	II-1
Formulation of Alternatives	II-1
Considerations that Remain Constant for all Alternatives	II-2
Reasonably Foreseeable Development (RFD)	II-2
Alternatives Considered in Detail	II-4
Alternative I - Current Management (No Action)	II-4
Alternative II - All NFS Lands Available for Standard	
Development	II-15
Alternative III - NFS Lands Available for Lease with	
Both Standard and Stipulated Terms	II-24
Alternative IV - No NFS or Split-Estate Lands Available	
for Leasing	II-32
Alternative Considered and Eliminated from Detailed Study	II-33
Comparison of Alternatives	II-34
The Proposed Action	II-37
Amendment to the Land and Resource Management Plan	II-37
Footnotes	II-38

## CHAPTER III - AFFECTED ENVIRONMENT

Introduction	III-1
Unit-Wide Description of Affected Environment (Level 1)	III-5
Location	III-5
Social and Economic Setting	III-5
Physical and Biological Setting	III-6
Climate	III-6
Air Quality	III-7
Sub-Unit Description of the Affected Environment (Level 2)	III-7
The Mountain Environment (National Forests)	III-7
Vegetation	III-7
Soils	III-7
Water	III-8
Surface Water	III-8
Ground Water	III-9
Wildlife and Fishery Resources	III-10
Wildlife	III-10
Fishery Resources	III-11
Riparian Resources	III-11
Alpine	III-12
Threatened and Endangered Species	III-12
Range Resource	III-13
Visual Resource	III-13
Cultural, Paleontological and Cave Resources	III-13
Prehistoric Resources	III-14
Historic Resources	III-15
Paleontological Resources	III-16
Cave Resources	III-16
Recreation	III-17
Developed Recreation	III-18
Dispersed Recreation	III-18
Wilderness	III-19
Special Areas	III-20
Wild and Scenic Rivers	III-20
Experimental Areas	III-20
Research Natural Areas	III-21
Special Interest Areas	III-21
Withdrawals	III-22
Mineral Resource	III-22
Mineral Potential	III-22
Historical Exploration and Production	III-23
Transportation	III-23
Special Uses	III-24
Existing Long-Term Special Uses	III-24
Short-Term Special Uses	III-24
Utility Corridors	III-24
The Grassland Environment (Cimarron and Comanche NG'S)	III-25
Vegetation	III-25
Soils	III-25
Water	III-25
Surface Water	III-25
Ground Water	III-26
Wildlife and Fishery Resources	III-26

Wildlife	III-26
Fishes	III-27
Riparian Resources	III-27
Threatened and Endangered Species	III-28
Range Resource	III-28
Visual Resource	III-28
Cultural, Paleontological, and Cave Resources	III-29
Prehistoric Resources	III-29
Historic Resources	III-30
Paleontological Resources	III-31
Cave Resources	III-32
Recreation	III-32
Special Areas	III-32
Wild and Scenic Rivers	III-32
Experimental Areas	III-33
Research Natural Areas	III-33
Special Interest Areas	III-33
Mineral Resources	III-33
Previous and/or Existing Oil and Gas Activities	III-34
Transportation	III-35
Special Uses	III-35
Existing Long-Term Special Uses	III-35
Geographic Zone Description of The Affected Env. (Level 3)	III-35
The Mountain Environment	III-41
Geographic Zone 1	III-41
Vegetation	III-41
Soils	III-41
Water	III-41
Wildlife and Fishery Resources	III-42
Riparian Resources	III-42
Alpine	III-42
Threatened and Endangered Species	III-43
Range Resource	III-43
Visual Resource	III-43
Cultural, Paleontological, and Cave Resource	III-43
Recreation	III-44
Transportation	III-44
Special Use	III-44
Geographic Zone 2	III-45
Geographic Zone 3	III-49
Geographic Zone 4	III-52
Geographic Zone 5	III-56
Geographic Zone 6	III-60
Geographic Zone 7	III-63
Geographic Zone 8	III-67
The Grassland Environment	
Geographic Zone 9	III-71
Geographic Zone 10	III-74
Geographic Zone 11	III-77
Geographic Zone 12	III-80
Geographic Zone 13	III-82

<b>RFD Well Sites - Affected Environment (Level 4)</b>	<b>III-87</b>
Introduction	III-87
The Mountain Environment	III-88
BLM	III-88
RFD	
Well 1	III-88
Well 2	III-89
Well 3	III-89
Well 4	III-89
Concentrated RFD (for Alternatives I and III)	III-91
Well 1R	III-91
Well 2R	III-91
Well 3R	III-92
Well 4R	III-92
Concentrated RFD (for Alternatives II and IV)	III-93
Well 1C	III-93
Well 2C	III-94
Well 3C	III-94
Well 4C	III-95
The Grassland Environment	III-96
Hard Lands	III-96
Sandy Lands	III-96
Canyon Lands	III-96
Riparian	III-96
Exhibits	III-98
Footnotes	III-123

#### **CHAPTER IV - ENVIRONMENTAL CONSEQUENCES**

Introduction	IV-1
Decisions to be Made	IV-1
Leasing Process	IV-2
Lessee Rights Granted During Leasing Process	IV-2
Speculative Nature of Oil/Gas	IV-2
Affected Environment	IV-3
Level of Detail	IV-3
Methodology	IV-4
On the Mountain District	IV-5
On the Grasslands	IV-5
Representative Wells	IV-5
Definitions	IV-6
Description of Alternatives	IV-6
Alternative I	IV-6
Alternative II	IV-7
Alternative III	IV-7
Alternative IV	IV-7
Environmental Consequences	IV-7
Representative Well Analysis	IV-7
Effects Common to All Alternatives	IV-9
Alternative I	IV-10
Alternative II & III	IV-10
Alternative IV	IV-10
Mountains	IV-10

Geographic Zone 1	IV-10
Well 1	IV-11
Representative Well Site	IV-11
Well Mitigation	IV-11
Access Road	IV-11
Road Mitigation	IV-11
Well 2	IV-11
Well 3	IV-12
Well 4	IV-14
Well 5	IV-14
Geographic Zone 2	IV-15
Well 6-9	
Geographic Zone 3	IV-19
Well 10-15	
Geographic Zone 4	IV-24
Well 16-19	
Geographic Zone 5	IV-28
Well 20-24	
Geographic Zone 6	IV-32
Well 25-28	
Geographic Zone 7	IV-35
Well 29-33	
Geographic Zone 8	IV-39
Well 34-41	
Grasslands-Comanche	IV-46
Geographic Zone 9	IV-46
Well 42-43	
Geographic Zone 10	IV-48
Well 44-46	
Geographic Zone 11	IV-50
Well 47-48	
Grasslands-Cimarron	IV-52
Geographic Zone 12	IV-52
Well 49-50	
Geographic Zone 13	IV-54
Well 51-53	
Effects of Management Alternatives	IV-57
RFD Well Analysis	IV-57
Comparing Alternatives	IV-57
Disturbed Acres	IV-57
Abandonment and Reclamation	IV-59
Effects Common to All Alternatives	IV-61
Comparison Alternatives by Resource	IV-62
Vegetation	IV-62
Soils	IV-64
Water	IV-69
Wildlife and Threatened and Endangered	
Plant and Animal Species	IV-72
Aquatic and Riparian	IV-75
Alpine	IV-77
Range	IV-78
Visual Resources	IV-79
Cultural, Paleontological and Cave Resources	IV-82

Recreation	IV-84
Research Natural Areas	IV-87
Special Uses	IV-88
<b>BLM RFD Effects Versus Concentrated RFD Effects on the Mountains</b>	<b>IV-89</b>
<b>Cumulative Effects</b>	<b>IV-90</b>
Affected Environment	IV-90
Past, Present, and Future Actions	IV-95
The Cumulative Effects	IV-95
Preferred Alternative (Alternative III)	IV-95
Mountains	
Oak Creek Area	IV-98
BLM RFD Well 1	
Rock Creek Area	IV-98
BLM RFD Well 2	
Rampart Area	IV-100
BLM RFD Well 3	
Beaver Creek Area	IV-103
BLM RFD Well 4	
Grasslands-Comanche	IV-105
Campo Area	IV-106
Vilas Area	IV-108
King Arroyo Area	IV-109
Grasslands-Cimarron	IV-111
Cimarron River Area	IV-111
North Fork Cimarron River Area	IV-114
Cumulative Effects of Alternatives I, II, IV	
Alternative I	IV-115
Alternative II	IV-116
Alternative IV	IV-116
<b>Irreversible and Irrecoverable Commitment of Resources</b>	
Vegetation	
Soils	
Water Quality	
Aquatic and Riparian	
Range	
Minerals	
<b>Summary by Alternative</b>	<b>IV-118</b>
Alternative I	IV-119
Alternative II	IV-119
Alternative III	IV-119
Alternative IV	IV-119
<b>Effects of Alternatives on Consumers, Civil Rights, Minority Groups and Women</b>	<b>IV-119</b>
<b>Effects of Alternatives on Prime Farm Land, Range Land and Forest Land</b>	<b>IV-120</b>
<b>Effects of Alternatives on Wetlands and Flood Plains</b>	<b>IV-120</b>
<b>Effects of Alternatives on Threatened and Endangered and Critical Habitat</b>	<b>IV-120</b>
<b>Effects of Alternatives on Cultural Resources</b>	<b>IV-120</b>
The Preferred Alternative	IV-120
Implementation of Site-Specific Decision	IV-121
<b>Footnotes</b>	<b>IV-122</b>

**CHAPTER V - LIST OF PREPARERS AND REVIEWERS**

V-1

**CHAPTER VI - PERSONS OR AGENCIES CONSULTED AND/OR RECEIVING COPIES OF THIS ENVIRONMENTAL IMPACT STATEMENT**

Introduction	VI-1
Part I Public Participation	VI-1
Part II List of Respondents and Letter Numbers	VI-2
Part III Response to Comments	VI-4
Part IV Letters from State and Federal Agencies	VI-33

**APPENDIX A - MITIGATION**

Introduction	A-1
Standard Lease Terms	A-2
Supplemental Stipulations	A-3
No Surface Occupancy Stipulation Guidance	A-3
Timing Limitation Stipulation Guidance	A-3
Controlled Surface Use Stipulation Guidance	A-3
Stipulations for use on the Unit	A-4
Supplemental Stipulation Descriptions	A-4
NSO - Cultural	A-6
NSO - Municipal Watersheds	A-8
NSO - Recreation	A-10
NSO - Riparian/Water/Fisheries	A-12
NSO - Soils	A-14
Timing - Wildlife	A-16
Timing - Wildlife (MIS)	A-18
CSU - Soils	A-20
CSU - Alpine	A-22
CSU - Special Area (NNL)	A-24
CSU - Visual	A-26
CSU - Water	A-28
Lease Notices	A-29
Lease Notice - Research/Special Interest Areas	A-30
Lease Notice - Special Uses	A-32
Lease Notice - Ski Areas	A-34
Lease Notice - Threatened & Endangered Species	A-36
Lease Notice - Vegetation (Timber)	A-38
Conditions of Approval	A-40
Standard COA's for Use on the Unit	A-40
Pre-activity Inventories	A-40
Mitigation Plans	A-41
General Conditions for all Site-Disturbing Activities	A-42
Road Construction and Operations	A-43
Drill Pad Development	A-44
Pits	A-45
Pipelines	A-46
Production	A-47
Reclamation	A-47
Split-Estate Mineral Resources	A-49
Bureau of Land Management Stipulations	A-49

Lease Notices	A-50
Conditions of Approval	A-51
Morton & Stevens Counties, Kansas, Analysis of Split-Estate Tracts for USFS (Including Reverted Tracts)	A-51
Exhibits A-1 through A-4	A-56-71
Notes	A-72

## APPENDIX B - ANTICIPATED ACTIVITY

Introduction	B-1
Determination of RFD	B-1
RFD Well Numbers	B-2
Levels of Development	B-2
Probable Locations of Development	B-2
RFD Drilling using Mineral Potential	B-3
Mountains	B-3
Well Distribution	B-3
Acres Disturbed	B-4
Grasslands	B-4
Cimarron Alternatives I, II, and IV	
Well Distribution	B-4
Acres Disturbed	B-4
Comanche Alternatives II and IV	B-5
Well Distribution	B-5
Acres Disturbed	B-5
Site Development	B-6
Access and Clearing	B-6
Facilities	B-6
Exploratory Well	B-6
Production	B-7
Gas	B-7
Oil	B-7
Maintenance & Operations	B-7
Abandonment & Reclamation	B-8
Abandonment Rates	B-8
Reclamation Rates	B-8
Production Well Reclamation	B-9
Cimarron	B-9
Comanche	B-9
Exploratory Reclamation	B-9
Mountains	B-9
Grasslands	B-10
Cimarron Alternatives I, II and IV	B-10
Comanche Alternatives II and IV	B-11
Concentrated RFD	B-12
Alternatives II and IV	B-12
Acres Disturbed	B-12
Effects of Alternatives on RFD	B-13
Mountains	B-14
Relocated Concentrated RFD	B-14
Grasslands	B-15
Acres Disturbed	B-15
Reclamation	B-16

Cimarron Alternative III	B-16
Comanche Alternatives I and III	B-17
Cumulative Effects	B-18
Oil and Gas Post-Leasing Activity	B-18
Foreseeable Activity Relating to Existing Wells	B-18
Non-Oil and Gas Activities	B-18
BLM	B-19
RFD	
Cumulative Effects of All Activities	B-21
Exhibits B-1 and B-2	B-22
Notes	B-35
<b>APPENDIX C - MAPS OF LEASING STATUS</b>	<b>C-1</b>
<b>APPENDIX D - STIPULATION BASE MAP</b>	<b>D-1</b>
<b>APPENDIX E - RESOURCE MAPS</b>	<b>E-1</b>
<b>APPENDIX F - CONTENT SUMMARY OF ADMINISTRATIVE RECORD</b>	<b>F-1</b>
General Contents	F-1
Explanation of Pagination	F-1
Other Reference Material	F-2
<b>APPENDIX G - MONITORING AND EVALUATION</b>	
Air	G-1
Vegetation	G-2
Acres Suitable for Timber Production (Mountains Only)	G-2
Reclamation Plan	G-2
Five Year Reforestation	G-3
Alpine Areas	G-3
Threatened and Endangered Species	G-3
Riparian Resources	G-4
Fishery Resources	G-4
Recreation	G-4
Visual Resource	G-4
Cultural, Paleontological and Cave Resources	G-5
Research Natural Areas and Special Areas	G-5
Wildlife	G-5
Range Resource	G-6
Watershed Resource	G-6
Soils	G-7
Transportation System	G-7
Oil and Gas Resources	G-7
Notes	G-8
<b>APPENDIX H - SOCIO-ECONOMIC AND COST EFFICIENCY ANALYSIS</b>	
Social Resource Units	H-1

Front Range Social Resource Unit	H-1
South Platte HRU	H-4
Pikes Peak HRU	H-4
Arkansas Social Resource Unit	H-5
Leadville HRU	H-5
Salida HRU	H-6
South Park HRU	H-6
Sangre de Cristo-Wet Mountain HRU	H-7
Spanish Peaks HRU	H-8
Southern Plains Social Resource Unit	H-9
Comanche HRU	H-9
Cimarron HRU	H-9
Economic Impacts	H-10
IMPLAN Analysis	H-10
Cost Efficiency	H-11
Revenues Accruing to the Treasury	H-12
Lease Bonus Bids	H-12
Annual Rentals	H-13
Royalties	H-13
Grazing Fees	H-14
Timber Sale Revenues	H-14
Recreation User Fees	H-14
Incremental Costs to the Forest Service	H-15
Operation and Maintenance	H-15
General Administration	H-15
Capital Investments	H-16
Other Costs	H-16
Present Net Value and Discounted Revenue-Cost Ratios	H-16
Revenues	H-16
Discounted Revenues	H-19
Costs	H-19
Discounted Costs	H-20
Cost Efficiency Ranks	H-21
Notes	H-22
Bibliography	H-23

<b>APPENDIX I - MINERAL POTENTIAL MAPS</b>	<b>I-1</b>
--	------------

<b>ACRONYMS/GLOSSARY OF TERMS</b>	
Acronyms	II-1
Glossary	II-4

<b>INDEX</b>	<b>III-1</b>
--------------	--------------

#### **LIST OF FIGURES**

I-1	Vicinity Map	I-4
I-2	Lands Excluded From Analysis	I-6
I-3	Phases of Oil and Gas Development	I-8

I-4	Drill Casing	I-10
I-5	Commonly Seen Pumpjack	I-12
I-6	High Production Oil Well Site	I-13
I-7	Leasing Process Flow Chart	I-20
I-8	Lessee Rights Granted in the Process	I-21
I-9	Land Availability Patterns	I-27
I-10	Stipulation Base Map	I-42
I-11	Resource Base Quad Map	I-43
I-12	Resource Overlay 1 on Base Quad Map	I-44
I-13	Lease Stipulation	I-45
I-14	Resource Overlay 2 on Base Quad Map	I-46
I-15	Resource Overlay 3 on Base Quad Map	I-47
I-16	Lease Stipulation	I-48
I-17	Resource Overlay 4 on Base Quad Map	I-49
I-18	Lease Stipulation	I-50
II-1	BLM/Concentrated RFD Well Locations	II-5
II-2	BLM/Concentrated RFD Well Locations	II-6
II-3	Alternative I - Concentrated RFD Well Locations	II-7
II-4	Alternative I - BLM RFD Well Site 1	II-9
II-5	Alternative I - BLM RFD Well Site 2	II-10
II-6	Alternative I - BLM RFD Well Site 3	II-11
II-7	Alternative I - BLM RFD Well Site 4	II-12
II-8	Alternative I - Concentrated RFD Well Sites 1R-3R	II-13
II-9	Alternative I - Concentrated RFD Well Site 4R	II-14
II-10	Alternative II - BLM RFD Well Site 1	II-17
II-11	Alternative II - BLM RFD Well Site 2	II-18
II-12	Alternative II - BLM RFD Well Site 3	II-19
II-13	Alternative II - BLM RFD Well Site 4	II-20
II-14	Alternative II - Concentrated Well Sites 1C-3C	II-21
II-15	Alternative II - Concentrated Well Site 4C	II-22
II-16	Alternative III - DNL Areas	II-27
II-17	Alternative III - DNL Areas	II-28
II-18	Alternative III - DNL Areas	II-29
III-1	Affected Environment, Levels of Analysis	III-2
III-2	Location of Geographic Zones	III-4
III-3	Elevational Ranges of Vegetation	III-98
III-4	Geographic Zone Locations-North Portion	III-37
III-5	Geographic Zone Locations-South Portion	III-38
III-6	Geographic Zone Locations-Grasslands	III-39
IV-1	Well Site Locations	IV-8
IV-2	Cumulative Effects, Affected Environment, North Portion	IV-91
IV-3	Cumulative Effects, Affected Environment, South Portion	IV-92
IV-4	Cumulative Effects, Affected Environment, Grasslands	IV-93
A-1	BLM Form 3100-11 - Offer to Lease	A-56
C-1	Leasing Status-North Portion	C-3
C-2	Leasing Status-South Portion	C-4
C-3	Leasing Status-Grasslands	C-5

E-1	Resource Map-North Portion-Soil & Water	E-3
E-2	Resource Map-North Portion-Dev. Rec & Visuals	E-4
E-3	Resource Map-North Portion-Wildlife & Special Areas	E-5
E-4	Resource Map-North Portion-Fish & Cultural	E-6
E-5	Resource Map-South Portion-Water & Soil	E-7
E-6	Resource Map-South Portion-Dev. Rec & Visuals	E-8
E-7	Resource Map-South Portion-Wildlife & Special Areas	E-9
E-8	Resource Map-South Portion-Fish & Cultural	E-10
E-9	Resource Map-Grasslands-Water & Soil	E-11
E-10	Resource Map-Grasslands-Dev. Rec & Visuals	E-12
E-11	Resource Map-Grasslands-Wildlife & Special Areas	E-13
E-12	Resource Map-Grasslands-Fish & Cultural	E-14
H-1	SRU General Locations	H-2
H-2	HRU General Locations	H-3
H-3	Generic Yearly Revenue Stream	H-18
I-1	Mineral Potential-North Portion	I-2
I-2	Mineral Potential-South Portion	I-3
I-3	Mineral Potential-Cimarron and Comanche NGs	I-4

#### LIST OF TABLES

I-1	Lands Excluded From Analysis	I-5
I-2	Location of Information Within This Document	I-25
II-1	RFD for the National Grasslands	II-3
II-2	Alternative I-Well Disturbance Acres, National Forests	II-15
II-3	Alternative I-Well Distribution and Disturbance Acres, National Grasslands	II-15
II-4	Alternative II-Land Distribution by Management Requirement National Forests and National Grasslands	II-23
II-5	Alternative II-Well Disturbance Acres, National Forests	II-23
II-6	Alternative II-Well Distribution and Disturbance Acres, National Grasslands	II-23
II-7	Alternative III-Land Distribution by Management Requirement National Forests and National Grasslands	II-31
II-8	Alternative III-Well Disturbance Acres, National Forests	II-31
II-9	Alternative III-Well Distribution and Disturbance Acres National Grasslands	II-32
II-10	Alternative IV-Land Distribution by Management Requirement, National Forests and National Grasslands	II-33
II-11	Availability of Lands for Leasing by Alternative	II-35
II-12	Alternative Comparison	II-36
II-13	Conformance with Direction and Policy	II-36
III-1	Vertebrate Species - Mountains	III-10
III-2	Acres by ROS Class	III-18
III-3	Special Interest Areas, P&SI National Forests	III-21
III-4	Withdrawals	III-22
III-5	Forest Road Summary, Miles	III-23

III-6	Vertebrate Species - Grasslands	III-27
III-7	1990 Grazing Use	III-28
III-8	BLM RFD Well Descriptions	III-88
III-9	Concentrated RFD Well Descriptions, Alternatives I & III	III-91
III-10	Concentrated RFD Well Descriptions, Alternatives II & IV	III-93
III-11	Visual Quality Objectives	III-107
III-12	Inventoried Visual Quality Objectives	III-108

IV-1	Well 1 USLE Predicted Surface Erosion	IV-11
IV-2	Well 2 USLE Predicted Surface Erosion	IV-12
IV-3	Well 3 USLE Predicted Surface Erosion	IV-13
IV-4	Well 4 USLE Predicted Surface Erosion	IV-14
IV-5	Well 5 USLE Predicted Surface Erosion	IV-15
IV-6	Well 6 USLE Predicted Surface Erosion	IV-16
IV-7	Well 7 USLE Predicted Surface Erosion	IV-17
IV-8	Well 8 USLE Predicted Surface Erosion	IV-18
IV-9	Well 9 USLE Predicted Surface Erosion	IV-19
IV-10	Well 10 USLE Predicted Surface Erosion	IV-20
IV-11	Well 11 USLE Predicted Surface Erosion	IV-21
IV-12	Well 12 USLE Predicted Surface Erosion	IV-21
IV-13	Well 13 USLE Predicted Surface Erosion	IV-22
IV-14	Well 14 USLE Predicted Surface Erosion	IV-23
IV-15	Well 15 USLE Predicted Surface Erosion	IV-24
IV-16	Well 16 USLE Predicted Surface Erosion	IV-25
IV-17	Well 17 USLE Predicted Surface Erosion	IV-26
IV-18	Well 18 USLE Predicted Surface Erosion	IV-27
IV-19	Well 19 USLE Predicted Surface Erosion	IV-28
IV-20	Well 20 USLE Predicted Surface Erosion	IV-29
IV-21	Well 21 USLE Predicted Surface Erosion	IV-29
IV-22	Well 22 USLE Predicted Surface Erosion	IV-30
IV-23	Well 23 USLE Predicted Surface Erosion	IV-31
IV-24	Well 24 USLE Predicted Surface Erosion	IV-32
IV-25	Well 25 USLE Predicted Surface Erosion	IV-33
IV-26	Well 26 USLE Predicted Surface Erosion	IV-33
IV-27	Well 27 USLE Predicted Surface Erosion	IV-34
IV-28	Well 28 USLE Predicted Surface Erosion	IV-35
IV-29	Well 29 USLE Predicted Surface Erosion	IV-36
IV-30	Well 30 USLE Predicted Surface Erosion	IV-36
IV-31	Well 31 USLE Predicted Surface Erosion	IV-37
IV-32	Well 32 USLE Predicted Surface Erosion	IV-38
IV-33	Well 33 USLE Predicted Surface Erosion	IV-39
IV-34	Well 34 USLE Predicted Surface Erosion	IV-40
IV-35	Well 35 USLE Predicted Surface Erosion	IV-41
IV-36	Well 36 USLE Predicted Surface Erosion	IV-42
IV-37	Well 37 USLE Predicted Surface Erosion	IV-42
IV-38	Well 38 USLE Predicted Surface Erosion	IV-43
IV-39	Well 39 USLE Predicted Surface Erosion	IV-44
IV-40	Well 40 USLE Predicted Surface Erosion	IV-45
IV-41	Well 41 USLE Predicted Surface Erosion	IV-46
IV-42	Well 42 USLE Predicted Surface Erosion	IV-47

IV-43	Well 43 USLE Predicted Surface Erosion	IV-48
IV-44	Well 44 USLE Predicted Surface Erosion	IV-48
IV-45	Well 45 USLE Predicted Surface Erosion	IV-49
IV-46	Well 46 USLE Predicted Surface Erosion	IV-50
IV-47	Well 47 USLE Predicted Surface Erosion	IV-51
IV-48	Well 48 USLE Predicted Surface Erosion	IV-52
IV-49	Well 49 USLE Predicted Surface Erosion	IV-53
IV-50	Well 50 USLE Predicted Surface Erosion	IV-54
IV-51	Well 51 USLE Predicted Surface Erosion	IV-55
IV-52	Well 52 USLE Predicted Surface Erosion	IV-55
IV-53	Well 53 USLE Predicted Surface Erosion	IV-56
IV-54	Site-specific Well Locations by Alternative	IV-58
IV-55	Grassland Disturbed Acres by Alternative	IV-59
IV-56	Reclaimed/Unreclaimed Acres for Each Alternative	IV-60
IV-57	Predicted Soil Loss	IV-67
IV-58	Total Delivered Sediment (Tons/year) Mountains	IV-70
IV-59	BLM RFD Well 1 - Past, Present & Future Activities	IV-96
IV-60	BLM RFD Well 2 - Past, Present & Future Activities	IV-98
IV-61	BLM RFD Well 3 - Past, Present & Future Activities	IV-100
IV-62	BLM RFD Well 4 - Past, Present & Future Activities	IV-103
IV-63	Campo Area - Past, Present & Future Activities	IV-106
IV-64	Vilas Area - Past, Present & Future Activities	IV-108
B-17	Acres Disturbed - Grasslands	B-15
B-18	RFD Wells by Soil/Ecotype-Cimarron NG	B-16
B-19	Reclamation Figures-Cimarron NG	B-16
B-20	RFD Wells by Soil/Ecotype-Comanche NG	B-17
B-21	Reclamation Figures-Comanche NG	B-17
B-22	Total Affected Acres-Mountains	B-21
B-23	Total Affected Acres-Comanche NG	B-21
B-24	Total Affected Acres-Cimarron NG	B-21
H-1	Comparison of Leasing Profiles by Alternative	H-13
H-2	Summary of Receipts to the Federal Treasury	H-18
H-3	Discounted Values of Revenues-At a 4.0% Discount Rate	H-19
H-4	Summary of Federal Expenditures	H-20
H-5	Discounted Value of Costs-At a 4.0% Discount Rate	H-20
H-6	Present Net Value and Net Revenue/Cost Ratio	H-21
H-7	Cost Efficiency Ranking of Alternatives	H-21

**LIST OF EXHIBITS**

I-1	Oil and Gas Lease Monitoring	I-55
III-1	Major Vegetation Types - Forests and Grasslands	III-98
III-2	Mountain Vegetation Types	III-99
III-3	Management Indicator Species	III-102
III-4	Summary of Riparian Area Acres	III-103
III-5	Threatened and Endangered Wildlife Species	III-104
III-6	Threatened and Endangered Plant Species	III-105
III-7	Suitable Acres for Range and Permitted Use-Mountain Env.	III-106

III-8	Visual Quality Objectives and Evaluation Criteria	III-107
III-9	Cultural Properties Listed on Historic National Registers	III-109
III-10	Significant Properties/Resources - Culture, American Indian Religious Sites, Paleontological, Caves	III-110
III-11	Summary of Total Recreation Use, P&SI National Forests	III-112
III-12	ROS Activity Characterizations	III-113
III-13	Recreation Opportunity Spectrum Class, Composition and Use; Percent Use by ROS Class and Type of Use	III-114
III-14	Long-Term Special Use Authorizations-Mountain Environment	III-115
III-15	Grassland Vegetation Types	III-116
III-16	Long-Term Special Use Authorizations-Grassland Environment	III-117
III-17	Vegetation Summaries - Mountain Environment	III-118
III-18	Summary of Alpine Area Acres	III-120
III-19	Special Uses-Mountain and Grassland Environment	III-121
A-1	Standard Lease Terms	A-56
A-2	Developed Recreation Sites on the Unit	A-59
A-3	Active Timber Sales	A-67
A-4	Planned Timber Sales	A-70
B-1	BLM Evaluation	B-22
B-2	Analysis and BLM Concurrence	B-29
D-1	Well Site Locations	D-95

# CHAPTER I

# **CHAPTER I**

## **PURPOSE AND NEED**

### **PURPOSE**

The purpose of this Environmental Impact Statement is to disclose the effects of alternative decisions the Forest Service may make to lease lands of the Pike and San Isabel National Forests and the Comanche and Cimarron National Grasslands for oil and gas exploration and development. Throughout this document we shall refer to these lands as the "Unit".

Oil and natural gas are important resources for the people of the United States. They are the primary sources of energy for most mechanical equipment, lighting, heat, transportation, communications, and production of food. Petroleum products are important components in agriculture, medicine, and manufacturing of fibers and plastics. The federal government seeks to reduce its dependency on oil and gas from other nations by continuing to locate and develop its own reserves. Firms in the oil and gas industry continually seek new deposits of oil or gas, or seek to profitably extract the resources from previously uneconomical deposits.

This EIS will describe and explain the leasing decisions the Forest Supervisor will make. It will explain how the Forest Supervisor and the State Director of the BLM will implement the decisions to authorize and sell leases and how future decisions will be made to issue permits to drill and develop fields of oil and gas. The environmental significance of each of these decisions, and measures the Forest Service will use to assure protection of the quality of the human environment will also be displayed.

It is important to explain the decisions required by the Leasing Reform Act, but the basic purpose of this document is to disclose the environmental effects of decisions the Forest Supervisor is considering for managing the oil and gas leasing and development programs on the Pike and San Isabel National Forests and the Comanche and Cimarron National Grasslands. This EIS describes:

- the significant environmental issues involved in these decisions,
- the nature of the lands and environmental conditions of the Unit,
- alternative patterns of land which could be available for leasing based on resource protection levels,
- stipulations to be applied based on resource values, and
- the direct, indirect and cumulative environmental consequences of these alternatives.

## **DECISIONS TO BE MADE**

The Supervisor of the Unit will make three related decisions in a Record of Decision that will accompany the final Environmental Impact Statement (EIS). The first decision will identify which lands will be administratively available for leasing to private individuals or firms and the stipulations that must be applied to their respective leases. The second decision will identify the specific lands the Bureau of Land Management will be authorized to lease upon the review of an identified lease parcel. The third decision will be to make an amendment to the Forest Land and Resource Management Plan (FLRMP or Forest Plan) for the Unit.

The Bureau of Land Management (BLM) is responsible for the management of sub-surface activities of all federally owned leasable minerals. The BLM, acting for the Secretary of the Interior, may lease the National Forest System (NFS) lands identified in the decision of the Forest Supervisor. Authorized leases will include the standard terms placed on federal oil and gas leases and may include special stipulations designed to protect the surface resources. Special stipulations can provide a broad range of restrictions, with the most severe requiring that drilling rigs, other equipment, and roads do not occupy the surface of the lease area. The Forest Supervisor will decide what types of stipulations are required for each area of land, and what modifications are required to the Forest Plan. These modifications may include changes to the Forest Plan goals and objectives, management areas, or standards and guidelines needed to accommodate the Leasing Decisions.

The Record of Decision will be accompanied by a series of maps that will be used in implementation. Information disclosed on the maps will include the resource values being protected and the stipulations required to provide the protection. The maps will not be generally distributed but will be available for review at the Denver office of the BLM and the Pueblo office of the Forest Service. Maps related to specific Ranger Districts will be on file at each District Office.

## **LANDS INVOLVED**

The Pike and San Isabel National Forests were administratively combined in 1973 and have 2,752,378 acres of NFS land. The eastern boundary of the Pike is roughly on a line along the Front Range of the Rockies between Mt Evans on the north and Pikes Peak on the south. The Forest then extends west to the crest of the Mosquito Range between Antero Jct on the south and Mt. Lincoln on the north.

The San Isabel is in three separate blocks. The easternmost straddles the Wet Mountains from just south of Canon City to the south end of the mountain range northwest of Walsenburg. The southernmost parcel is a compact block extending from the Spanish Peaks on the east to the crest of the Sangre de Cristo range on the west. The remaining and largest parcel begins at Tennessee Pass north of Leadville and extends southward between the Continental Divide and the crest of the Mosquito Range to near Salida. From there it extends south along the east side of the Sangre de Cristo range to Blanca Peak.

Lands in southeastern Colorado and southwestern Kansas were made part of the San Isabel National Forest in 1954 and named the Comanche and Cimarron National Grasslands in 1960. The Comanche National Grassland is in southeastern Colorado from La Junta southeast to Springfield

and the Kansas and Oklahoma state lines. The Cimarron Grassland is in the southwestern part of the state of Kansas, in the vicinity of Elkhart, and are bordered by the Colorado and Oklahoma state lines [see Figure I-1].

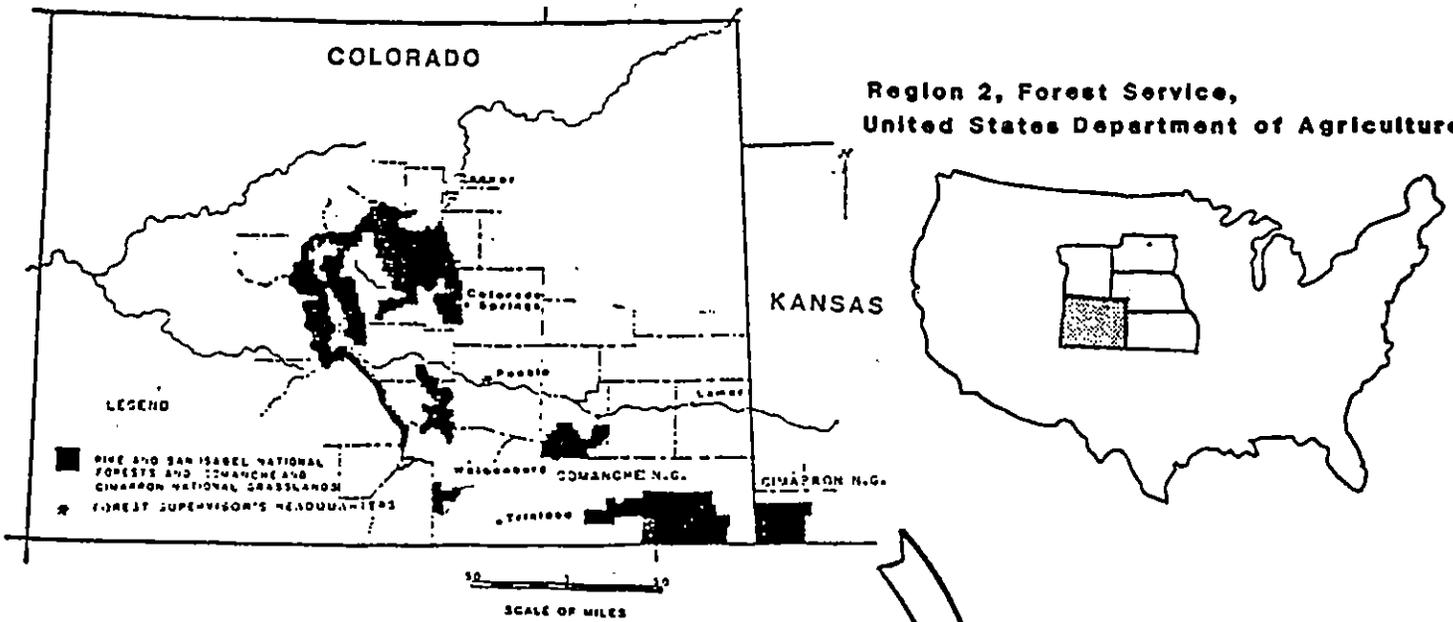
The Forest is characterized by a large amount of intermingled ownership with adjacent landowners including private individuals, corporations, the State of Colorado and Bureau of Land Management.

The current Forest Plan makes the majority of lands on the Forest available for oil and gas leasing using Standard Lease Terms without the identification of stipulations or any site-specific analysis. Slopes over 60% with high geologic hazard ratings and watersheds with extreme sedimentation problems have special management requirements. Some lands have been precluded from mineral development through legislative action or a formal withdrawal process. Some lands within the Forest boundary are also not under the jurisdiction of the Deciding Officer. These lands are displayed in Table I-1 and Figure I-2. None of these lands will be analyzed for availability. They, and the reason they are not being analyzed are:

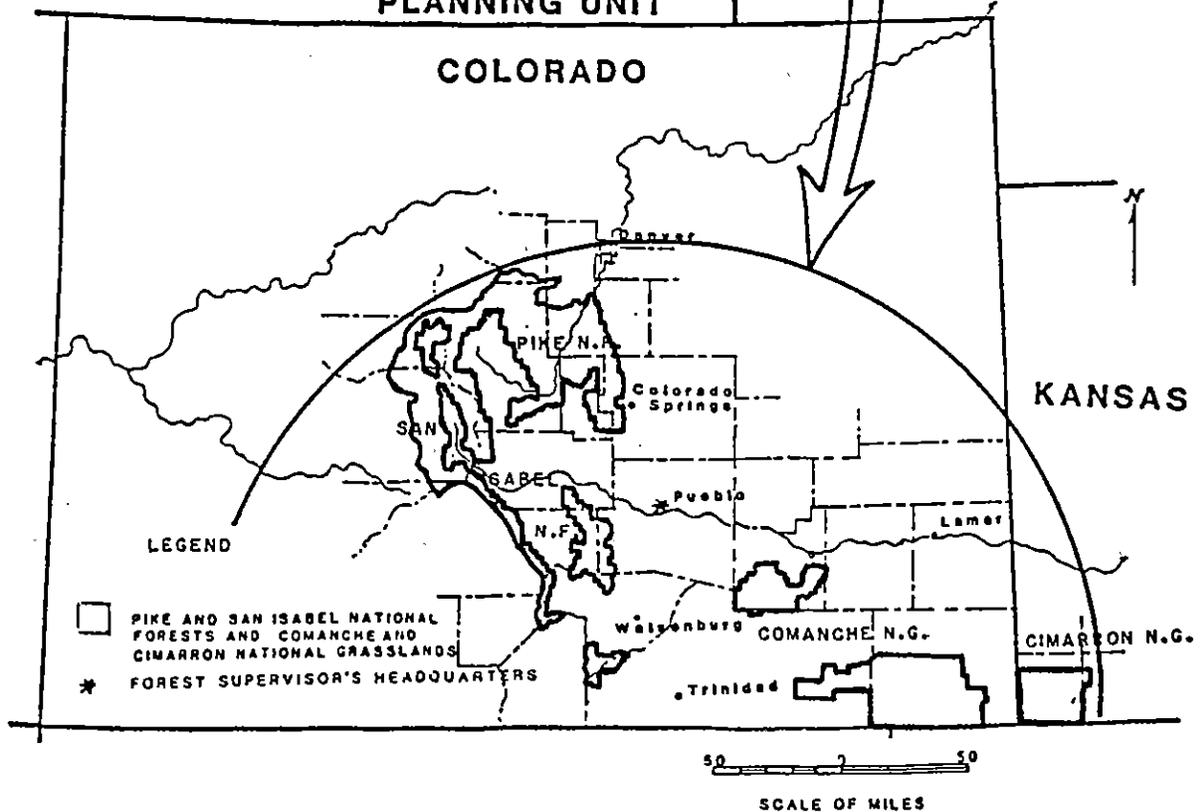
- Lands with non-federal minerals - no authority to lease
- Designated Wilderness Areas - legislatively withdrawn
- Wilderness Study Areas - withdrawn per Federal Onshore Oil and Gas Leasing Reform Act
- Identified Special Areas - reserved or no authority to lease

Figure I-1  
Vicinity Map

Region 2, Forest Service,  
United States Department of Agriculture



GENERAL LOCATION MAP  
PLANNING UNIT



**Table I-1  
Lands Excluded From Analysis**

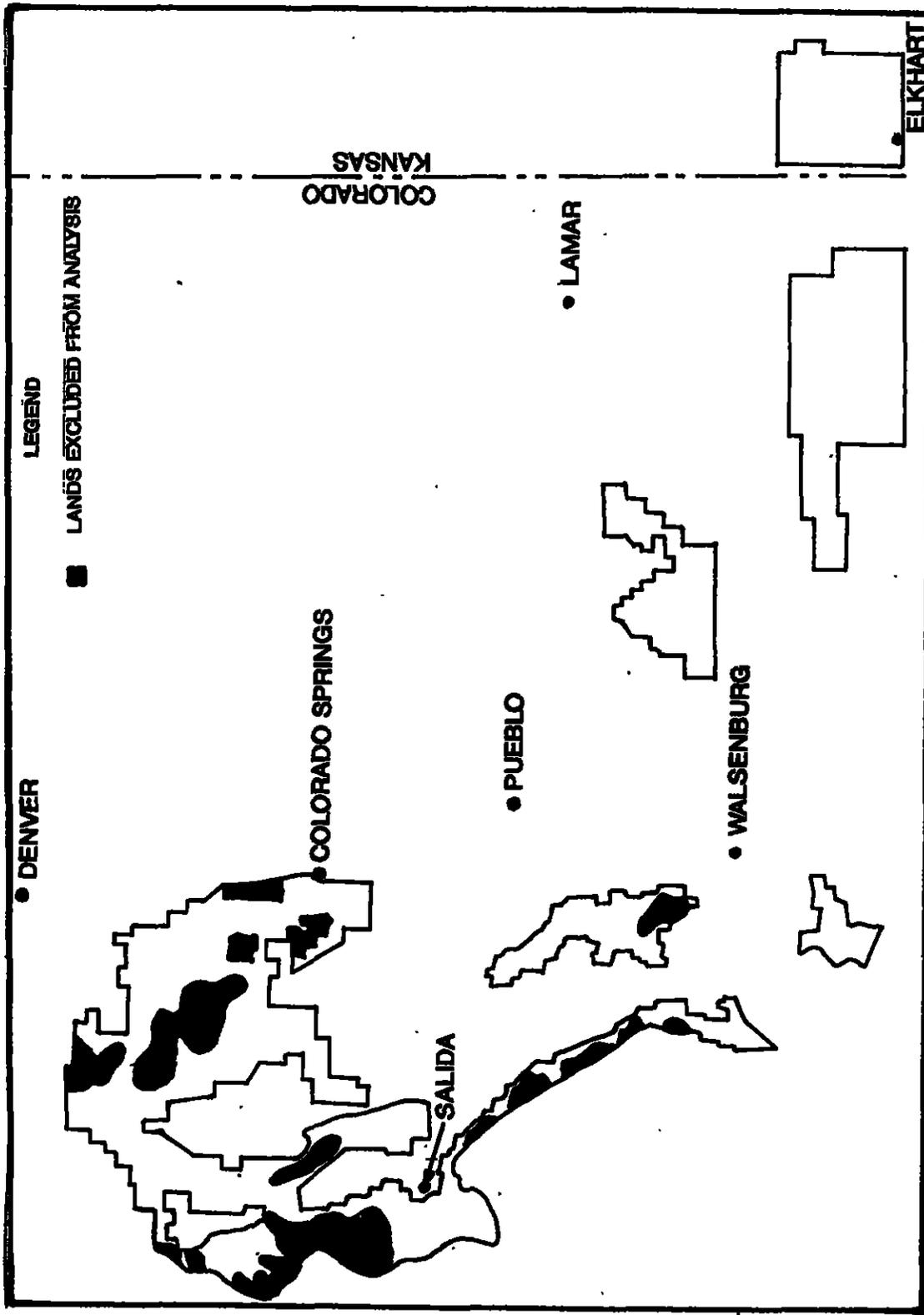
Designation	Acres
NFS Lands With Non-federal Minerals	134,014
Designated Wilderness:	
Collegiate Peaks	82,248
Mt. Massive	27,980
Lost Creek	105,090
Mt. Evans	34,127
Holy Cross	9,489
Wilderness Study Areas:	
Buffalo Peaks	36,060
Sangre de Cristo	61,657
Greenhorn Mtn.	22,300
Special Areas:	
U.S. Air Force Academy	8,859
Manitou Municipal Watershed	4,722
Colo. Springs Watershed	9,514
Manitou Experimental Forest	14,812
<b>TOTAL ACRES EXCLUDED FROM ANALYSIS</b>	<b>550,872</b>

## OIL AND GAS DEVELOPMENT, A SNAPSHOT

### Historical Program

*Activities relating to oil and gas exploration and development have been allowed after approval of an Application for Permit to Drill (APD) and a Surface Use Plan of Operations (SUPO). The authorized activities that have occurred in the past 45 years are a good indication of the level of activity that we may continue to expect. The leasing and development program on the Unit has been concentrated on the Cimarron and Comanche National Grasslands. There are 23 producing oil and gas fields on the Cimarron. It overlies one of the world's largest known accumulations of natural gas, the Hugoton Known Geologic Structure, over 4 million acres in size. Hugoton has been producing oil and gas since 1923. Much of the Cimarron is already leased with a majority of the leases containing a producing well.*

Figure I-2  
Lands Excluded From Analysis



The Comanche National Grassland has seven active fields on the Carrizo Unit but little production coming from other areas of the unit.

The Mountain Districts on the Pike and San Isabel National Forests have never produced oil or gas resources. Exploration has occurred in several areas in the past but no resources have been identified. Overthrust geologic structures in the Rampart Range and just east of South Park indicate moderate to high potential for oil and gas resources. A producing carbon dioxide area exists on private land making many believe that potential exists on the flanks of the Sangre de Cristo and Mosquito Ranges.

## Oil and Gas Field Development

Generally, any development of oil and gas resources will progress through five basic phases: (1) preliminary investigations, (2) exploratory drilling, (3) development, (4) production, and (5) abandonment (see Figure I-3).

### PRELIMINARY INVESTIGATIONS

Preliminary investigations include geological and geophysical exploration. Published geologic maps, aerial photography, and landsat imagery are used to identify geologic characteristics that may indicate oil or gas deposition. Further exploration can occur by plane, vehicle, or on foot if warranted. Once geologic indicators are identified, subsurface characteristics can be measured using geophysical methods.

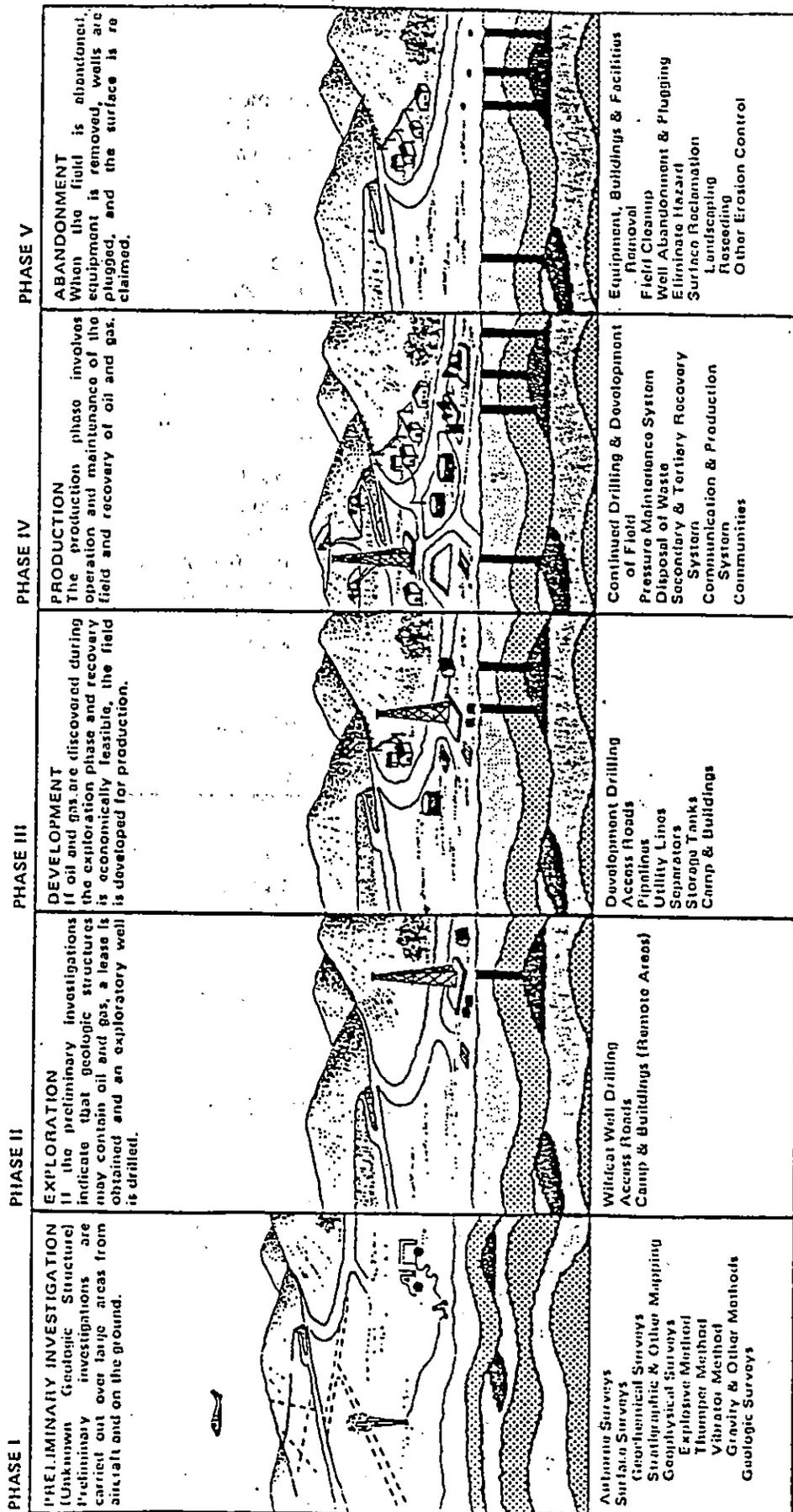
Geophysical methods include gravitational and magnetic surveys that are completed on the ground near a suspected "field." Seismic surveys are considered the most dependable geophysical test and they record impulses from an artificially-generated shock wave. Positive results from these tests may result in an application for permission to drill an exploratory well.

### EXPLORATORY DRILLING

An oil and gas exploration company must identify an area as having sufficient oil or gas potential to warrant further exploration. Once the company has obtained the proper leases and other legal permits, drilling operations may begin. Only by drilling a hole in the ground can the existence of petroleum actually be verified.

A well drilled to test for the presence of oil or gas in a previously undeveloped area is called a "wildcat well." The techniques for drilling a wildcat well are the same as for wells in areas of known production. Upon approval of the application for permit to drill, construction of the access road and well site could begin. The process usually begins by staking the location. A survey crew goes into the field and surveys the location which has been selected by the geologist or geophysicist. The location must then be prepared for the drilling rig. The well site would be cleared of vegetation and a level pad constructed to accommodate the drill rig, mud pumps, reserve pit, generators, pipe racks, and tool house. The drilling rig is then brought in and "rigged up." A small to medium size drill rig may be used because of the relatively shallow drilling depths common in the area, between 1,300 and 4,500 feet. A two-acre drill pad would be sufficient to accommodate the size drill rig expected to be utilized. Getting the rig operational can take anywhere from several hours to weeks, depending on how complicated the drilling equipment is.

**Figure I-3  
Phases of Oil and Gas Development**



SOURCE: U.S. Department of the Interior, BLM, 1972.

The substructure, which supports the mast, is assembled first; then the mast is brought in and raised on top of it. Other rigging-up operations including erecting or setting up stairways, walkways, guardrails, storage facilities, living quarters, and auxiliary equipment. Since water is necessary to a drilling operation, a water well has to be dug or a water supply line installed. The well is now ready to be spudded, a term referring to the process of starting the hole.

The most common drilling machine used to drill the six-to-eight-inch diameter hole is the rotary rig. Rotary drilling involves rotating the drill bit, which is attached to a long string of drill pipe. This rotating action allows for fast and efficient cutting of rock. Most rotary drill rigs utilize a fluid circulating system. The fluid, called "drilling mud", is pumped down the inside of the drill pipe and out through the bit at the bottom of the hole. The drilling mud carries the fragments of broken rock, cut by the drill bit, to the surface. It also counteracts any high pressure zones encountered during drilling, and cools and lubricates the bit.

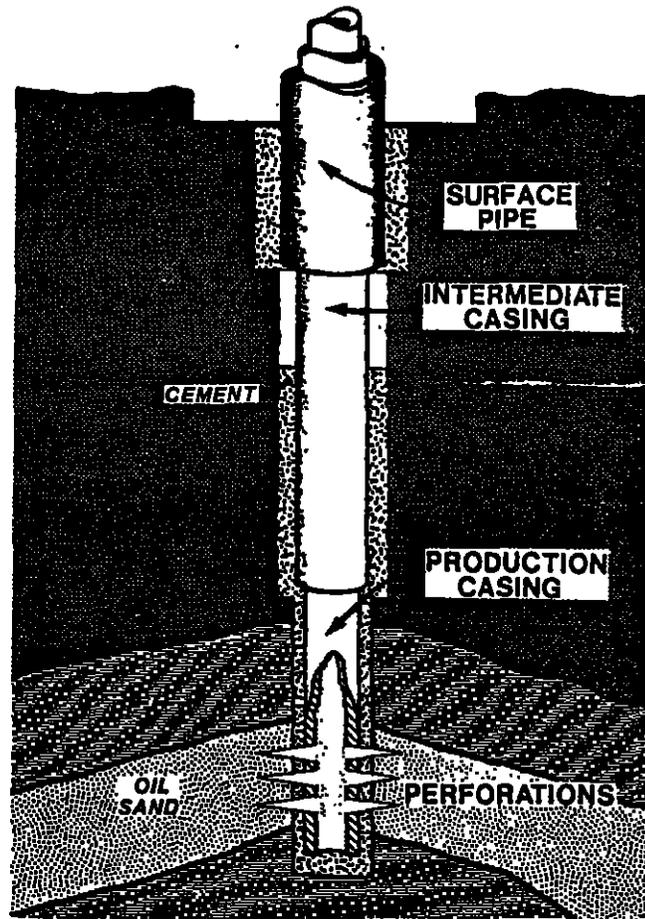
The first step in drilling is to set a "surface pipe" several hundred feet deep. A string of surface pipe or casing is inserted into the hole and cemented into place. The pipe is usually in 30 to 40 foot lengths and is screwed together as it is run into the hole. The surface pipe is 10 to 20 inches in diameter to allow the drill string and bit to pass through it for deeper drilling. Cement is pumped down the inside of the pipe, followed by a plug used to wipe the cement from the inside of the casing. Drilling mud is pumped in on top of the plug to displace the cement to the bottom and out into the space between the exterior of casing and the wellbore. Once the cement has set the drilling operations are ready to resume.

After the surface pipe has been set, deeper drilling begins. A smaller bit is run down the inside of the casing and drills through the plug and a guide shoe at the bottom of the casing. Routine drilling then continues to the desired depth. The operator would be required to seal off, protect, and isolate fresh water zones during and after drilling.

Upon reaching the desired depth, the well is evaluated to determine whether or not it has located an oil or gas formation. If the hole is found to be a potential producer, the final string of casing, called the production casing, is run into the well. The producing zone may be hydraulically fractured or treated to increase permeability and stimulate the recovery of oil and gas. The production casing is cemented in place in a manner similar to that used for all previous casing. The production casing is the final casing, making the well a permanent vehicle for the transmission of oil or gas to the surface. (See Figure I-4)

The time needed to drill a well to a total depth of 4500 feet is normally one to three weeks. The greatest amount of human, vehicular, and equipment activity and accompanying noise occurs during drilling.

**Figure I-4  
Drill Casing**



Used with permission of Scientific  
Software-Intercomp.

## DEVELOPMENT

If the "wildcat" well accesses oil or gas resources a lessee is likely to request approval to drill additional wells and develop a field.

The development of a field is determined by market demands, topography, reservoir characteristics, and other factors. The level of development that would occur cannot be accurately predicted. However, a typical field on the Comanche and Cimarron National Grasslands might consist of 5 to 20 individual wells with the associated roads and facilities.

Once a producing well is found, the existing surface use plan would need to be amended to address the production phase. The lessee, Forest Service, and BLM representatives would formulate this amended surface use plan to address roads, well site development, and additional facilities needed to make the production operation effective. The amendment of the surface use plan is an important step in ensuring that future operations meet oil company objectives and minimize environmental effects.

Natural gas appears to be the most likely product that would come from wells in the analysis area. The surface area required for a flowing gas well is usually a 20' by 20' fenced area together with an access road and turnaround area. A valve/gauge assembly (referred to as a "Christmas tree") to control gas flow, metering and treatment facilities, and compressor equipment would be installed on the well. In some instances water in association with the gas may enter the well and choke off the gas flow. A pump would be needed to remove the column of water (see Figure I-5). Flowlines are installed when the well is to be placed into production. The flowlines would transport the gas from the wellhead to a collector pipeline system which would carry the gas to the gas plant. An electrical system would be needed to supply electricity to the well sites and other facilities. Flowlines, collector lines and powerline cables would be buried to the extent practicable within the roadways to minimize surface disturbance.

Development of an oil producer is very similar to the natural gas producer described. Oil wells, at some time during production, will always have a pump and, in general, the surface facilities would include storage tanks for the oil. Additional traffic would occur to drain the storage tanks and remove the oil by truck. (see Figure I-6).

In addition to the actual well sites, other facilities are common in a field. Oil treatment facilities to remove water and other contaminants from the oil are normally present. Saltwater disposal wells are sometimes drilled and maintained to allow for disposal of saltwater that is generated during production. Occasionally additional wells are drilled in a field to aid in recovery of oil and gas. These wells are used to inject water, steam, carbon dioxide, polymers and micellar fluids into the reservoir to increase production.

An oil and gas field is an area with high rate of activity. Wells are checked daily to ensure that all equipment is working properly. Tanker trucks are often present somewhere in the field, removing and transporting oil from the storage tanks. Wells are maintained numerous times during their life. Workover rigs are a common site in the field. These rigs are similar to, but smaller than, drilling rigs. The workover rigs are used to perform down-hole maintenance, and other activities that stimulate oil production.

**Figure I-5  
Commonly Seen Pumpjack**

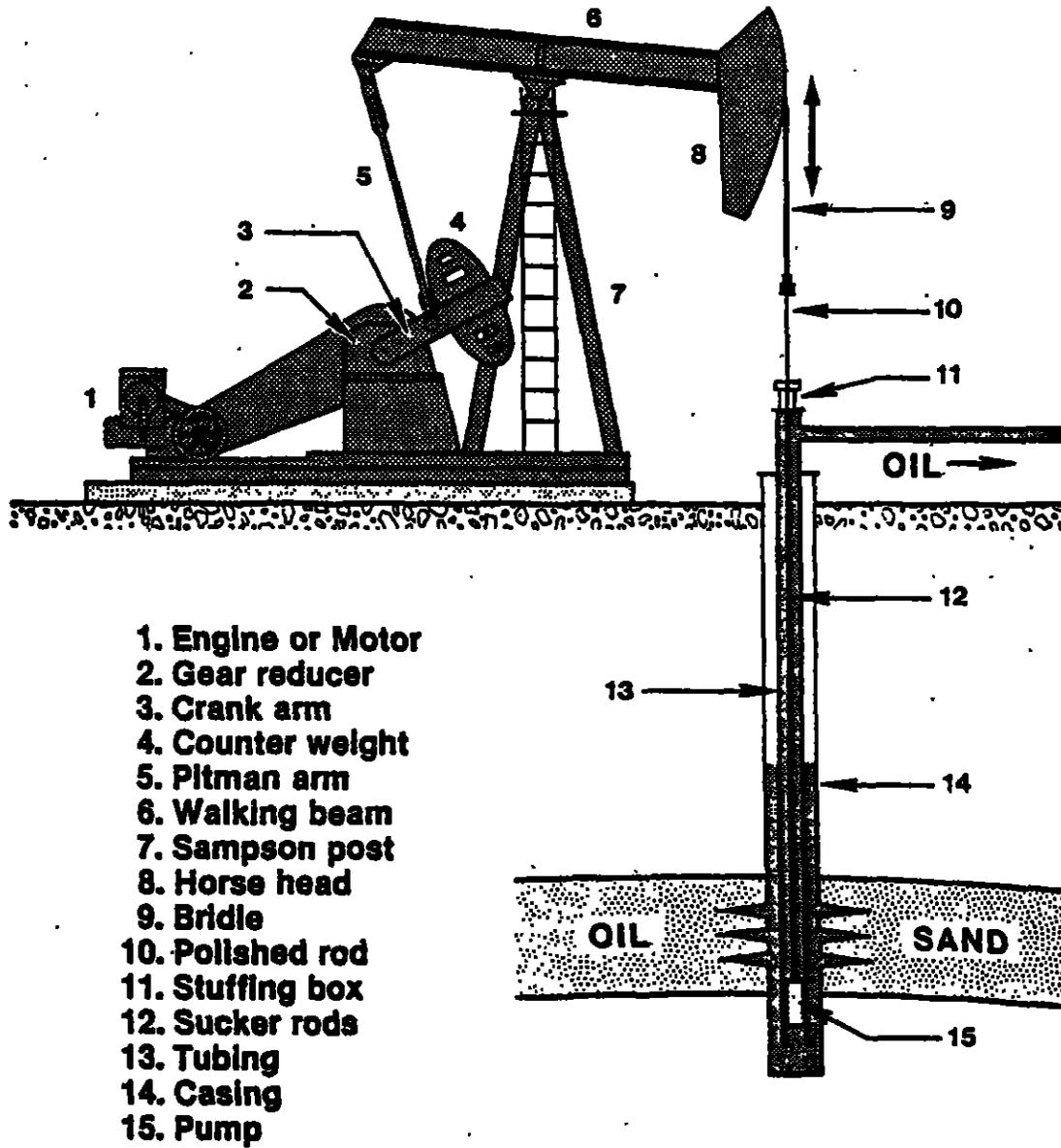
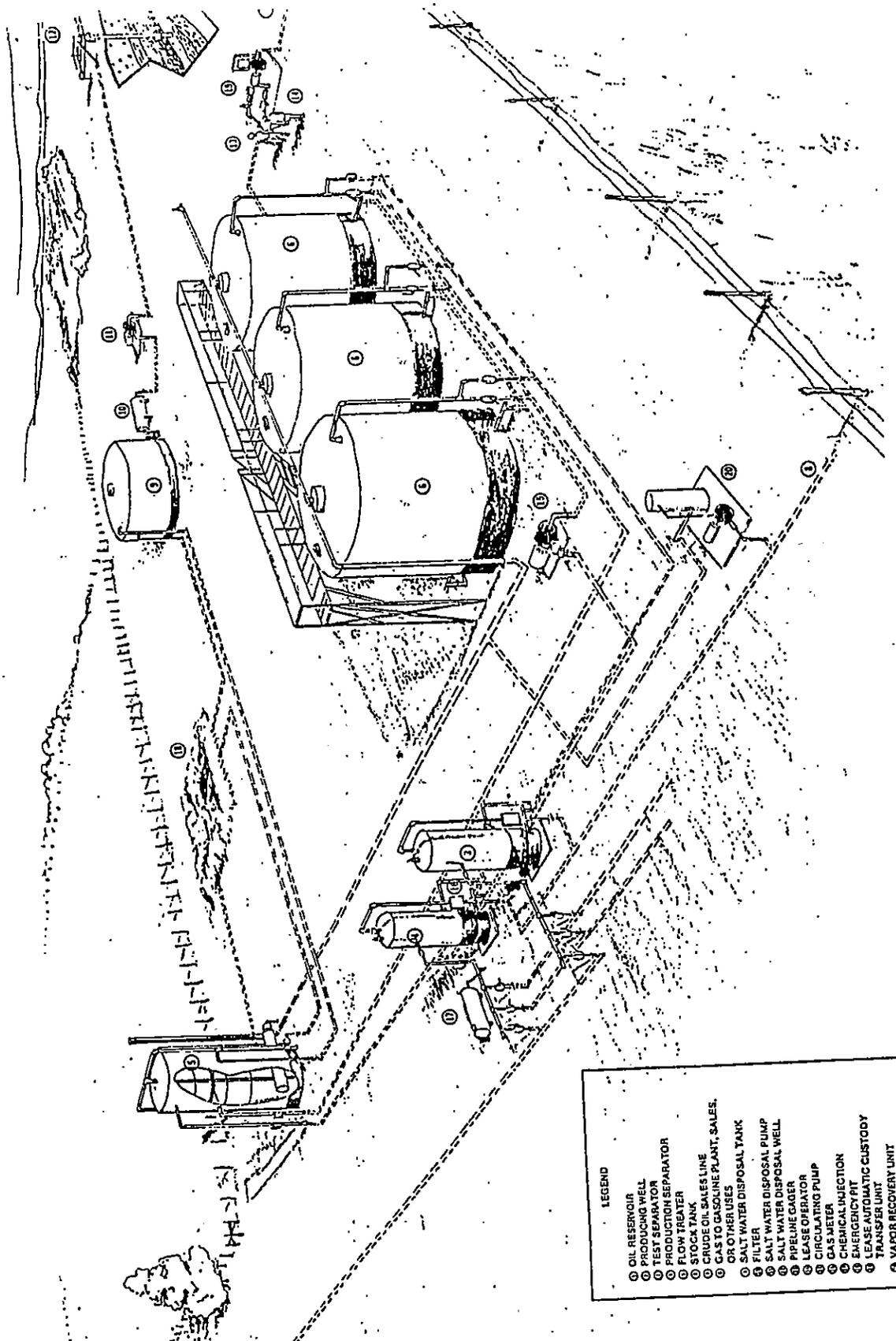


Figure I-6  
High Production Oil Well Site



- LEGEND
- ① OIL RESERVOIR
  - ② PRODUCING WELL
  - ③ TEST SEPARATOR
  - ④ PRODUCTION SEPARATOR
  - ⑤ FLOW TREATER
  - ⑥ STOCK TANK
  - ⑦ CRUDE OIL SALES LINE
  - ⑧ GAS TO GASOLINE PLANT, SALES, OR OTHER USES
  - ⑨ SALT WATER DISPOSAL TANK
  - ⑩ FILTER
  - ⑪ SALT WATER DISPOSAL PUMP
  - ⑫ SALT WATER DISPOSAL WELL
  - ⑬ PIPELINE GAGER
  - ⑭ LEASE OPERATOR
  - ⑮ CIRCULATING PUMP
  - ⑯ GAS METER
  - ⑰ CHEMICAL INJECTION
  - ⑱ EMERGENCY PIT
  - ⑲ LEASE AUTOMATIC CUSTODY TRANSFER UNIT
  - ⑳ VAPOR RECOVERY UNIT

## **PRODUCTION**

During production little activity would occur at the well site except for periodic maintenance and periodic visits to assure the well is operating properly. The estimated life of a typical field is 15 to 25 years.

## **ABANDONMENT**

Wells are plugged and abandoned upon depletion of the resource. Truck mounted equipment is used to plug formerly producing wells, all surface equipment is removed, and the site is restored.<sup>1</sup> Specific plugging and abandonment requirements vary based on the rock formations, subsurface water conditions, and the specific well site.

### **Dry Hole Abandonment**

During standard dry hole abandonment the hole below the casing is filled with heavy drilling mud, a cement plug is installed at the bottom of the casing, the casing is filled with mud, and a cement cap is installed at the top of the casing. A pipe monument is required unless waived. Additional cement plugs may be required.

### **Abandonment of Depleted Production Wells**

In addition to the measures required for the plugging of a dry hole, a depleted producer requires that the perforated section of casing in the producing zone be plugged with cement. This is generally done with a workover rig.

After plugging the well the drilling rig is removed and the surface is restored to the requirements of the surface management agency. Pumpjack foundations are removed or buried below ground level. Surface lines are removed and buried pipelines are drained, left in place, and plugged at intervals.

The surface is reshaped to allow revegetation and restore the landform as near as possible to its original contour. Stockpiled topsoil is replaced and the site revegetated. Fencing may be provided to ensure successful revegetation.

## **BACKGROUND**

In many places in the United States, National Forests and National Grasslands lie over geological formations which do, or may, contain oil or natural gas. Private firms purchase "leases" on many of these lands to search for oil or gas, to drill exploratory wells, and to extract any oil or gas located below them.

### **Lease**

The government conveys limited rights to the purchaser of a lease. The lessee has the right to apply for permission to drill and to disturb an approved surface area in order to explore for oil or gas. Upon approval of a permit to drill the government conveys the exclusive right to: (1) drill for,

mine, extract, remove and dispose of all the oil and gas (except helium) in the leasehold, and (2) build and maintain necessary supporting facilities for the term of the lease. The oil and gas lease does not convey the right to build housing, cultivate the land, or remove any minerals other than oil and gas. Lease rights provide that drilling and development take precedence over rights the government may subsequently grant other users of the area, such as ranchers or recreationists. If the government has previously granted privileges by permit to others such as ranchers, those granted by the earlier permit will take precedence over the lease rights. A lease is normally issued for a period of five or ten years and is extended if it is producing oil or gas in "paying" quantities (43 CFR 3107).

Individuals, associations of citizens, and corporations organized under the laws of the United States, or any state, are entitled to lease federal lands for these purposes under authority of the Mineral Leasing Act of 1920 as amended, and the Mineral Leasing Act for Acquired Lands of 1947 unless the lands have been specifically withdrawn by the responsible federal agency. Leases also may be issued to a legal guardian or trustee on behalf of a minor. Aliens, whose country of origin does not deny similar privileges to U.S. citizens may hold interest in leases, but only through stock ownership of United States corporations that hold leases. Aliens may not hold interest in federal oil and gas leases through units in publicly-traded limited partnerships.

## **COMPETITIVE AND NONCOMPETITIVE LEASES**

*Competitive and noncompetitive leases* may be obtained for oil and gas exploration and development on lands owned or controlled by the federal government. The Leasing Reform Act requires all public lands available for oil and gas leasing to be offered first by competitive leasing at an oral auction. Noncompetitive leases may be issued only if the competitive process results in no bids. Competitive leases are issued for a period of five years, while noncompetitive leases are issued for a ten-year period. Both are extended for the duration that they are producing oil and gas in paying quantities. The maximum competitive lease size is 2,560 acres in the lower 48 states and 5,760 in Alaska. The maximum noncompetitive lease size is 10,240 acres in all states.

### **Competitive Leases**

The Bureau of Land Management conducts oral auctions for oil and gas leases on at least a quarterly basis, when there are available parcels of land. A Notice of Competitive Lease Sale lists lease parcels to be offered at auction. The Sale Notice is published at least 45 days before the date of the auction. The Sale Notice identifies any lease stipulations to uses or restrictions on surface occupancy. There are three sources for federal lands available for lease:

- (1) Existing leases which have expired, and leases which have been terminated, canceled, or relinquished.
- (2) Parcels identified by informal expressions of interest from either the public or BLM for management reasons.
- (3) Lands included in offers filed for noncompetitive leases (effective January 3, 1989).

On the day of the auction, successful bidders must submit a properly executed lease bid form and make a payment consisting of a share of the sale costs (\$75 per lease), one year advance rental (\$1.50 per acre), and not less than the \$2.00 per acre minimum bonus. The balance of the bonus bid must be received within 10 working days of the auction.

The bid form constitutes the legally binding lease offer.

## **Noncompetitive Leases**

Noncompetitive leases may be issued only for parcels which have been offered competitively and failed to receive a bid. Lands in expired, terminated, canceled or relinquished leases are not available for noncompetitive leasing until they have been offered competitively. After an auction, all lands that were offered competitively without receiving a bid are available for issuance of noncompetitive leases for a period of two years.

Noncompetitive offers must be submitted on a BLM-approved form, and they must include a \$75 filing fee, and one year advance rental (\$1.50 per acre).

Noncompetitive lease offers filed on the first business day following the auction are considered as having been filed simultaneously. The priority among multiple offers received on the first business day for the same parcel are determined by drawings open to the public.

## **Lease Restrictions**

A lease does not convey an unlimited right to explore or an unlimited right to develop any oil or gas resources found under the land. Leases are subject to terms and conditions. These are restrictions derived from legal statutes and measures to minimize adverse impacts to other resources and are generally characterized in a lease as *stipulations*. Stipulations modify the rights the government grants to a lessee. The stipulations are known by potential lessees prior to any sale, and must be applied at the time of APD.

### **STANDARD LEASE TERMS**

The *Standard Lease Terms* are contained in Form 3100-11, Offer to Lease and Lease for Oil and Gas, U.S. Department of Interior, Bureau of Land Management, June 1988 [See Appendix A]. The Standard Lease Terms provide the lessee the right to use the leased land as needed to explore for, drill for, extract, remove and dispose of oil and gas deposits located under the leased lands. Operations must be conducted in a manner that minimizes adverse impacts to the land, air, water, cultural, biological, and visual elements of the environment, as well as other land uses or users. Federal environmental protection laws such as the Clean Water Act, Endangered Species Act, and Historic Preservation Act, will be applied to all lands and are included in the standard lease stipulations. If threatened or endangered species, objects of historic, cultural or scientific value, or substantial unanticipated environmental effects are encountered during construction, all work affecting the resource will stop and the land management agency will be contacted. Surface-disturbing operations which would destroy or harm these species or objects are prohibited.

Standard Lease Terms provide for reasonable measures to minimize adverse impacts to surface resources. These include, but are not limited to, modifications to the siting or design of facilities, timing of operations, and specifications of interim and final reclamation measures. Standard Lease Terms may not require the lessee to relocate drilling rigs or supporting facilities by more than 200 meters, require that operations be sited off the leasehold, or prohibit new surface-disturbing operations for more than 60 days each year (43 CFR part 3101.1-2).

The lease requires that the lessee meet stipulation conditions or avoid activities within all, or an identified part, of the leasehold. All leases on National Forest System lands contain the "Stipulation

for Lands of the National Forest System Under Jurisdiction of Department of Agriculture," requiring the lessee to comply with the rules and regulations of the Department of Agriculture. All leases are subject to regulations and formal orders of the Secretaries of the Interior and Agriculture in effect at the time of issuance.

## **SUPPLEMENTAL STIPULATIONS**

The Standard Lease Terms can be modified by special or supplemental stipulations attached to the lease. (See *Forest Service Manual 2820 - Timing Of Operations, Conditional Surface Uses, No Surface Occupancy and 43 CFR 3101.1-2 through 3101.1-4.*) Additional special stipulations can be developed specifically to meet resource concerns that cannot be mitigated by existing stipulations. All stipulations which may be applied when implementing the Forest Supervisor's decisions are detailed in Appendix A.

# **Federal Oil and Gas Leasing Process**

## **PRIOR TO THE 1987 LEASING REFORM ACT**

The Secretary of the Interior, through the Bureau of Land Management, was responsible for authorizing the sale of leases for all available federal lands, including the lands of the National Forest System. The Mineral Leasing Act for Acquired Lands of August 7, 1947, (USC 351-359) provided for oil and gas leases on mineral deposits of coal, phosphate, oil, oil shale, gas, sodium, potassium, and sulphur which are owned or may be acquired by the United States and which are within the lands acquired by the United States. National Grasslands (NG's) were authorized by the Bankhead-Jones Act.

Individuals and firms wishing to lease parcels of the National Forests or Grasslands would make a "Request For Lease" for a specific parcel of land to the Bureau of Land Management. The BLM would then ask the Forest Service to make a recommendation regarding sale of the lease subject to provisions of the 1920 Mineral Leasing Act or the 1947 Act for Acquired Lands. Officers of the Forest Service would determine the stipulations necessary to protect the resources. However, only the Secretary of the Interior possessed the authority to determine which stipulations to place on the lease for minerals reserved from public domain. The final decision was appealable to the BLM.

## **AFTER THE REFORM ACT**

In 1987, Congress passed the Federal Onshore Oil and Gas Leasing Reform Act (P.L. 100-203). (We will refer to this as the "Leasing Reform Act" throughout the remainder of this document.) The Leasing Reform Act makes leasing on public domain lands very similar to that of acquired lands. It made two significant changes in the way leasing decisions are reached. First, the Leasing Reform Act expanded the role of the Secretary of Agriculture in the leasing decision process. The Secretary was authorized to identify the National Forest System lands for which leases could be sold. Also, he or his officers were authorized to determine the appropriate stipulations to apply to a lease to protect the surface resources.

The Leasing Reform Act also established a statutory requirement for processing the Surface Use Plan of Operation prior to ground-disturbing activities. This established a staged decision process for sale of a lease and approval of a permit to drill and operate. That is, before a firm can drill an exploratory well or extract oil or gas from National Forest System lands, the Forest Service must first authorize sale of a lease (the preliminary decision), and then must approve or disapprove a

detailed Surface Use Plan of Operation at the time of an application for permit to drill (the substantive decision). The lease decision is based on, among other things, an environmental analysis in accord with the requirements of the National Environmental Policy Act (NEPA) (40 CFR part 1502) that identifies stipulations needed to protect the environment. The approval of drilling (the substantive decision) is also based on an environmental analysis in accord with NEPA, which is specific to the proposed plan of operation.

## **THE REGULATIONS IMPLEMENTING THE REFORM ACT**

The Leasing Reform Act modified the authorities of the Secretaries of Interior and Agriculture and established the foundation for staged decision-making, but the procedures to be used were defined in implementing regulations. The Forest Service developed those regulations over a two-year period and published the "Final Rule" in the Federal Register on March 21, 1990. (36 Code of Federal Regulations, Part 228, 100 et. seq.; 55 FR 10423.)

In the implementing regulations, the Secretaries of Agriculture and Interior have caused the leasing decision to be made based on a level of information appropriate to the speculative nature of oil and gas exploration. The text of the regulations which describes this decision process is as follows:

**(c) Leasing Analyses: ... the authorized Forest officer shall:**

**(1) Identify on maps those areas that will be:**

**(i) Open to development subject to the terms and conditions of the standard oil and gas lease form (including an explanation of the typical standards and objectives to be enforced under the Standard Lease Terms);**

**(ii) Open to development but subject to constraints that will require the use of lease stipulations such as those prohibiting surface use on areas larger than 40 acres or such other standards as may be developed in the plan for stipulation use (with discussion as to why the constraints are necessary and justifiable) and;**

**(iii) Closed to leasing, distinguishing between those areas that are being closed through exercise of management direction, and those closed by law, regulation, etc.**

**(2) Identify alternatives to the areas listed in paragraph (c)(1) of this section including that of not allowing leasing.**

**(3) Project the type/amount of post-leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in the proposal and for each alternative.**

**(4) Analyze the reasonable foreseeable impacts of post-leasing activity projected under paragraph (c)(3) of this section.**

**(d) Area or Forest-wide Leasing decisions (Lands Administratively Available For Leasing)**

**Upon completion of the leasing analysis, the Forest Supervisor [as designated by the Regional Forester] shall promptly notify the Bureau of Land Management as to the area or**

*Forest-wide leasing decisions that have been made, that is, identify lands which have been found administratively available for leasing.*

***(e) Leasing Decisions for Specific Lands***

*At such time as specific lands are being considered for leasing, the Forest Supervisor shall review the area or Forest-wide leasing decision and shall authorize the BLM to offer specific lands for lease subject to:*

*(1) Verifying that oil and gas leasing on the specific lands has been adequately addressed in a NEPA document, and is consistent with the Forest land and resource management plan.*

*(2) Ensuring that conditions of surface occupancy identified in section 228.102(c)(1) are properly included as stipulations in resulting leases.*

*(3) Determining that operations and development could be allowed somewhere on each proposed lease, except where stipulations will prohibit all surface occupancy.*

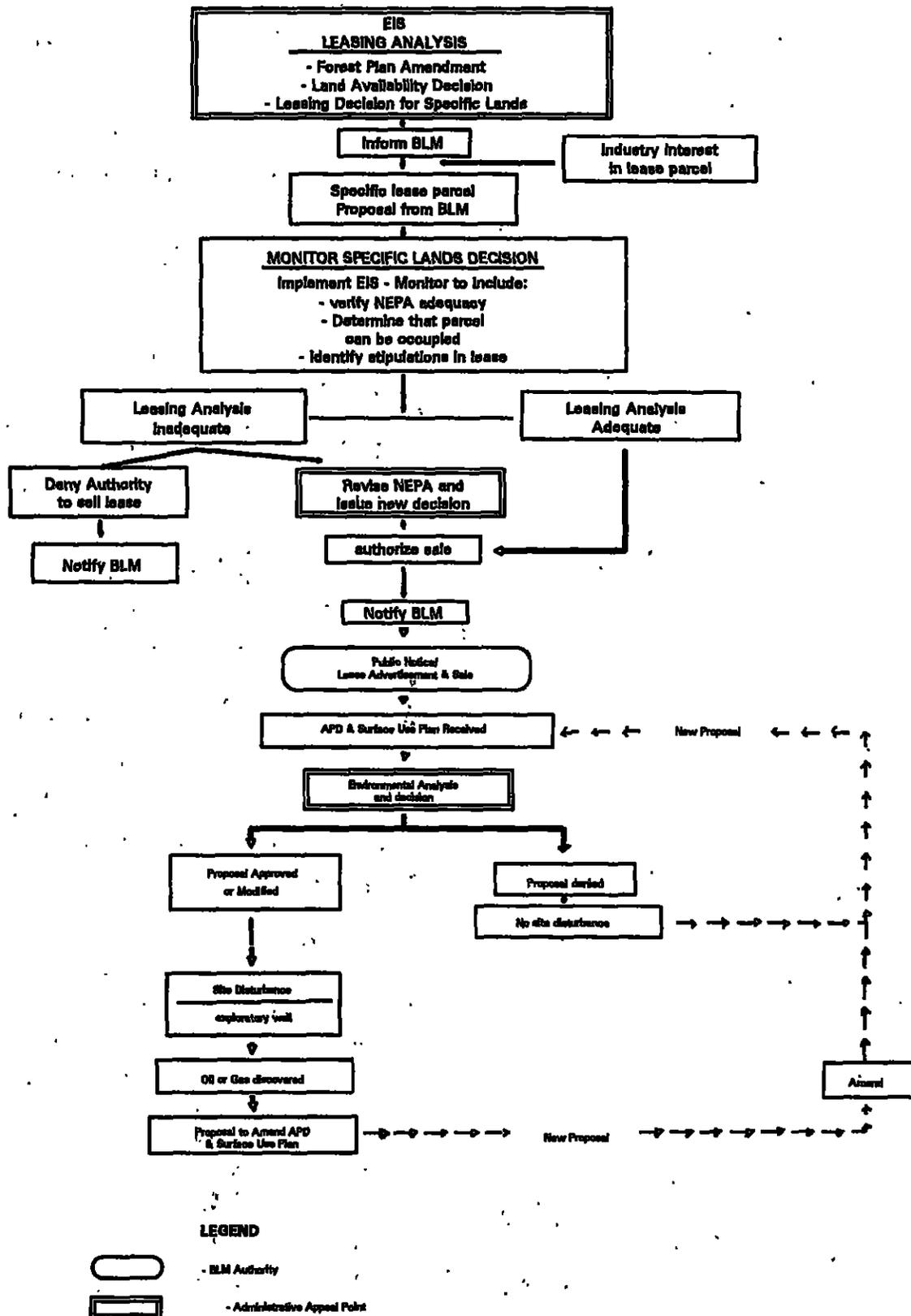
*36 Code Of Federal Regulations, part 228.102  
Leasing Analysis and Decisions.*

Figure I-7 is a graphic depiction of the process that the Forest Service will use to implement the regulations and identifies decision points in the leasing, exploration, and development phases of the program. The steps displayed in that figure are briefly described here and detailed on the following pages.

The Leasing Analysis is the first step in the process mandated by the regulations. The Forest Service has decided to administratively combine it, and its resultant decision notice, with the second step, the Leasing Specific Lands Decision. Both of these decisions will be documented in a single Record of Decision. Once these decisions have been made and provided to the BLM they will work with industry to provide specific proposals for lease parcels to the Forest Service. The Forest Service will implement the decision and authorize or deny the lease parcel advertisement. After purchase a lessee may propose to develop the lease and will request approval for construction in an Application for Permit to Drill. That proposal will be analyzed in a NEPA document prior to approval, modification, or denial. If the proposal is approved ground disturbing activities will occur, if not approved the lessee may make another proposal.

Figure I-8 further displays the roles of the BLM and Forest Service in the process and identifies the rights granted to the lessee at the decision points. The BLM and Forest Service as cooperating agencies entered into the Leasing Analysis. At the time that a Record of Decision is signed for the availability and specific lands decision there is no authority granted to the BLM to authorize a lease. That authority is granted after the lease proposal has been received and reviewed by the Forest Service. Once the Forest Supervisor authorizes the BLM to lease a specific parcel and it is sold the rights to apply for permission to drill are granted to the lessee. It is only after the APD is received, analyzed, and approved that the lessee receives the right to generate ground disturbing activities.

**Figure I-7  
Leasing Process Flow Chart**





## THE STAGED DECISION PROCESS

The legally required, staged decision process is designed to accommodate the tentative nature of oil and gas exploration and development. Exploration for oil and gas resources is costly and speculative. Firms must commit costly equipment, purchase a variety of land rights and use expensive environmental protection technologies to begin exploration for oil or gas. Driven by pressures to be efficient and minimize risk, the nature of the enterprise has evolved over decades into a form in which exploration and development requires long-term planning by many loosely associated, mutually-dependent industries. There is no guarantee that the expensive commitment of exploratory resources will result in a discovery of oil or gas as only about 15 percent of exploratory wells drilled in the United States result in a paying discovery of oil or gas.<sup>2</sup>

Consequently, firms or individuals pursuing oil and gas must be able to plan in advance to most efficiently utilize their exploratory resources. One tactic they rely on to stage commitments of their own resources is the purchase of public land leases. Developers want to know what lands are available for exploration and development and they want to be assured of continued future opportunities. Leasing of public lands is a way to do this.

Those purchasing leases, however, do not automatically or immediately drill exploratory wells on these leaseholds. In any given time period, exploration firms must match geologic characteristics with the commitment of technology, capital, available equipment, and market conditions in a decision to risk a drilling operation. As a result, federal land leases are bought, relinquished, expire, and may be bought and sold again many times without ever being drilled upon. This demonstrates a major distinction between oil and gas leasing and other activities which are authorized by the Forest Service. Most activities are reasonably certain to proceed to development after the permit or contract is issued. Even though there is great uncertainty at the time of lease authorization as to whether a well will be drilled and, if so, when and where, the effects of a typical well in a given location can be estimated reliably on the basis of past experience.

The federal government wants to respond to industry concerns but must ensure that future activities will neither unduly harm the environment nor unduly interfere with other uses of these public lands. A regulatory framework has been created to meet industry's needs while protecting other resources. The regulations include staged permitting of oil and gas exploration and development. Those stages include public disclosure at the following decision points: (1) the determination of lands available for leasing, (2) the leasing specific lands decision, (3) Application for Permit to Drill (APD), and (4) amendment of the permit to drill if field development occurs. The staged process is designed to minimize the risk of making a decision that could lead to undisclosed irreversible or irrevocable environmental impacts. Each decision is based on environmental analysis and disclosure of the probable effects in accord with the National Environmental Policy Act. Each decision is appealable to the responsible federal agency.

The U.S. Supreme Court in *Robertson v. Methow Valley Citizens Council*, 104 L.Ed.2d 351 (1989), upheld the use of more than one stage of NEPA compliance after a Forest Plan is issued. In the Methow Valley situation, there was a permit stage (which allowed no ground-disturbing activities) and a faster development plan stage which involved another NEPA process and decision by the Government before environmental effects would be experienced. This is very similar to the situation that is involved here.

## **Stage One, Lands Available for Leasing**

The decision regarding lands available for leasing is based on disclosure and analysis provided in a "Leasing Analysis." The Leasing Analysis is a "programmatic" rather than a "site-specific" or "project" level activity. No rights are granted by the government to other parties when the Leasing Analysis is completed and the decision described in 36 CFR 228.102(d) is made. This EIS was prepared to satisfy the requirements of the National Environmental Policy Act for the Leasing Analysis.

The programmatic decision will identify which, if any lands will be available for leasing. The Forest Plan will be amended at the same time so that the decisions made on the basis of this EIS will be consistent with the Forest Plan.

## **Stage Two, Leasing Decisions for Specific Lands**

The Leasing Reform Act also provides for consent by the Forest Service for the issuance of oil and gas leases for specific lands. The regulations implementing the Leasing Reform Act require the following before consent can be given for one or more leases to be issued by the Bureau of Land Management:

Verifying that oil and gas leasing on the specific lands has been adequately addressed in a NEPA document, and is consistent with the Forest Land and Resource Management Plan.

Ensuring that conditions of surface occupancy identified in section 228.102(c)(1) are properly included as stipulations in resulting leases.

Determining that operations and development could be allowed somewhere on each proposed lease, except where stipulations will prohibit all surface occupancy.

## **Stage Three, Application for Permission to Drill**

This document, and its Record of Decision, does not authorize any ground-disturbing activities. Subsequent to lease award, the activities will be proposed through an APD and surface use plan of operations submitted to the Forest Service for approval. The Forest Service will analyze environmental effects of the proposed operations and issue a decision document.

## **Stage Four, Amendment to APD**

If oil or gas resources are found through exploratory activities, industry may request a change to their approved surface use plan of operations to allow for development facilities. At that time the Forest Service must analyze the environmental effects of these proposed changes and issue another decision document.

As we continue discussions in this document we may refer to the 228.102(d), or "Area or Forest-wide Leasing Decision" as the "Land Availability Decision." The 228.102(e), or "Leasing for Specific Lands" decision may be referred to as the "Consent Decision."

## Impacts of a Lease

The authorization of a lease does not, in itself, create any environmental effects. However, authorization implies that oil and gas development may take place at a future time with identified restrictions. The regulations direct the Forest Service to consider the subsequent actions which would be authorized by a lease, and their potential environmentally disturbing effects, as *connected actions*. This includes all activities described earlier in this chapter. These actions also meet the definition of connected actions in the procedural requirements for the National Environmental Policy Act. (40 CFR 1502.)

These expected actions are the basis of the environmental analysis from which the leasing decisions will be made. The decision on the lands that will be administratively available, and the subsequent decision authorizing leases, are based upon analysis of the likely environmental effects of the connected actions.

## NATIONAL ENVIRONMENTAL POLICY ACT REQUIREMENTS (NEPA)

The purpose of this section is to assist the reader in tracking information that is required to be disclosed by the National Environmental Policy Act (NEPA). The analysis that is documented here is complex and relates to both the availability and specific lands decisions. They require disclosure of the same type of information under NEPA (see Table I-2). Content requirements of an EIS are found in 40 CFR 1502.10 and in Forest Service Handbook 1909.15 chapter 40.

Several parts of this document address the various requirements of NEPA. Included amongst these are affected environment, projected action, projected effects, mitigation, and net effects (see Table I-2).

The discussions relating to these NEPA requirements for the availability and specific lands decisions are often combined in this document. Reasons for doing this include the following: 1) The Forest Service has no information about specific well hole location or other ground disturbing activity at the time of either decision, whether they are made together or separately. 2) The same level of resource information is known about the lands that are being analyzed for both decisions. 3) Both decisions are made knowing the location of, and development that has occurred on, existing leases. This includes the activities associated with typical drilling operations (see page I-7-14), the effects of activities on particular resources (see Table I-2), and the effectiveness of various mitigation measures (see Table I-2). The primary difference between the two decisions is that when monitoring the consent decision, as explained on pages I-43-53, we know the proposed lease parcel boundary.

Because we do not have any specific ground disturbing proposal a basic assumption has been made for the purposes of this analysis. If an area is considered available in the alternative being discussed we assume that consent has been granted. In projecting post-leasing activities we are, therefore, processing a hypothetical Application for Permit to Drill (APD) and Surface Use Plan of Operations (SUPO). The alternative and any requirements of the alternative are applied to the SUPO to analyze effects.

In implementation, the decision to authorize lease advertisement on specific lands will be identified in the Record of Decision. Actual authorization will not occur until the monitoring has been completed on the proposed lease parcel. Approval of ground disturbing activity will not be given, if at all, until additional NEPA analysis based on a specific project proposal is done. That analysis will not be done until the APD stage.

The assumption identified above allows us to combine the discussions relating to affected environment, and effects, for the two decisions. Table III-1 identifies various levels of affected environment that are discussed in the document. Chapter IV discusses site-specific effects of potential specific lands decisions, as well as the effects of the programmatic availability decision. The following table references other sections in this document that provide discussion of the NEPA disclosure requirements as well as requirements of oil and gas regulations described earlier in this chapter.

**Table I-2  
Locations of Information Within This Document**

Topic Discussed	Document Pages Beginning Discussion Relating to the Following Decisions	
	Availability	Specific Lands
Affected Environment	Chpt III(all) IV-9	III-35, III-87 IV-987
Effects of Implementation	I-29 IV-9, IV-62 IV-90	IV-9, IV-62 IV-90 IV-
Mitigation/Lease Terms and Stipulations	I-16, II-4, IV-57 App A, App G(all)	I-16, IV-9, IV-57 App A, App G
Net Effects	IV-9, IV-57, IV-90 IV-116, IV-118	IV-9, IV-57, IV-90 IV-116, IV-118
Authorities	I-17, I-23, I-36, IV-1	I-17, I-23 I-31, IV-1
Analysis Process	I-18, I-24, I-26 . I-28, IV-1	I-18, I-24, I-26 I-31, IV-1
Rights Conferred	I-14, I-16 I-22, IV-1	I-14, I-16 I-23, IV-1

# **THE ANALYSIS PROCESS**

The land availability decision, the decision to authorize lands for leasing, and the decision to amend the Forest Plan to accommodate these leasing decisions are separate, sequential decisions, but they are based on one analytical process. Because of the complexity of these decisions, and the analytical process needed to support them, we offer a brief explanation of the analysis process here and to show how it supports the decisions being made.

## **Identification and Mapping of the Surface Land Features and Natural Resources of the Unit**

The Supervisor's three decisions must be based on knowledge and consideration of the effects oil and gas leasing could have on the lands and the natural resources of the Unit, the ways in which those effects might be mitigated, and the ability to satisfactorily mitigate or forstall those effects.

To develop this knowledge and make these determinations, the Supervisor and his staff first developed maps of the surface features (physical and biological characteristics) of the unit at a 1:24,000 scale. At this scale, 2.6 inches on the map is approximately equal to one mile of land on the ground. This scale is sufficient to reveal which areas of ground have which kinds of elevations, plant communities, waterbodies, and what other resources exist where. This information is sufficient to allow us to identify the possible environmental effects of an exploratory oil or gas well or production facility. In actuality, the Supervisor and his staff have prepared many individual layers of maps to describe soils, water, plant communities, wildlife areas of special concern, recreation resources, visual properties and so forth. These maps and the scale of the maps are identical to those commonly used by the Forest Service and other land management agencies for purposes of environmental analysis.

## **Alternative Land Availability Patterns**

The Supervisor has the choice of continuing with current Forest Plan direction, or making parts or all of the Unit administratively available for oil and gas leasing. In order to determine which lands to make administratively available, the Supervisor has considered a number of alternative land availability patterns. In brief, the Supervisor has considered:

- determining which lands are administratively available on a request basis, as is currently provided for in the Forest Plan,
- making all lands of the Unit administratively available for leasing with the set of standard lease terms which commonly apply to oil and gas exploration and development, and
- making some lands administratively available for leasing with a pattern of standard lease terms, supplemental stipulations, and discretionary no lease.



Per regulation, the text in Chapter II of this EIS which accompanies these maps includes "an explanation of the typical standards and objectives to be enforced under the standard lease terms." (36 CFR 228.102(c)(1)(I)). Chapters II and IV of this EIS describe the expected environmental effects of these alternative land leasing availability patterns, and "discuss why additional constraints are necessary and justifiable." (36 CFR 228.102(c)(1)(II))

## **Projection of the Reasonably Foreseeable Development Scenario**

The regulations, in 36 CFR 228.102(c)(3 and 4), require the Forest Service to "project the type/ amount of post-leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in the proposal and for each alternative and analyze the reasonable foreseeable impacts of post-leasing activity under (c)(3) of this section" as a part of the analysis. This is the projected activity that will be generated when each alternative is implemented. It is the activity that generates the social and economic effects.

The staff specialists of the BLM assisted in the development of a projection of how much, when and where oil and gas leasing are most likely to take place on the Unit (since not all locations are conducive to oil and gas development). We also developed a set of assumptions about the technological or physical nature of oil and gas activities in those locations sufficient to estimate the kinds of environmental effects which might result from these activities. These premises, along with information about the rate and extent of development over time, are the "Reasonably Foreseeable Development," or RFD scenario for the Unit. In brief, we anticipate oil or gas firms to drill four exploratory wells on the Pike and San Isabel National Forests, 45 wells on the Comanche National Grassland and 165 wells on the Cimarron National Grassland, which will be a mixture of exploratory and production wells, during the next fifteen years. The RFD Scenario is described in more detail in Chapter II and Appendix B.

## **Land Availability Decision**

In the first step of the analysis, the Supervisor and his staff compared the maps of the surface features of the Unit with knowledge of the effects of oil and gas drilling or development on lands similar to those of the Unit. That is, the Supervisor and his staff used information from a variety of sources (scientific studies, scientific simulation models, professional observation, etc.) to estimate what the environmental impacts of the projected post-leasing activities would be. These individual analyses are documented in a series of "specialist reports" included in the administrative record for this Environmental Impact Statement.

Knowledge of the probable effects for each place in the Unit then were compared with knowledge of the effect standard lease terms and supplemental stipulations would have in mitigating the environmental effects. The Supervisor and his staff then made a series of decisions (for each alternative) about which environmental effects could be satisfactorily mitigated through use of standard lease terms, supplemental stipulations, discretionary no lease, or which effect could not be mitigated under any circumstance. Each alternative availability map reflects these decisions made for each place in the Unit.

The overall effects of these alternatives were compared through the application of RFD and an effects analysis based on that RFD as required in the oil and gas regulations (228.102(c)). We overlaid the "map" of the projected "Reasonably Foreseeable Development Scenario" on the map (or maps) of the surface features of the Unit. The overlain maps allow us to determine which kinds of land features and natural resources are most likely to be impacted by the projected post-leasing activities. We again used information from the same scientific and professional sources to determine which kinds of environmental effects are likely to result from these impacts.

We analyzed the environmental effects which could be expected to occur under the "Reasonably Foreseeable Development Scenario" for each of the four alternative administratively available land patterns. These effects are disclosed in Chapter IV of this document.

## **Application of RFD**

The RFD information provided by the BLM clearly indicates that there is little likelihood of exploratory drilling - and no expectation of development - on the Mountain Districts. The regulations direct the Forest Supervisor to make Forest-wide decisions about land availability, including those lands where exploration and development are not anticipated. The Forest Supervisor will then determine which specific lands to authorize for leasing. In order to disclose the information the Forest Supervisor needs to make those decisions, we have considered the types of lands involved, the surface resources, and the likelihood of oil and gas development occurring on the different types of lands. There are lands which:

- have oil & gas drilling or production development
- are currently leased, in which industry has expressed an interest to lease, or do or may have geologic formations to support oil and gas
- are unlikely to be developed because the likelihood of oil or gas resources existing underneath them is low or unknown

In order to make the availability decision, we have looked at all the land, regardless of the likelihood of development. The decision to make land available for leasing is based strictly on knowledge of the surface resources and knowledge of the standard lease terms and stipulations necessary to protect those resources. We have looked, based on the available information, at the surface resources to determine whether or not any given area can be authorized for lease. We used the probable post leasing activities to determine the cumulative effects of leasing, and determine how much, and where, land could be leased should leasing occur.

## **Lands Likely to be Developed**

The Cimarron and Comanche National Grasslands has several areas where known oil reserves exist, including the Hugoton Field, one of the largest in the continental U.S. Field boundaries have not been identified for all of the reserves so continued drilling is anticipated. Other lands without known resources are unlikely to be developed.

On those lands where drilling and development are occurring, we extrapolated real information to develop the activities to base the analysis on. These lands account for about 15% of the land on the unit and include the Cimarron and part of the Comanche National Grasslands. Statistical information provided in the Engineering Specialist Report allowed us to develop mathematical

models for the amounts of disturbance on these lands. The distribution of wells is consistent with past occurrence by land type and watershed.

## **Lands Unlikely to be Developed**

In the case of the Pike & San Isabel National Forests, it is unlikely that oil or gas development will occur on 2 million of the 2.3 million acres that are being analyzed. There is currently no development activity underway on the National Forests. Interest in possible future development has been expressed on some areas through leasing or the identification of potential parcels.

On those mountain lands most likely to be developed the analysis is based on the RFD scenario, developed in coordination with the BLM. It considers construction of a conventional well and road. The analysis establishes points of development and the disclosure of the effects at these points. Knowing that development on these specific points is highly unlikely, a "Concentrated RFD" was developed to use to establish a hypothetical range of effects for each availability alternative.

Even though many of the mountain lands are unlikely to be developed for oil and gas exploration we can reasonably and reliably predict the kinds of effects that would occur if they were leased and developed. The ID Team identified land types of similar character. We then tested a proposition that analysis of the environmental effects resulting from placing an exploratory well on one kind of land will have much the same result as an analysis of the effects of a well on the same kind of land in a different location. For example, if an exploratory well were drilled on a decomposed granite site of 35 percent slope, it could be expected to produce about the same amount of soil erosion as another exploratory well drilled on another decomposed granite site of 35 percent slope. The physical processes which apply to soil movement on 35 percent slopes in decomposed granite should lead to the same result, regardless of where on the Unit those sites are located.

For the test, we randomly placed four hypothetical wells on each kind of land in several test watersheds on the Unit, developed an independent analysis of the environmental effects of each hypothetical well, and then compared the results for wells on the same kinds of land. In each case, we did find that wells on the same kind of land generally produce the same local, direct, environmental effects.<sup>4</sup>

Then for "low-probability lands", we divided all the lands of the Unit into kinds of land (land with similar physical and biological features), mapped each occurrence of each kind of land, randomly placed at least two hypothetical exploratory wells on separate areas where that land occurs, and analyzed the environmental effects of that "representative well." The standards for these environmental analyses are the same as the standards for analysis of sites with a more reliably known development potential, and they are the same standards for environmental analysis of other kinds of projects contemplated for National Forest System lands.

The role of this analysis is to allow the Supervisor to determine whether or not to authorize one or more areas of "low-probability lands" for oil or gas leasing on the basis of the environmental effects most likely to occur on that kind of land.

## **CONSENT (Leasing Specific Lands 36 CFR 228.102(e))**

The decision to authorize lands for leasing makes an initial commitment of public resources to a potential lessee. When a lease is purchased the lessee receives the exclusive right to apply for an application for permission to drill (APD) for oil and gas on the lease parcel.

The consent decisions which will be made as a result of this analysis will go through a monitoring process prior to the specific authorization of the BLM to advertise a lease for sale. This monitoring process will include map and on-the-ground field review to insure consistency with the information disclosed in this document based on proposed lease parcel boundaries, certification that NEPA requirements have been met and that the parcel can be occupied, and the attachment of applied stipulations on the proposed lease documents. If any of the monitoring results are unsatisfactory the consent will be denied or supplemental NEPA analysis will be completed. A copy of the monitoring form can be found in Exhibit I-1 of this Chapter.

The Consent Decision will be made on the basis of knowledge of the possible environmental effects gathered from the availability analysis and the ability of the Forest Supervisor to *"verify that oil and gas leasing on the specific lands has been adequately addressed according to the requirements of the National Environmental Policy Act, that conditions of surface occupancy identified in section 228.102(c)(1) are properly included as stipulations in the leases," and that "operations and development could be allowed somewhere on each proposed lease, except where stipulations will prohibit all surface occupancy."*

The Forest Supervisor will then use the information disclosed in this EIS to make the "Land Availability and Consent Decisions" described in the implementing regulations for the Leasing Reform Act.

The Supervisor will decide which lands to make available for leasing, and what stipulations to apply should those lands be leased. The decision to lease or not lease land areas will be made. The time period the decisions will be in effect, and processes for review, revision, implementation, and monitoring will be identified.

The information disclosed in this document and decisions in the Record of Decision will be incorporated into the *Land and Resource Management Plan for the Pike and San Isabel National Forests and the Comanche and Cimarron National Grasslands as an amendment to the plan.*

## **APPLICATION FOR PERMIT TO DRILL (Surface Use Plan of Operations 36 CFR 228.106)**

Many existing leases on the Unit have never been drilled on. The consent to lease lands may not result in any ground disturbing activities. The greater the potential to find oil or gas with minimal investment, the higher the likelihood of development.

When industry decides to start developing a lease parcel they must have a specific Surface Use Plan of Operations included in their Application for Permit to Drill. This is the first time that the exact location and extent of ground disturbing activities is known. Approval, or disapproval, is based on an environmental analysis and published in a decision document subject to administrative appeal. Because this information is not known until a proposal for development is provided to the BLM we cannot include the decision to approve drilling and it's level of site-specific analysis in this document.

## **THE NEED FOR THESE DECISIONS**

There are legal and practical needs for these decisions. The legal needs were described earlier. The Forest Supervisor has several practical reasons to make these decisions at this time, they are as follows.

### **Outstanding Requests For Lease**

During the two-year period between passage of the Leasing Reform Act and publication of the final implementing regulations, firms applied to the BLM for approximately 400 leases on portions of the Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands. Upon completion of this document only 14 of the 400 lease proposals will still be active. The remaining 14 requests have been mapped and are found in Appendix C. The BLM and the Forest Service could not properly act upon these "Requests For Lease" prior to the regulations. The Forest Supervisor needs to determine which lands are available for leasing, and which of the outstanding lease requests to authorize.

### **Renewal Decisions For Existing Leases**

The Unit currently has 450 existing leases. Forty percent of these leases are expected to expire within the fifteen year planning horizon of this document. The others are not expected to expire within that fifteen years because they are currently producing oil or gas resources and have been extended. We are analyzing all lands, including those currently leased, so that when they do expire the decision has been made whether or not to offer them for sale and the required stipulations are known. It is possible that currently-leased lands would not be available for resale or would be available with stipulations that are not in the current lease.

### **Anticipated Lease Requests**

Based on past experience, the Forest Supervisor can expect to receive approximately 90 Requests For Lease on the Unit each year.

Under present circumstances, the Forest Supervisor must react to each request individually. This involves documentation of as many as 90 individual environmental analyses per year for which the Forest Service is neither staffed nor funded. When each lease request is studied on an individual basis, it is difficult for the Forest Supervisor and staff to study the aggregate and cumulative environmental effects of these operations. In order to plan for the orderly management of National Forest System lands, resolve potential conflicts in land or resource use in a meaningful way, and study the aggregate and cumulative effects of oil and gas leasing, the Forest Supervisor has chosen to disclose the analysis leading to the availability and consent decisions on a Forest-wide basis.

# CONTEXT OF THE DECISIONS

## Geographical Context

The Pike and San Isabel National Forests and the Comanche National Grassland are located in southeastern Colorado. The National Forests lie along the eastern slope of the central and southern Rocky Mountains. The Comanche National Grassland is in the high plains area of southeastern Colorado near the Kansas and Oklahoma borders. The Cimarron National Grassland is located in Kansas, near the town of Elkhart. It also is located in the high plains environment.

The two National Forests and the two National Grasslands were combined into a single administrative unit of the National Forest System in 1973. That is, one Forest Supervisor administers these National Forests and National Grasslands.

The majority of the Forest's lands are available for oil and gas leasing at the current time. A few areas of the Forest (designated wildernesses, Manitou Experimental Forest, Congressionally designated Wilderness Study Areas (WSA's), and several special areas) will not be studied at this time (See Table I-1). Most have been declared unavailable by Congressional action or are withdrawn from mineral leasing by action of the Forest Service or Department of Agriculture. The Forest Supervisor does not have the authority make leasing decisions on the Experimental Forest. The unavailable lands total 550,872 acres in comparison to the 2,201,603 acres of the Unit available for analysis.

Split-estate lands, that is, lands for which the federal government holds mineral rights but has no surface ownership, are included in this document, and constitute 107,973 acres.

The lands being analyzed can be segregated based on areas which are already leased, currently unleased lands that have been identified by industry in lease requests, and currently unleased lands that have not been identified by industry on the Unit.

## The Forest Plan Context

Management of each administrative unit of the National Forest System (one or more National Forest or National Grassland) is governed by a Land and Resource Management Plan (Forest Plan). The existing Forest Plan includes general decisions to make lands administratively available for oil and gas leasing, but does not include decisions for leasing specific lands. Decisions the Forest Supervisor will make, including refinement of availability, will be used to develop a programmatic amendment to the Forest Plan.

### PROGRAMMATIC VERSUS PROJECT, OR SITE-SPECIFIC

Forest Plans provide broad, programmatic direction for management of National Forest System lands. This direction is in the form of multiple-use goals and objectives, area-specific management prescriptions, and standards and guidelines to be applied to individual projects. Forest Plans normally do not make site-specific decisions; that is the role of project-level environmental analysis.

The first step in the land management planning process is the Forest Plan, which determines land management emphasis areas, and provides the requirements for site-specific activities. The second step is the analysis of individual projects, which includes applying the standards and guidelines in the Forest Plan to site-specific activities.

Project-level decisions require site-specific environmental analysis. An environmental analysis document, such as an EIS or environmental assessment (EA), precedes these decisions unless they are categorically excluded from documentation. Project-level planning provides an additional opportunity for public participation. In the case of oil and gas program management, this site-specific planning is done when applications for permit to drill (APD) for exploration and development are processed. This level of planning may result in further amendment to the Forest Plan at some time in the future.

## **STANDARDS AND GUIDELINES**

The Forest Plan contains management standards for oil and gas exploration and development. The Plan also provides other Forest-wide standards for the protection coordination of other resources. Both the Forest Plan and the Forest Plan EIS are incorporated into this document by reference. Some standards and guidelines may be amended as a result of this analysis.

## **TIERING**

This EIS is directly tiered (40 CFR Parts 1502.20 and 1508.28) to Chapters I, III, IV and VI and Appendices B, C, and F of the Forest Plan FEIS. Copies of the Forest Plan FEIS are available for review in the Forest Supervisor's Office and at all Ranger District Offices on the Forest, in the Regional Forester's Office, 11177 West 8th Ave., Lakewood, Colorado, in the Forest Supervisor's Office of all National Forests contiguous to this Forest and in most public libraries in or near this Forest. Mailing addresses of these offices can be found in Chapter VI or by calling the Forest Supervisor's Office at (719) 545-8737.

## **CURRENT FOREST PLAN DIRECTION**

The current Forest Plan directs managers to conduct site-specific analysis of available lands for oil and gas leasing. Negative recommendations or consent denials are based on the following criteria:<sup>9</sup>

- Slopes steeper than 60 percent.
- High erosion hazard soil ratings.
- High geologic hazard ratings.
- Low visual absorption capacity that prevents reclamation to established visual quality objectives.
- Conditions jeopardize the survival or recovery of federally, or state listed threatened and endangered wildlife or plant species.

## **FOREST PLAN AMENDMENTS**

When a change to the Forest Plan is needed, the Forest Supervisor must prepare an amendment and conduct an environmental analysis. Non-significant amendments may be approved by the Forest Supervisor. Significant amendments must be approved by the Regional Forester, and the development and approval of a significant amendment must follow the same procedures as were required for developing and approving the current Forest Plan. "Significance" is defined, in this case, by the National Forest Management Act regulations, and is different than "significance" as defined by the National Environmental Policy Act.

The Forest Supervisor may amend, or recommend to amend, the Forest Plan at any time. An amendment may result from:

- Recommendations of an interdisciplinary team, based on the results of monitoring and evaluation.
- Decisions by the Forest Supervisor that existing or proposed permits, contracts, cooperative agreements, or other instruments authorizing occupancy and use are appropriate, but are not consistent with the Forest Plan.
- Changes in proposed implementation schedules, resulting from differences between Forest Plan projected funding levels and actual funds appropriated.
- Administrative appeal decisions.
- Planning errors found during plan implementation.
- Changes in physical, biological, social, or economic conditions.
- Implementation of new legislation.

The Forest Supervisor will determine whether the proposed changes are significant or non-significant. If the Forest Supervisor decides that the leasing availability decision is a non-significant change to the Forest Plan, the reasoning will be explained in the decision document. If the Supervisor feels the decision results in a substantial change to the Forest Plan the Regional Forester must decide how the Plan will be changed. The Regional Forester will prepare a decision document based on environmental analysis and public disclosure.

This document will disclose the information needed for the Forest Supervisor to determine if a Forest Plan Amendment is required, and whether or not that amendment is significant. The Supervisor may refine the availability determinations made in the Forest Plan, identify specific mitigation requirements to be applied at the time of leasing and allows more specific mitigation to be identified at the time a Surface Use Plan of Operations is being analyzed.

## **CURRENT BUREAU OF LAND MANAGEMENT DIRECTION**

The BLM's District's Royal Gorge Resource Management Plan covers "severed mineral estates" within and adjacent to NFS boundaries in the eastern plains of Colorado and of the Pike and San Isabel National Forests. The BLM will incorporate information from this EIS into their management plan.

# **AUTHORITY OF THE FOREST SUPERVISOR TO MAKE THE DECISIONS**

The authority of the Forest Supervisor to make these decisions is conferred by the Leasing Reform Act as previously described. The implementing regulations gave the authority to make these decisions to Regional Foresters. The Regional Forester has delegated that authority to the Supervisor of the Pike and San Isabel National Forests and the Comanche and Cimarron National Grasslands.<sup>8</sup>

A series of statutes prior to the Leasing Reform Act further establish and define the authority of the Supervisor to make these decisions. These are:

## **GENERAL MINING LAW OF 1872 (later amended by the Mineral Leasing Act of 1920)**

Public lands, including National Forest System lands, valuable for oil deposits were open to entry and placer mining claims under the General Mining law. (See Act of Feb. 11, 1872, 29 Stat. 526.) The General Mining Law of 1872 (30 USC 22-54) preceded the Organic Act and the establishment of the Forest Reserves and National Forests. The General Mining Law governs mining activity on public lands and National Forest System lands.

So many claims were filed under the General Mining Law that the President issued a Proclamation in 1909 withdrawing public lands from such entry, pending the enactment of legislation to protect such lands. (See *U.S. v. Midwest Oil Co.*, 59 L.Ed. 673 (1915), and *Udall v. Tallman*, 13 L.Ed. 2d 616, 628 (1965)). However, protective legislation was not enacted until the Mineral Leasing Act of 1920. (See *Boesche v. Udall*, 373 US 472, 10 L.Ed. 2d 491, 497 (1963).) This Act authorizes the Secretary of the Interior to issue leases for disposal of certain minerals (currently applies to coal, phosphate, sodium, potassium, oil, oil shale, gilsonite, and gas). The Act applies to National Forest System lands reserved from the public domain.

## **Mineral Resources on Weeks Law Lands**

The Act of March 4, 1917 (39 Stat. 1150, as supplemented; 16 U.S.C. 520). This act authorizes the Secretary of the Interior to prescribe general regulations to permit prospecting, development, and utilization of the mineral resources of the lands acquired under the Act of March 1, 1911, known as the Weeks Law, for the best interests of the United States.

## **Reorganization Plan No. 3 of 1946**

Part IV, Section 402 (60 Stat. 1097, 1099; 5 USC Appendix). This Plan provides that development of mineral deposits in certain lands pursuant to provisions of the Mineral Resources on Weeks Law Lands Act of March 4, 1917 (Ch. 179, 39 Stat. 1134, 1150, 16 USC 520) shall be authorized by the Secretary of the Interior only when he is advised by the Secretary of Agriculture that such development will not interfere with the primary purposes for which the land was acquired and only in accordance with such conditions as may be specified by the Secretary of Agriculture in order to protect such purposes.

## **Mineral Leasing Act for Acquired Lands of August 7, 1947**

Ch. 513, 61 Stat. 913; 30 USC 351, 352, 354, 359. This Act provides that all deposits of coal, phosphate, oil, oil shale, gas, sodium, potassium, and sulphur which are owned or may be acquired by the United States and which are within the lands acquired by the United States may be leased by the Secretary of the Interior under the same conditions as contained in the leasing provisions of the mineral leasing laws. No mineral deposit covered by this section shall be leased except with the consent of the head of the executive department, independent establishment, or instrumentality having jurisdiction over the lands containing such deposit, or holding a mortgage or deed of trust secured by such lands which is unsatisfied of record, and subject to such conditions as that official may prescribe to ensure the adequate utilization of the lands for the primary purposes for which they have been acquired or are being administered.

## **Energy Security Act of June 30, 1980**

P.L. 96-294, 94 Stat. 611; 42 USC 8801 (note), 8854, 8855. This Act directs the Secretary of Agriculture to process applications for leases and permits to explore, drill and develop resources on National Forest System lands, notwithstanding the current status of the land and resource management plan.

## **The Federal Onshore Oil and Gas Leasing Reform Act Of December 22, 1987**

30 USC 181, et seq.; P.L. 100-203. The 1987 Reform Act expanded the authority of the Secretary of Agriculture in the management of oil and gas resources on National Forest System lands and directed the Secretary to issue rules on bonding and reclamation standards. Under the Act, leases for oil and gas on NFS lands cannot be issued by the BLM without the approval of the Forest Service. All surface-disturbing activities on NFS lands must be approved by the Forest Service before operations commence. The Act also provides for inspections and enforcement of operations once commenced. Regulations implementing this statute were published in the Federal Register by the U.S. Forest Service on March 21, 1990. (55 FR 10423, et. seq.) The regulations were codified in 36 Code of Federal Regulations 228.100 et. seq.

## **Organic Act**

The Organic Act of June 4, 1897 (16 USC 475) established the system of Forest Reserves, which later became the National Forest System. This act defines and describes the basic purposes for which National Forests (and later, National Grasslands) are to be managed.

The Act provides in part that *"it is not the purpose or intent of these provisions, or of said section, to authorize the inclusion therein of lands more valuable for the mineral therein, or for agricultural purposes, than for forest purposes."* (Chpt. 2, Sec. 1, (30 Stat. 34)) Provision is made for regulations allowing free use of timber and stone for bona fide miners and prospectors in 16 USC 477. Authority for regulations providing access for prospecting, locating, and developing mineral resources is found in 16 USC 478.

The General Mining Law of 1872 (30 USC 22-54) preceded the Organic Act and the establishment of the Forest Reserves and National Forests.

## **Multiple-Use Sustained-Yield Act**

The Multiple-Use Sustained-Yield Act of 1960 (16 USC 528) extended the purposes for which lands of the National Forest System could be managed. It also declared that these lands be managed for multiple uses, rather than for individual uses in individual places. Management of the individual natural resources of the lands is declared to be according to the principle of sustained yield in perpetuity.

This Act provides, in part, that, *"Nothing herein shall be construed so as to affect the use or administration of the mineral resources of national forest lands ..."*

## **National Forest Management Act**

This statute (16 USC 1600, et. seq.) and its implementing regulations (36 CFR Part 219) define additional principles for management of the lands and resources of the National Forest System. This Act also directs the Forest Service to create Land and Resource Management Plans for each administrative unit of the National Forest System. The Plans are *"to provide for multiple use and sustained yield of goods and services from the National Forest System in a way that maximizes net public benefits in an environmentally sound manner."* (36 CFR 219.1(a)). The Act describes required management of renewable resources, but indicates that mineral exploration and development must be considered in the planning and management relating to the renewable resources. (36 CFR 219.22).

These authorities, and the discretion of the Forest Supervisor in making these decisions, are conditioned by several other statutes. The basic laws which limit the discretion of the Supervisor to make these decisions are the following.

## **National Environmental Policy Act**

This statute (40 USC 4331 et. seq.) and its implementing regulations (40 Part 1500) apply to federal actions relating to oil and gas leasing on the National Forests. This statute requires the Forest Supervisor to perform an environmental analysis and disclose the effects of his decisions on the quality of the human environment. The law further requires the Forest Supervisor to identify and describe the significant environmental issues associated with his decision and to develop alternatives to his proposed action (including the alternative of no action). The Supervisor must disclose the direct, indirect and cumulative effects of the decisions, and adverse environmental effects which cannot be avoided, the relationship between short-term uses of man's environment and the maintenance of long-term productivity, and any irreversible or irretrievable commitments of resources made by the decision. For additional information on NEPA requirements as they relate to this analysis see Pages I-24 and I-25.

## **The Clean Air Act of 1970**

91 Stat. 685; 42 U.S.C. 7401 et. seq. The Clean Air Act provides that each state is responsible for ensuring achievement and maintenance of air quality standards within its borders.

## **The Endangered Species Act of 1973**

Public Law 93-204; 16 USC 15311, et. seq. As amended, this law requires special protection and management on federal lands for threatened or endangered species. The U.S. Fish and Wildlife Service (USFWS) is responsible for administration of this act. Federal agencies proposing an

action or processing an action proposed by a third party which "may affect", in any way, the existence of an identified species must consult with the USFWS to determine if, and how, the proposed action will affect those species. Mitigation measures will be developed through the consultation process and are put forth as suggested conservation measures included in the "FWS Biological Opinion."

## **Clean Water Amendments**

Federal Water Pollution Control Act Amendments of 1972; Act of October 18, 1972 (P.L. 92-500, 86 Stat. 816, as amended; 33 USC 1251, et seq.) The act puts forth national standards to restore and maintain chemical, physical and biological integrity of the Nation's waters. Upon passage of Environmental Quality Acts and adoption of water quality standards, state agencies were empowered to enforce water quality standards.

## **Historic Preservation Act**

The National Historic Preservation Act is Public Law 89-665, 80 Stat. 915 (16 USC 470) as amended. Section 106 of the Act requires a federal agency planning an undertaking to consider the effects of the action on cultural sites eligible to, or listed on, the National Register of Historic Places. Prior to the approval of the undertaking the agency must afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

# **FOREST SERVICE ROLE IN IMPLEMENTATION**

The decisions identified in the Record of Decision shall be implemented in the following manner:

- (1) The Forest Supervisor will notify the BLM as to the decision made. This will include:
  - Lands available for leasing
  - Resource and stipulation maps
  - Lands the Forest service intends to authorize for leasing

The maps will be used by BLM and industry, prior to submitting a lease proposal to the Forest Service, to design a lease parcel based on information disclosed in the EIS. They will be able to determine the stipulations that will be applied and determine whether or not they want to make an investment in that specific lease. Pending Lease applications will be processed beginning with Monitoring Step 1 - EIS Review, described later.

- (2) The Specific Lands Decisions, made in this EIS, is only a decision that authorization will be given. It is not the actual authorization itself. The actual authorization will be made on a parcel-by-parcel basis, after a parcel has been proposed through the Bureau of Land Management (BLM), and will be made utilizing the following step-by-step monitoring process.

### *Monitoring Step I - EIS Review*

The EIS will be reviewed to see if a representative well was analyzed that is similar to the anticipated effects of leasing on the proposed parcel.

### *Monitoring Step II - Map Review*

The proposed lease parcel will be superimposed onto the Stipulation Base Map (Appendix D) and the Resource Quad Maps (Appendix E) to identify all resources involved and applicable stipulations. The following "Sample Mapping Exercise" demonstrates actual use of the maps.

### *Monitoring Step III - Field Review*

Using the map information, an on-the-ground field review will be made of the proposed parcel. The Oil and Gas Lease Monitoring Form, Exhibit I-1, will be used for carrying out this step of the process.

### *Monitoring Step IV - Authorization*

Upon completion of Steps I, II, and III, the Forest Service will notify BLM as to the applicability of the "specific land decision" for that proposed parcel. If the decision in the ROD is not applicable to the proposed parcel authorization to lease is disapproved and additional NEPA analysis will be done.

## **Sample Mapping Exercise**

This section provides a step-by-step description of how the Stipulation Base Quad Map and its overlays will be used to carry out Step II, described above, when a lease proposal is received by the Forest Service. The figures used display excerpts from the actual maps that will be used in the monitoring process.

### *Step 1.*

The proposed lease parcel is superimposed on the stipulation base map (Figure I-9). This shows the lease parcel to be in an area open to leasing with a minimum of a Controlled Surface Use (CSU) stipulation on a portion of the parcel and a Timing Stipulation on a portion of the parcel. Since this map only shows the most restrictive stipulations, we now have to go to the Resource Quad Maps to determine what resources the CSU & NSO stipulations protect and whether other stipulations may apply.

### *Step 2*

The proposed lease parcel is superimposed on the Resource Base Quad Map (Figure I-10). We can now overlay this map with the various resource overlays to determine what resources exist within the proposed lease parcel boundary and what stipulations may be required.

The resource overlays consist of four overlays. See Exhibit I-1 for the listing of the resources mapped on each overlay.

### *Step 3*

Resource Overlay No. 1 is superimposed on the Resource Base Quad (Figure I-11). This shows that the area within the lease proposed lease parcel contains soils with high erosion

potential. We now go to the stipulations for soils (Figures 1-12) and find that a Controlled Surface Use (CSU) stipulation is to be applied.

**Step 4**

Resource Overlay No. 2 is superimposed on the Resource Base Quad (Figure I-13). This shows that no resources contained on this overlay exist within the proposed lease parcel.

**Step 5**

Resource Overlay No. 3 is superimposed on the Resource Base Quad (Figure I - 14). This shows that an area of high visual quality exists within the parcel boundary. Checking the stipulations for visual quality (Figures I -15) shows that a CSU stipulation is to be applied to another portion of the parcel. No other resources exist on this overlay.

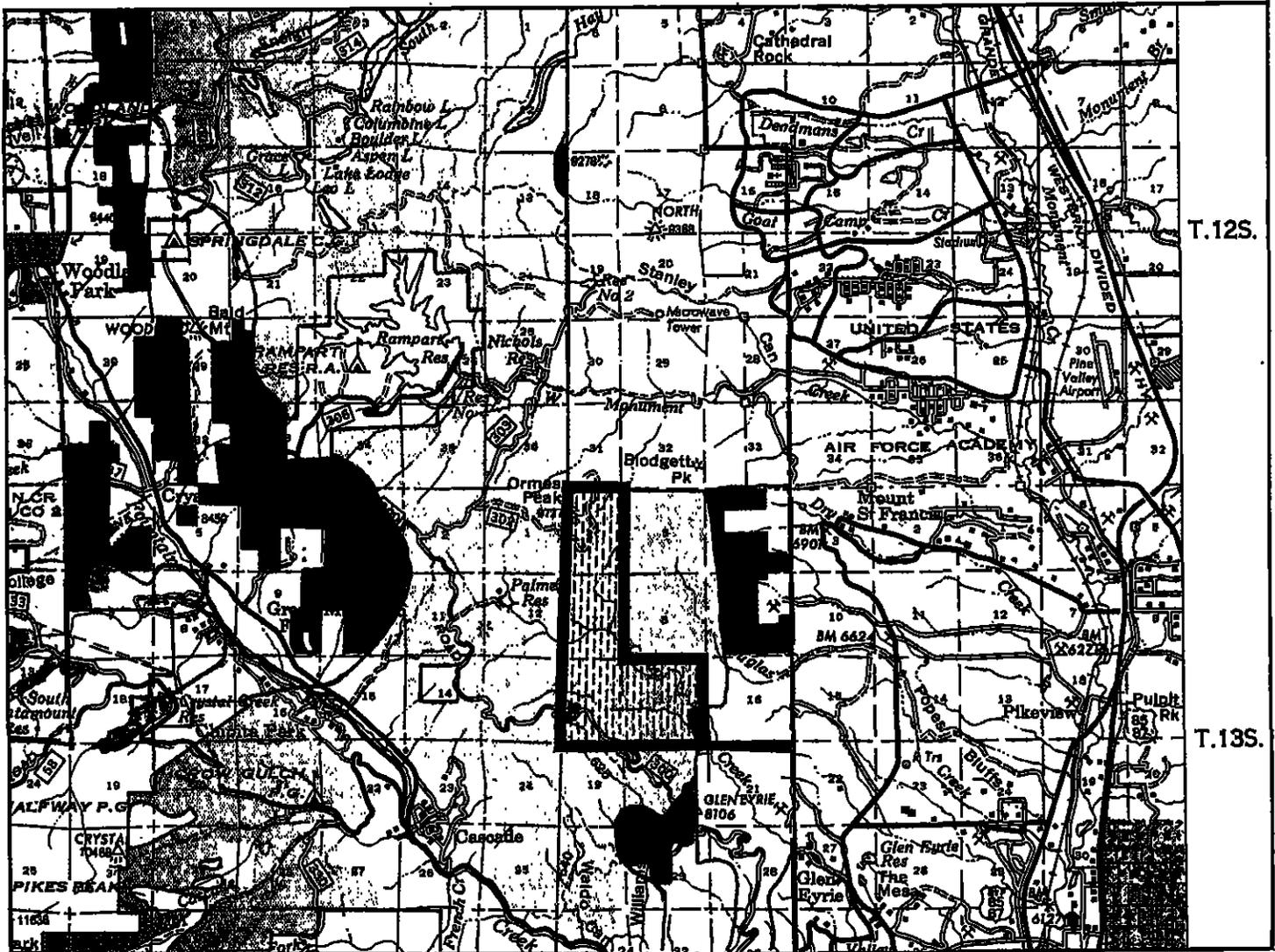
**Step 6**

Resource Overlay No. 4 is superimposed on the Resource Base Quad (Figure I-16). This shows that a Mule Deer Winter Range exists within the proposed parcel. Checking the stipulations for wildlife (Figure I-17) shows that a timing stipulation is to be applied.

**Step 7**

The stipulations referenced in each map legend are disclosed in Appendix A and will be copied and applied to the lease. The overlays will also be duplicated and attached.

Figure I - 10  
Stipulation Base Map



Scale 1/8" = 1 mile



LEGEND



LEASED AREA



TIMING LIMITATION



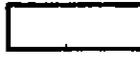
NO LEASE FORMALLY WITHDRAWN FROM LEASING



CONTROLLED SURFACE USE (CSU)



DISCRETIONARY NO LEASE



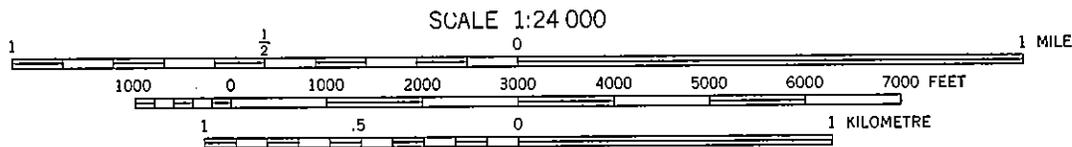
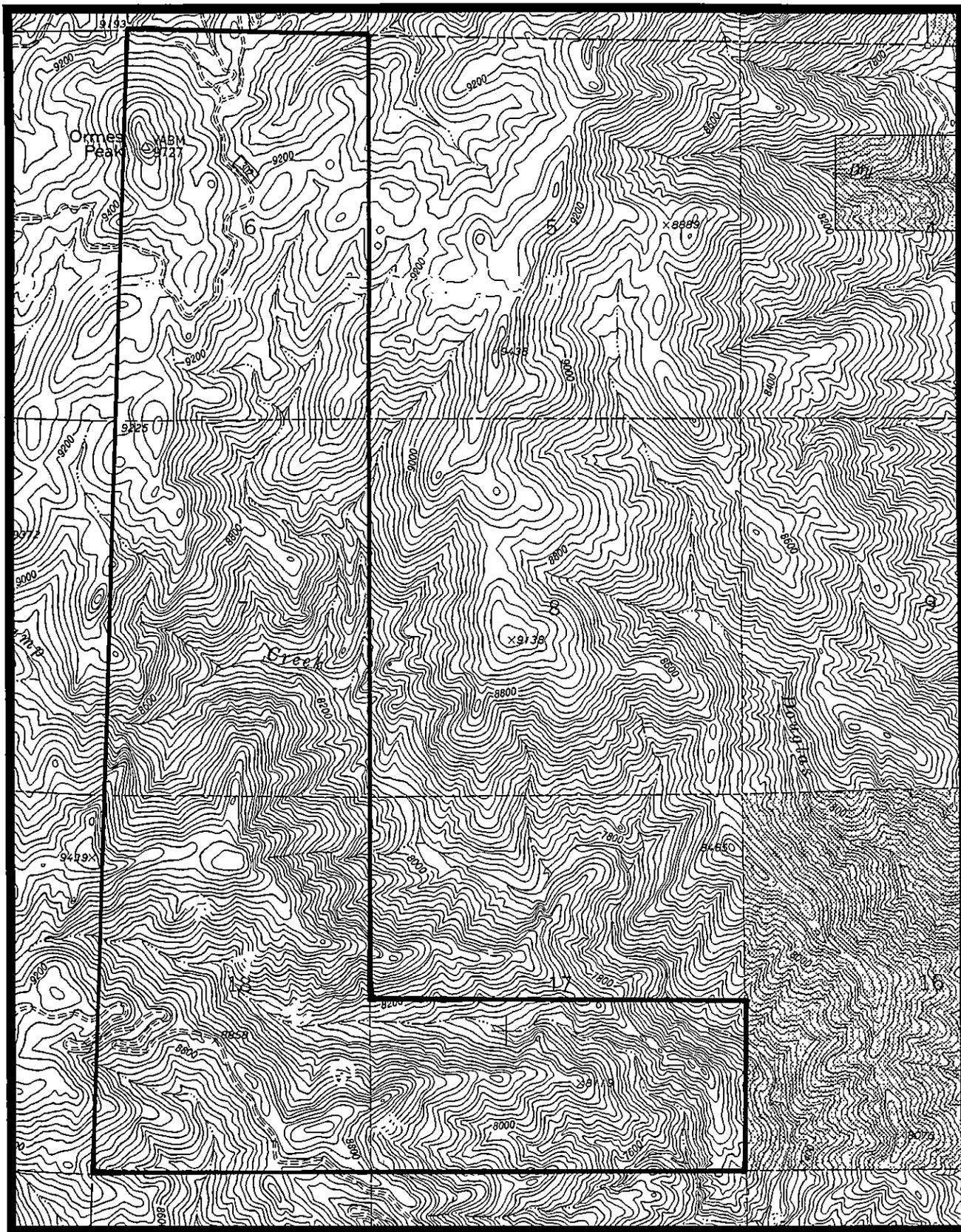
STANDARD STIPULATIONS



NO SURFACE OCCUPANCY (NSO)



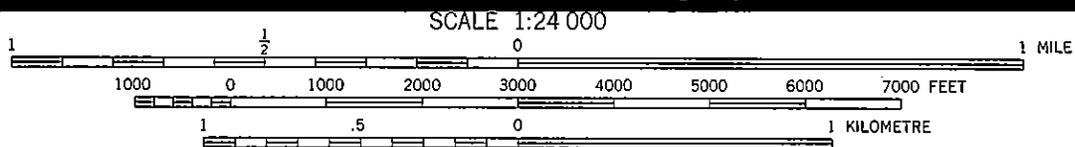
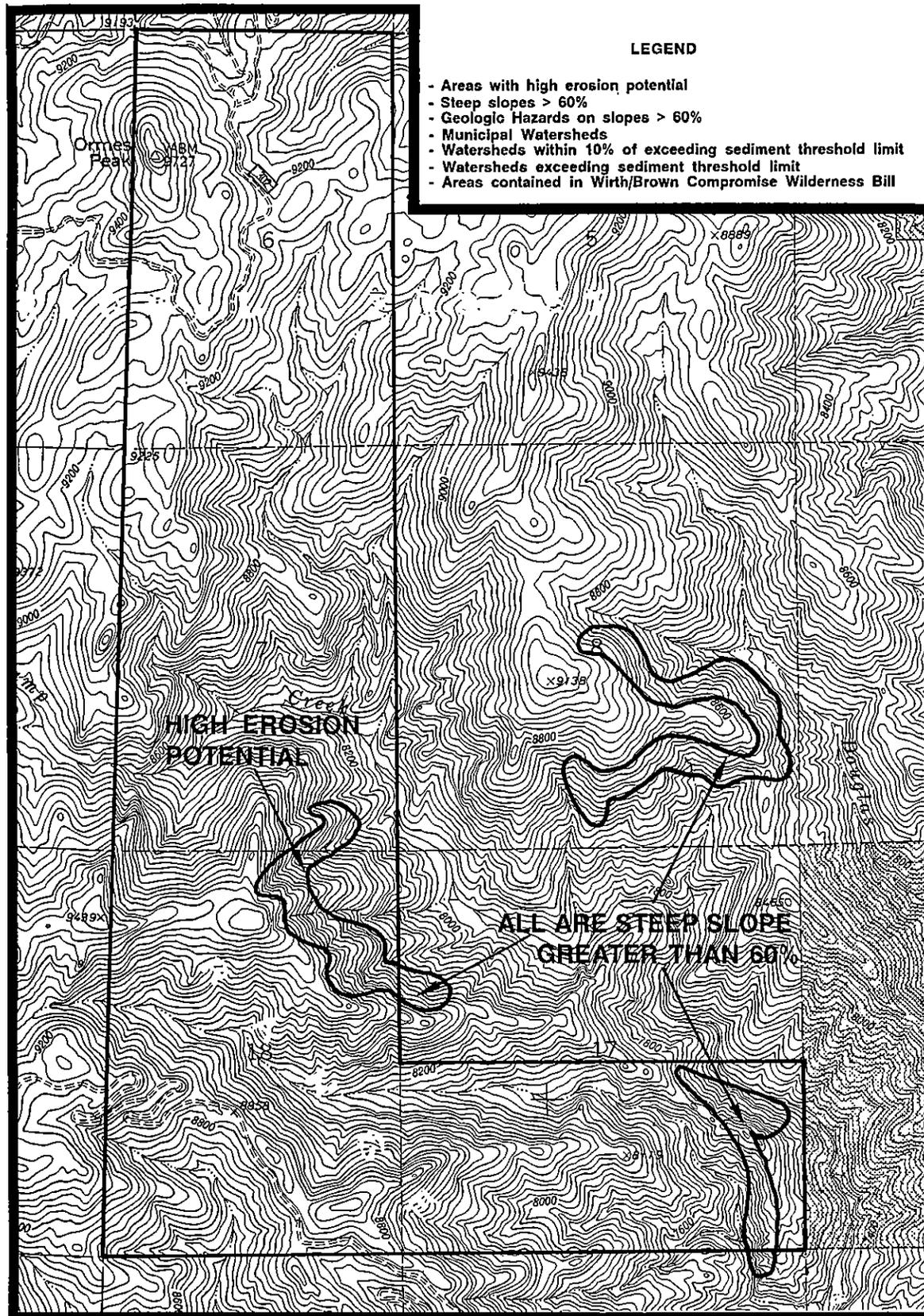
Figure I - 11  
Resource Base Quad Map



CONTOUR INTERVAL 40 FEET  
DATUM IS MEAN SEA LEVEL



Figure 1-12  
Resource Overlay 1 on Base Quad Map



CONTOUR INTERVAL 40 FEET  
DATUM IS MEAN SEA LEVEL



**Figure I-13  
Lease Stipulation  
CSU - Soils**

---

Serial No. \_\_\_\_\_

**CONTROLLED SURFACE USE STIPULATION**

**Surface occupancy or use is subject to the following special operating constraints.**

Ground disturbing activities will be relocated beyond 200 meters to suitable soil types and/or stable slope conditions where such controls are necessary to protect resource values on the lands described below:

1. Slopes steeper than 60 percent.
2. Fragile soils with High (severe) erosion potential on slopes of 40 percent or greater.
3. Fragile soils with High (severe) erosion potential, soil depth to bedrock is less than 20 inches, and slopes of 35 percent or greater.

**Exception Criteria**

This stipulation will not be applied on lands within lease areas where neither of the above limiting characteristics are found to exist. Modification of this stipulation may occur as long as resource values are protected.

**For the purpose of:**

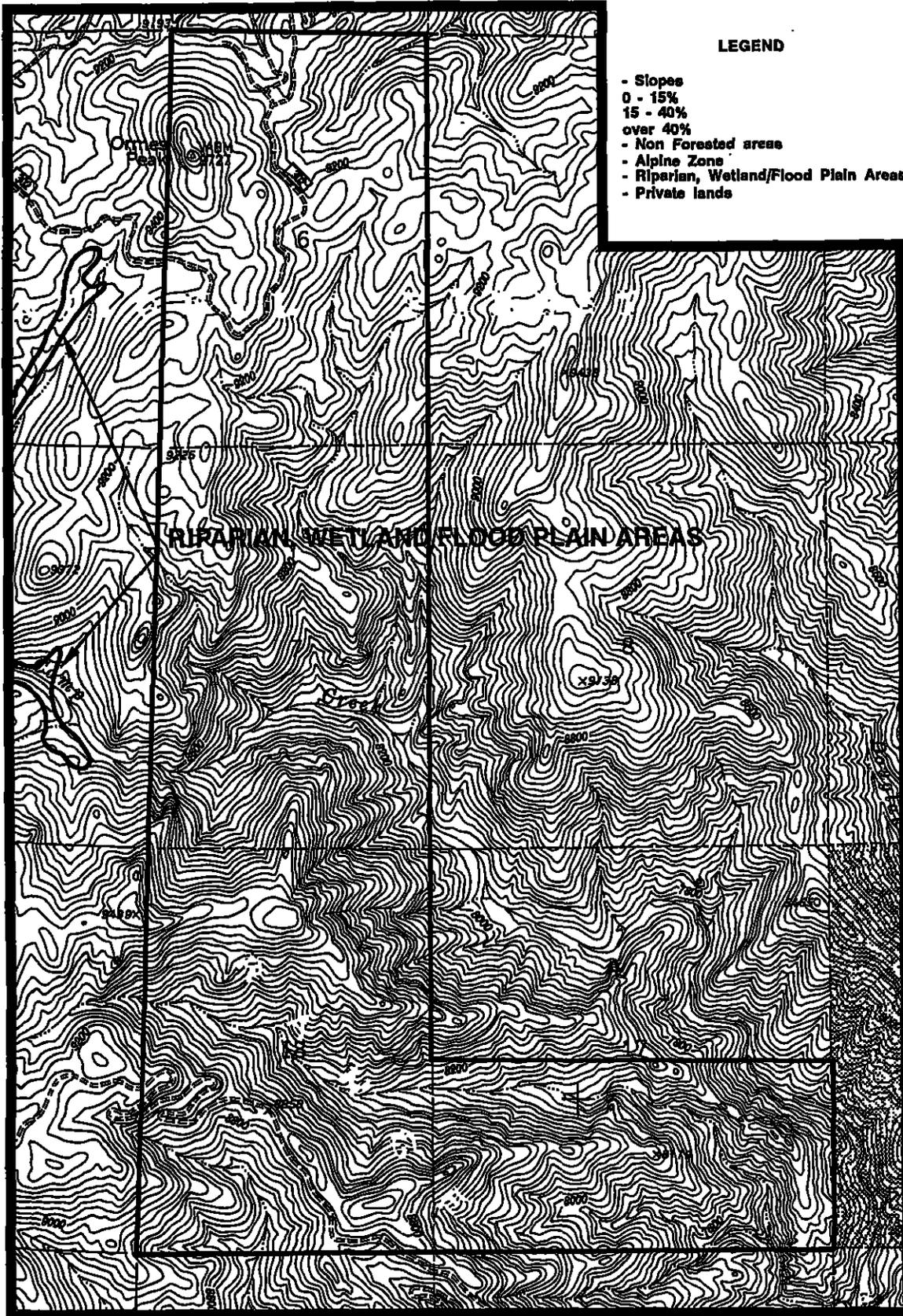
1. Preventing significant or permanent impairment of soil productivity.
2. Protecting off-site areas by preventing impacts from accelerated soil erosion.
3. Maintaining or improving water quality to meet Federal or State standards.
4. Preventing detrimental impacts such as gully erosion, streambank failure, soil compaction, and severe rutting which could cause long-term damage or permanent impairment to soil productivity.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101, FS Oil & Gas Regulations, 36 CRF, Sec. 228.104.)

Form #/Date

---

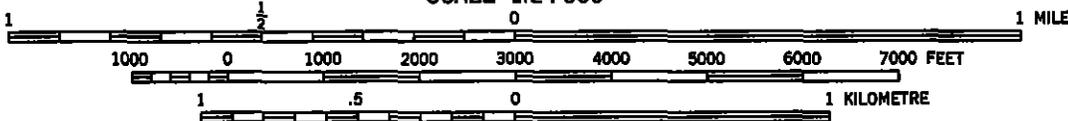
Figure I - 14  
Resource Overlay 2 on Base Quad Map



LEGEND

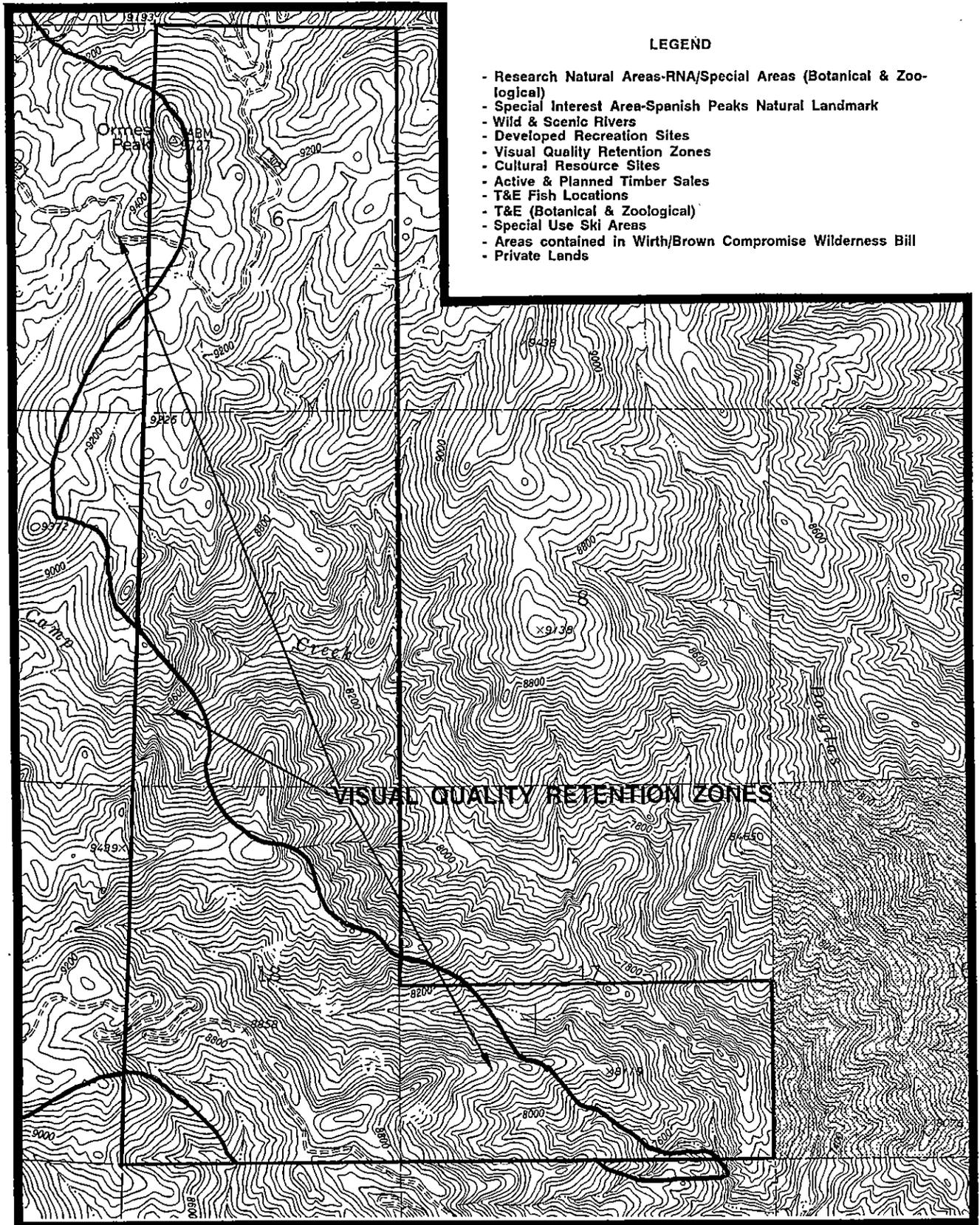
- Slopes
- 0 - 15%
- 15 - 40%
- over 40%
- Non Forested areas
- Alpine Zone
- Riparian, Wetland/Flood Plain Areas
- Private lands

SCALE 1:24 000



CONTOUR INTERVAL 40 FEET  
DATUM IS MEAN SEA LEVEL

Figure 1-15  
Resource Overlay 3 on Base Quad Map

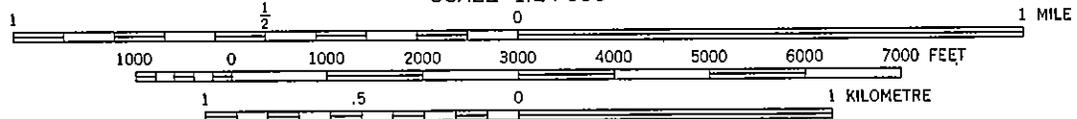


LEGEND

- Research Natural Areas-RNA/Special Areas (Botanical & Zoological)
- Special Interest Area-Spanish Peaks Natural Landmark
- Wild & Scenic Rivers
- Developed Recreation Sites
- Visual Quality Retention Zones
- Cultural Resource Sites
- Active & Planned Timber Sales
- T&E Fish Locations
- T&E (Botanical & Zoological)
- Special Use Ski Areas
- Areas contained in Wirth/Brown Compromise Wilderness Bill
- Private Lands

VISUAL QUALITY RETENTION ZONES

SCALE 1:24 000



CONTOUR INTERVAL 40 FEET  
DATUM IS MEAN SEA LEVEL



**Figure I-16  
Lease Stipulation  
CSU - Visual**

---

Serial No. \_\_\_\_\_

**CONTROLLED SURFACE USE STIPULATION**

**Surface occupancy or use is subject to the following special operating constraints.**

When necessary to meet VQO's, site clearings, collection facilities, structures, utilities and pipelines will be relocated more than 200 meters. At the time of APD a visual site analysis will be completed to determine if vegetation, topography, and on-site controls are sufficient to mitigate visual impacts. If so, the site will be excepted, and not require relocation.

**On the lands described below:**

Lands with the following visual resource classification, FG1A, FG1B, and MG1A, that have retention identified as the quality objective. Federal and State Highways, nationally designated trails, major water features, recreation complexes, and high use Forest Service Roads are examples. Visual Quality Maps are on file in the Supervisor's Office, Pueblo, Colorado.

**For the purpose of:**

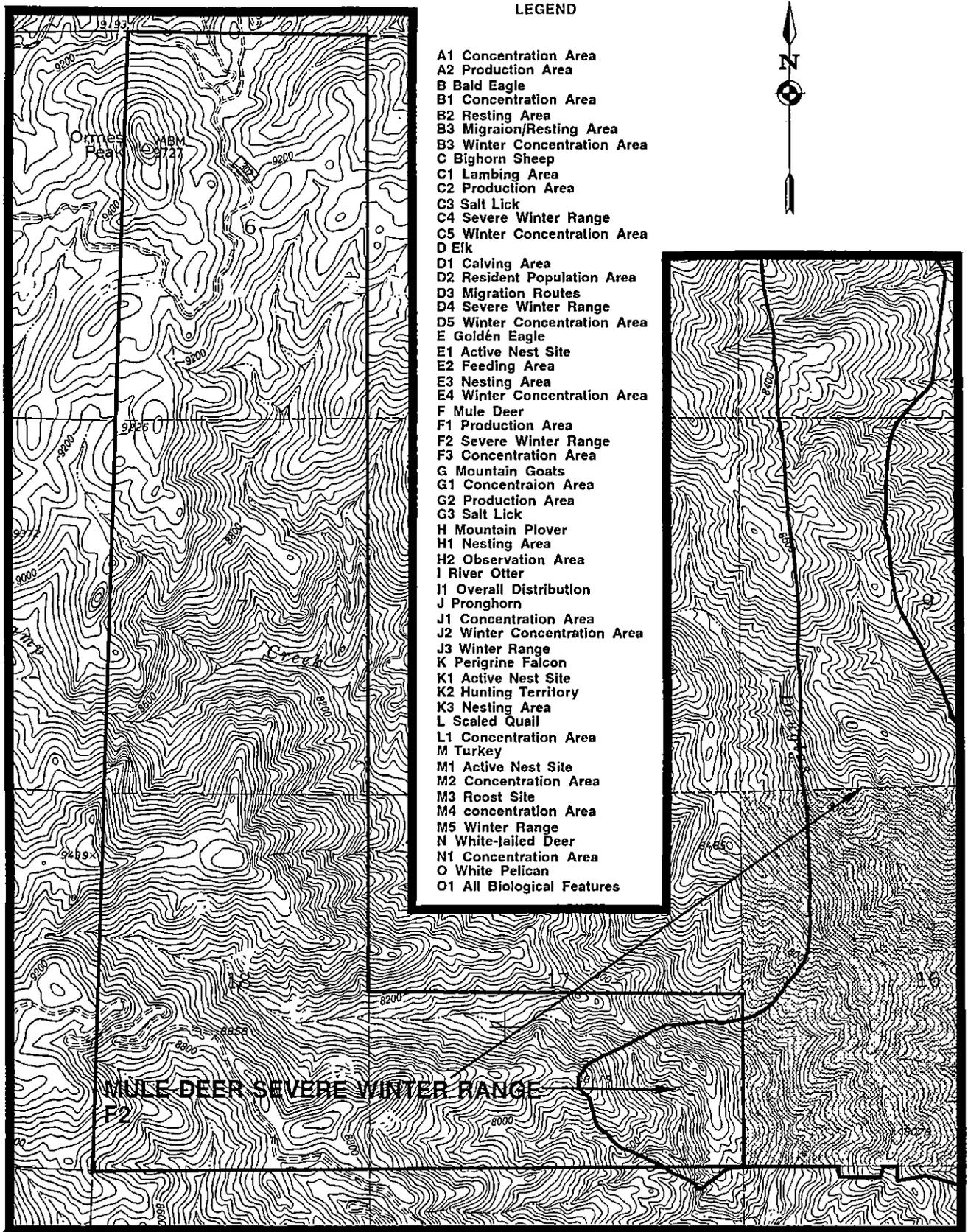
1. Protecting the natural, cultural and historical scenic values of these areas.
2. Preventing the placement of collection facilities, well sites or exploration activity within these areas that do not meet Visual Resource Management guidelines.
3. Providing Forest and Grassland visitors with quality experiences.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

Form #/Date

---

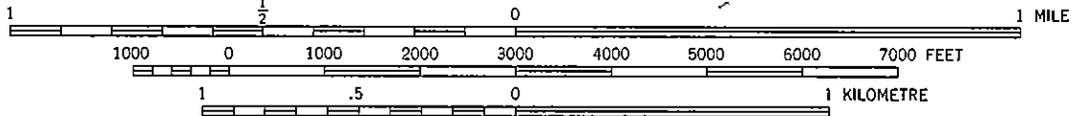
Figure I-17  
Resource Overlay 4 on Base Quad Map



LEGEND

- A1 Concentration Area
- A2 Production Area
- B Bald Eagle
- B1 Concentration Area
- B2 Resting Area
- B3 Migration/Resting Area
- B3 Winter Concentration Area
- C Bighorn Sheep
- C1 Lambing Area
- C2 Production Area
- C3 Salt Lick
- C4 Severe Winter Range
- C5 Winter Concentration Area
- D Elk
- D1 Calving Area
- D2 Resident Population Area
- D3 Migration Routes
- D4 Severe Winter Range
- D5 Winter Concentration Area
- E Golden Eagle
- E1 Active Nest Site
- E2 Feeding Area
- E3 Nesting Area
- E4 Winter Concentration Area
- F Mule Deer
- F1 Production Area
- F2 Severe Winter Range
- F3 Concentration Area
- G Mountain Goats
- G1 Concentration Area
- G2 Production Area
- G3 Salt Lick
- H Mountain Plover
- H1 Nesting Area
- H2 Observation Area
- I River Otter
- I1 Overall Distribution
- J Pronghorn
- J1 Concentration Area
- J2 Winter Concentration Area
- J3 Winter Range
- K Peregrine Falcon
- K1 Active Nest Site
- K2 Hunting Territory
- K3 Nesting Area
- L Scaled Quail
- L1 Concentration Area
- M Turkey
- M1 Active Nest Site
- M2 Concentration Area
- M3 Roost Site
- M4 concentration Area
- M5 Winter Range
- N White-jailed Deer
- N1 Concentration Area
- O White Pelican
- O1 All Biological Features

SCALE 1:24 000



CONTOUR INTERVAL 40 FEET  
DATUM IS MEAN SEA LEVEL

**Figure I-18**  
**Lease Stipulation**  
**TIMING - Wildlife Critical Winter Ranger**

---

Serial No. \_\_\_\_\_

**TIMING LIMITATION STIPULATION**  
**(CRITICAL WINTER RANGE)**

No surface use is allowed during the following time period(s); this stipulation does not apply to operation and maintenance of production facilities.

1. Exploration, drilling, and development activity will not be allowed during the period from December 1 to April 15.
2. New oil and gas roads on public lands will be closed to the public from December 1 to April 15.

**On the lands described below:**

Critical Winter Ranges for big game and turkey

**For the purpose of:**

These areas are critical mule deer, pronghorn antelope, big horn sheep, elk, and turkey winter ranges. These key concentration areas support and sustain a large percentage of the total winter populations. They are extremely important for animal survival during winters of harsh weather conditions. Disturbances and habitat losses may place unnecessary stress on the wintering wildlife herds and cause an increase in mortality.

Conditions under which this stipulation would be waived.

1. Winter conditions which would not concentrate wildlife on the critical winter ranges, and
2. The duration of the operation would not exceed two weeks.

Any changes to this stipulation will be made in accordance with the land use plan and/or the regulatory provisions for such changes. (For guidance on the use of this stipulation, see BLM Manual 1624 and 3101 or FS Manual 1950 and 2820.)

Form #/Date

---

# **PUBLIC NOTIFICATION AND PUBLIC INVOLVEMENT**

## **Notification Of The Proposed Actions**

The Forest Service invited written comments and suggestions about issues pertaining to this action in a Notice of Intent to Prepare an EIS, published in the Federal Register, Volume 53, No. 249, Wednesday, December 28, 1988 (please see Chapter VI, Record of Public Notice, Other Agency and Public Participation and Forest Service Response to Issues for discussions of public participation pertaining to this EIS). The notice, in part, stated:

*"To satisfy requirements of the 1987 Reform Act, the Forest Supervisor, Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands will prepare an EIS which will analyze and disclose expected environmental impacts including possible cumulative effects when consenting or not consenting to issuance of oil and gas leases on the Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands.*

*The scope of the analysis for the EIS will include: Identifying areas where the Forest Service will consent or deny consent to issuance of oil and gas leases on National Forest System lands within the Pike and San Isabel National Forests (Colorado), the Comanche National Grassland (Colorado) and the Cimarron National Grassland (Kansas); determining site-specific and cumulative effects resulting from leasing decisions; determining stipulations to protect surface resources; and, satisfying requirements of the 1987 Reform Act."*

A revised notice of intent to prepare an EIS was published in the Federal Register, Volume 54, No. 110, Friday, June 9, 1989. The revised notice, in part, stated:

*"The EIS has been expanded to include analysis and disclosure of expected environmental impacts, including possible cumulative impacts on split-estate lands where the minerals are federally owned and the surface estate is owned or managed by parties other than the Forest Service, where such lands are within the administrative boundaries of the Pike and San Isabel National Forests and Comanche National Grassland, Colorado, and within the administrative boundary of the Cimarron National Grassland, Kansas. The analysis and EIS will be used for a final decision by the BLM to lease or not lease these lands."*

All issues that were identified during the scoping and public notification processes have been documented. Those that were not considered significant, or which have been covered by prior environmental review, are not discussed in this EIS but are referenced in Appendix H (40 CFR Part 1501.7 (a)(3)).

## **SCOPING**

To perform the environmental analyses for these leasing decisions, the Forest Supervisor assembled a team of soil scientists, wildlife biologists, cartographers, archaeologists, hydrologists, forest

ecologists, engineers, and other resource specialists, social scientists, and landscape architects. This group of people are the Supervisor's *Interdisciplinary Team (IDT)* for this study.

This team reviewed the scientific literature associated with oil and gas exploration and production and the literature associated with environmental impacts of these activities. They made field studies of on-going oil and gas drilling, production, and reclamation activities, and consulted with experts in the Bureau of Land Management, the Colorado Division of Wildlife, the U.S. Fish and Wildlife Service, and other federal and state agencies. They also consulted with the public to learn about possible environmental, social and economic issues associated with such activities. Finally, they identified and mapped the environmental characteristics of the National Forest System lands to learn how these lands might be affected by these activities.

These various background study activities are termed *scoping* in the National Environmental Policy Act procedural regulations. These scoping activities were conducted to help the Interdisciplinary Team and Forest Supervisor identify the elements of the environment likely to be affected by the leasing decisions, determine what the significant environmental issues are associated with these decisions, and to determine what information and analyses are needed to make these decisions. [See Chapter VI]

## PLANNING RECORD

This EIS has considered and incorporated by reference all of the documents contained in the administrative record entitled "Administrative Record for Oil and Gas Leasing, Pike and San Isabel National Forests, Cimarron and Comanche National Grasslands, December 18, 1991." (Appendix F, Content Summary of Administrative Record for Oil and Gas Leasing, Pike and San Isabel National Forests, Cimarron and Comanche National Grasslands, December 18, 1991.) These documents are assembled and maintained at the Forest Supervisor's Office in Pueblo, Colorado to satisfy the requirements of 36 CFR 219.01(h). The public may review the documents at that office which is located at 1920 Valley Drive.

## SIGNIFICANT ENVIRONMENTAL ISSUES

The issues identified throughout the public involvement process, from initial scoping to review of the draft EIS, have been collected. A full list of the substantive issues can be found in Chapter VI, Persons or Agencies Consulted or Receiving this Environmental Impact Statement. The significant issues were determined (40 CFR Part 1501.7 (a)(2)(3)). Those that will be analyzed in this EIS include:

Effects of oil and gas leasing activities on wildlife, fish, and vegetation.

There are concerns about the effects leasing, drilling, and construction activities will have on wildlife habitat, wildlife breeding areas, wildlife migration patterns, and noise pollution. Playa lake beds need special protection because they are an important water sources for wildlife, and when full, are important waterfowl habitat for breeding, feeding and nesting. The impacts of transmission lines, including raptor mortality from collisions and electrocu-

tions. Reserve pits contribute to mortality of water birds through oiling and subsequent poisoning/drowning.

Effects of this, as well as the next 3 issues, include those related to direct ground disturbance, potential hazardous wastes, access impacts and drilling activities.

Effects on wetlands, floodplains, and threatened and endangered plant and animal species.

Concern about the effects leasing, drilling, and construction activities will have on wetlands, floodplains, and on rare and endangered plants and animals.

Effects of oil and gas leasing activities on soils and water and air quality.

Concern about the effects on soils resulting in the degradation of water quality and increasing sedimentation. Air quality could be affected by pollutants and sulphur dioxide. Stream degradation (bank failure, erosion, accelerated sedimentation) and adverse impacts to riparian areas and associated recreational opportunities along river corridors may occur.

Effects of drilling on surface and groundwater supplies and potable water.

Oil and gas exploration and development activities could result in water pollution. Surface and groundwater protection measures may not be effective or may not be enforced, affecting drinking water supplies.

Effects on designated and proposed wilderness areas, wilderness study areas, and potential wild and scenic rivers.

Concern that wilderness characteristics in the Sangre de Cristo, Spanish Peaks, Greenhorn Mountain and Buffalo Peaks Wilderness Study Areas may be harmed if the Forest Service consents to oil and gas leasing within wilderness study areas or too near existing wilderness. River corridors of concern include the Cimarron, Arkansas, Huerfano, and Badger Creek systems.

Recreation opportunities on significant areas should protected.

Concerns include highly scenic areas; developed recreation areas and areas with potential for wilderness designation; current river canyons, and buffers around all wilderness areas.

Alpine areas should protected from development.

Areas of alpine include extremely fragile plant and animal communities, found on many of the mountain districts.

Special management areas that need need protection include formally designated and proposed Special Interest Areas, Research Natural Areas, Natural Areas, Manitou Experimental Forest, municipal watersheds.

# EXHIBITS

EXHIBIT I-1

Oil and Gas Lease Monitoring Checklist  
PSICC form # 2820-01

District \_\_\_\_\_ Date Received \_\_\_\_\_

Proposed Parcel Identification \_\_\_\_\_

Parcel Location \_\_\_\_\_

Legal Description \_\_\_\_\_

NEPA Verification

Do site analyses in the EIS adequately address the site(s) proposed for lease?  
YES \_\_\_\_\_ NO \_\_\_\_\_

If not, is there a well in the analysis where the differences are insignificant? YES \_\_\_\_\_ NO \_\_\_\_\_

Identify the well in the EIS that best represents this site. \_\_\_\_\_

Have NEPA requirements been adequately met? YES \_\_\_\_\_ NO \_\_\_\_\_

Resource Monitoring

Follow these steps:

Map proposal to 1/2" to the mile and 1:24,000 scales on mylar.

Overlay smaller scale mylar on the Stipulation Base Map to determine if stipulations may be required and what quad or quads have to be referenced.

Overlay the 1:24000 scale mylar on the Resource Base Quad map(s).

Superimpose all resource overlays for the appropriate quads, identify, and map the resources identified on any lands within the lease parcel. A listing of the resources that may be mapped are found on the "Field Monitoring Review" form.

Obtain copies of any stipulations that may apply.

Complete the "Field Monitoring Review Form" and attach.

CERTIFICATION

Responsible District Ranger certify one of the following:

Authorization for the BLM to advertise lease parcel \_\_\_\_\_ shall not be granted until additional NEPA analysis is completed.

\_\_\_\_\_  
Date

\_\_\_\_\_  
District Ranger

OR:

The BLM is authorized to lease proposed parcel \_\_\_\_\_. I certify that an on-the-ground field check has performed and NEPA requirements have been met; appropriate stipulations have been identified and are attached to the lease; and, there is some location(s) on the lease proposal that can be occupied.

\_\_\_\_\_  
Date

\_\_\_\_\_  
District Ranger

FIELD MONITORING REVIEW FORM

Proposed parcel identification \_\_\_\_\_ Date reviewed \_\_\_\_\_  
 Proposed parcel legal location \_\_\_\_\_

Resource identified in EIS *	Lease Notice Required	DNL Apply?	Monitoring verifies that Values Exist and Supplemental Stip Required	Apply to Lease	Comments
<u>Resource Value</u>			NSO CSU	Timing	

SOILS

Areas of high erosion potential  
 Steep slopes > 60%  
 Geologic Hazards on slopes > 60%  
 Geologic Hazards on slopes > 35%

WATER

Wetlands/Floodplains  
 Riparian areas  
 Municipal Watersheds  
 Watersheds within 10% of or exceeding threshold limit

SPECIAL AREAS

Research Natural Areas  
 Special Interest Areas  
 Spanish Peaks NWL

RECREATION

Developed Recreation Sites  
 Visual Quality Areas  
 Cultural Resource Sites

OTHER

Alpine areas \*\*  
 Active & Planned Timber Sales  
 T&E plant/animal/fish locations  
 Special Use Ski Areas  
 Other Special Uses

\* Provide map attachment

\*\* If present monitoring is to be completed by a qualified botanist or ecologist.

FIELD MONITORING REVIEW FORM

Proposed parcel identification

<u>Resource Value</u>	<u>Resource Identified in EIS *</u>	<u>Lease Notice Required</u>	<u>DNL Apply?</u>	<u>NSQ</u>	<u>CSU</u>	<u>Timing</u>	<u>Monitoring verifies that Values Exist and Supplemental Stip Required</u>	<u>Apply to Lease</u>	<u>Comments</u>
<u>WILDLIFE</u>									
Aberts Squirrel Concentration Area									
Production Area									
Bald Eagle Concentration Area									
Feeding Area									
Migration/Resting Area									
Winter Concentration Area									
Bighorn Sheep									
C1 Lambing Area									
C2 Production Area									
C3 Salt Lick									
C4 Severe Winter Range									
C5 Winter Concentration Area									
Elk									
D1 Calving Area									
D2 Resident Population Area									
D3 Migration Routes									
D4 Severe Winter Range									
D5 Winter Concentration Area									
Golden Eagle									
E1 Active Nest Site									
E2 Feeding Area									
E3 Nesting Area									
E4 Winter Concentration Area									
Mule Deer									
F1 Production Area									
F2 Severe Winter Range									
F3 Concentration Area									
Mountain Goats									
G1 Concentration Area									
G2 Production Area									
G3 Salt Lick									
Mountain Plover									
H1 Nesting Area									
H2 Observation Area									

FIELD MONITORING REVIEW FORM

Proposed parcel identification \_\_\_\_\_

Resource Value	Resource Identified in EIS *	Lease Notice Required	DNL Apply?	NSO	CSU	Timing	Apply to Lease	Comments
Monitoring verifies that Values Exist and Supplemental Strip Required								

WILDLIFE (cont)

- River Otter
- I1 Overall Distribution
- Pronghorn
- J1 Concentration Area
- J2 Winter Concentration Area
- J3 Winter Range
- Peregrine Falcon
- K1 Active Nest Site
- K2 Hunting Territory
- K3 Nesting Area
- Scaled Quail
- L1 Concentration Area
- Turkey
- M1 Active Nest Site
- M2 Concentration Area
- M3 Roost Site
- M4 Concentration Area
- M5 Winter Range
- White-tailed Deer
- N1 Concentration Area
- White Pelican
- O1 All Biological Features

If there are inconsistencies between the field monitoring and the EIS do you feel they are significant? Describe.

Monitoring completed by :  
(name and title)

\_\_\_\_\_ date: \_\_\_\_\_

\_\_\_\_\_ date: \_\_\_\_\_

\_\_\_\_\_ date: \_\_\_\_\_

\_\_\_\_\_ date: \_\_\_\_\_

# NOTES

<sup>1</sup> "Environmental Assessment for Oil and Gas Leasing in the Escalante Known Geologic Structure", Dixie National Forest and Cedar City District (BLM), Garfield County, Utah, undated. Probable date 1988, pp 14-16.

<sup>2</sup> "Environmental Assessment for Oil and Gas Leasing in the Escalante Known Geologic Structure", Dixie National Forest and Cedar City District (BLM), Garfield County, Utah, undated. Probable date 1988, pp 14-16.

<sup>3</sup> Forest Land and Resource Management Plan

<sup>4</sup> USDA, Forest Service; Jorgensen, Rodney, Oil and Gas Leasing EIS, Soil Resource Report, PSICC, Pueblo, CO. Appendix I, May 199, revised.

<sup>5</sup> Region 2 Forest Service Handbook Supplement No. 2800-90-2. Effective August 15, 1990. 2822.04(C).

# **CHAPTER II**

## **ALTERNATIVES**

### **INTRODUCTION**

This chapter discusses the alternatives explored for management of an oil and gas leasing program on the PSICC. Management of a leasing program is based on a determination of the administrative availability of lands for leasing and the protection requirements applied to those lands found available. If a given area of land is available to be leased the conditions that would be applied to the lease and the analysis to determine them must be disclosed in this, or subsequent, environmental documents prior to leasing. These are new requirements based on the Oil and Gas Leasing Reform Act.

The section, Formulation of Alternatives, explains the requirements in the National Environmental Policy Act (NEPA), the National Forest Management Act (NFMA), and the Oil and Gas Leasing Regulations (36 CFR 228.102(c)) governing the development of alternatives. The use of major public issues as a basis for developing alternatives is also discussed. The section also discusses considerations that remained constant in all alternatives.

The section, Reasonably Foreseeable Development (RFD), describes the type and amount of post leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program consistent with that described in each alternative. It identifies the activities upon which the effects disclosed in Chapter IV are based.

The section, Alternatives Considered in Detail, describes the range of alternatives considered reasonable and analyzed as future management opportunities.

The section, Alternatives Considered and Eliminated from Detailed Study, describes the alternatives that were considered and eliminated from detailed study, and gives reasons for their elimination.

The Chapter concludes with a general comparison overview of the Alternatives Considered in Detail and their anticipated effects of implementation.

## **FORMULATION OF ALTERNATIVES**

The National Environmental Policy Act (NEPA) implementing regulations (40 CFR Part 1502.14) require rigorous evaluation of all reasonable alternatives, including "No Action", to minimize possible environmental effects. The National Forest Management Act (NFMA) directs the Forest Service to develop specific management direction for oil and gas activities on the Pike and San Isabel

National Forests, Comanche and Cimarron National Grasslands. The Oil and Gas Regulations (36 CFR 228.102(c)) require that environmental documents prepared for leasing decisions on National Forest System lands identify alternatives as to the lands to be made administratively available for oil and gas leasing.

The major public issues considered in the development of alternatives are as follows:

1. Potential adverse effects of oil and gas development on Forest resources.
2. Concern that alternatives not be developed based on mineral potential which may change as technology and information change over time.
3. Effects on areas being considered for wilderness designation or as potential wild and scenic rivers. .
4. Social and economic effects
5. Mitigation of impacts

## **CONSIDERATIONS THAT REMAIN CONSTANT FOR ALL ALTERNATIVES**

- \* Forest Plan Management direction for all resources except oil and gas.
- \* Forest Plan Management direction for oil and gas will be amended to be consistent with the 1987 Leasing Reform Act.
- \* Standard Lease Terms in BLM Lease Form 3109-11 provide a basic level of protection for resources and land uses that might be affected by oil and gas development. Standard Lease Terms (SLT) are a part of every lease issued and apply all non-discretionary statutes related to National Forest System Management.

## **REASONABLY FORESEEABLE DEVELOPMENT (RFD)**

Oil and Gas Regulations (36 CFR 228.102(c)(3&4)) require a projection of the type/amount of post leasing activity that is reasonably foreseeable as a consequence of conducting a leasing program under each alternative. The regulations also require that the Reasonable Foreseeable Impacts of post-leasing activity be analyzed in order to make the availability decision.

Projections of the type/amount of post-leasing activity were made by the Bureau of Land Management (BLM) for the Pike and San Isabel National Forests and the Comanche National Grassland. Projections for the Cimarron National Grassland were developed by the District minerals staff based on historical trends, industry activity and technology, and mineral potential. The RFD developed for the Cimarron was coordinated with, and approved by, the BLM. The development of all RFD projections is provided in Appendix B. These projections are necessary for a meaningful and reasoned analysis of the potential direct, indirect, and cumulative impacts resulting from oil

and gas leasing and development. The RFD projections for the Pike & San Isabel National Forests, Comanche National Grassland, and Cimarron National Grassland are as follows:

Pike & San Isabel National Forests - 1 exploratory well every 4 years over the next 15 years for a total of 4 wells.

Comanche National Grassland - 3 wells, one exploratory and 2 production, per year over the next 15 years for a total of 45 wells.

Cimarron National Grassland - 11 production wells per year over the next 15 years for a total of 165 wells.

The locations of the four exploratory wells the BLM expects for the Pike and San Isabel National Forests are shown in Figures II-1 & II-2. The BLM staff identified the most likely locations of these wells from their knowledge of current industry practices. The BLM feels that exploratory drilling is improbable on the remainder of the forest, primarily because the geologic material underneath the National Forests is precambrian granite. Oil and gas are not known to form in this material.

The environmental effects of four scattered exploratory wells on the 1.7 million acres of the Mountain Districts is very small and almost impossible to measure in any meaningful way. The Interdisciplinary Team does not feel that a study of these four wells allows examination of the full range of possible effects of oil and gas development on the mountain resources. This is because the probable well locations identified by BLM represent only one of a large array of possible locations of wells and because the wells were expected to be drilled on the lands with resources sensitive to oil and gas development.

Therefore, the ID Team devised a concept of "Concentrated Reasonably Foreseeable Development (RFD)". In this concept, the four Reasonably Foreseeable Development wells were located together on an area of land the ID Team determined is most environmentally sensitive to oil and gas development. Analysis of the concentrated wells reveals the most amount of environmental impact which could occur under the Reasonably Foreseeable Development scenario.

For probable locations of post leasing activity on the Grasslands, the BLM and Forest Service staffs identified a distribution of wells based on major land forms where development could be expected. General location descriptions and the number of wells predicted on each land form are shown in Table II-1.

**Table II-1  
RFD For the National Grasslands**

	Major landforms			
	Sandy Lands	Hard Lands	Canyon Lands	Riparian
Comanche NG	67% (30 wells)	29% (13 wells)	2% (1 well)	2% (1 well)
Cimarron NG	61% (101 wells)	35% (57 wells)	0%	4% (7 wells)

## **CHAPTER II**

# ALTERNATIVES CONSIDERED IN DETAIL

Four alternative strategies to manage oil and gas leasing were developed to study in detail. This section describes those Alternatives. They differ in the location and amount of lands made available for leasing as well as the application of mitigation through supplemental lease stipulations.

## ALTERNATIVE I Current Management (No Action)

Under this alternative, the Forest Service will continue to lease all legally available NFS lands except those removed under the Discretionary No Lease (DNL) authority. Those removed under the DNL authority include Research Natural Areas and Ski Areas where Forest Plan Direction specifies withdrawal from leasing, but the withdrawal process has not been completed, as well as those in which the management plans have not been completed to determine the protection needed. See Table II-11 for a listing of lands available for leasing. The BLM will issue leases on split-estate lands with federal minerals within National Forest or National Grassland boundaries. This is a "NO ACTION ALTERNATIVE" because there will be no deviation from the existing management direction in the Forest Plan. The National Environmental Policy Act (NEPA) requires the study of the No Action alternative for use as a baseline in comparing the effects of the other alternatives.

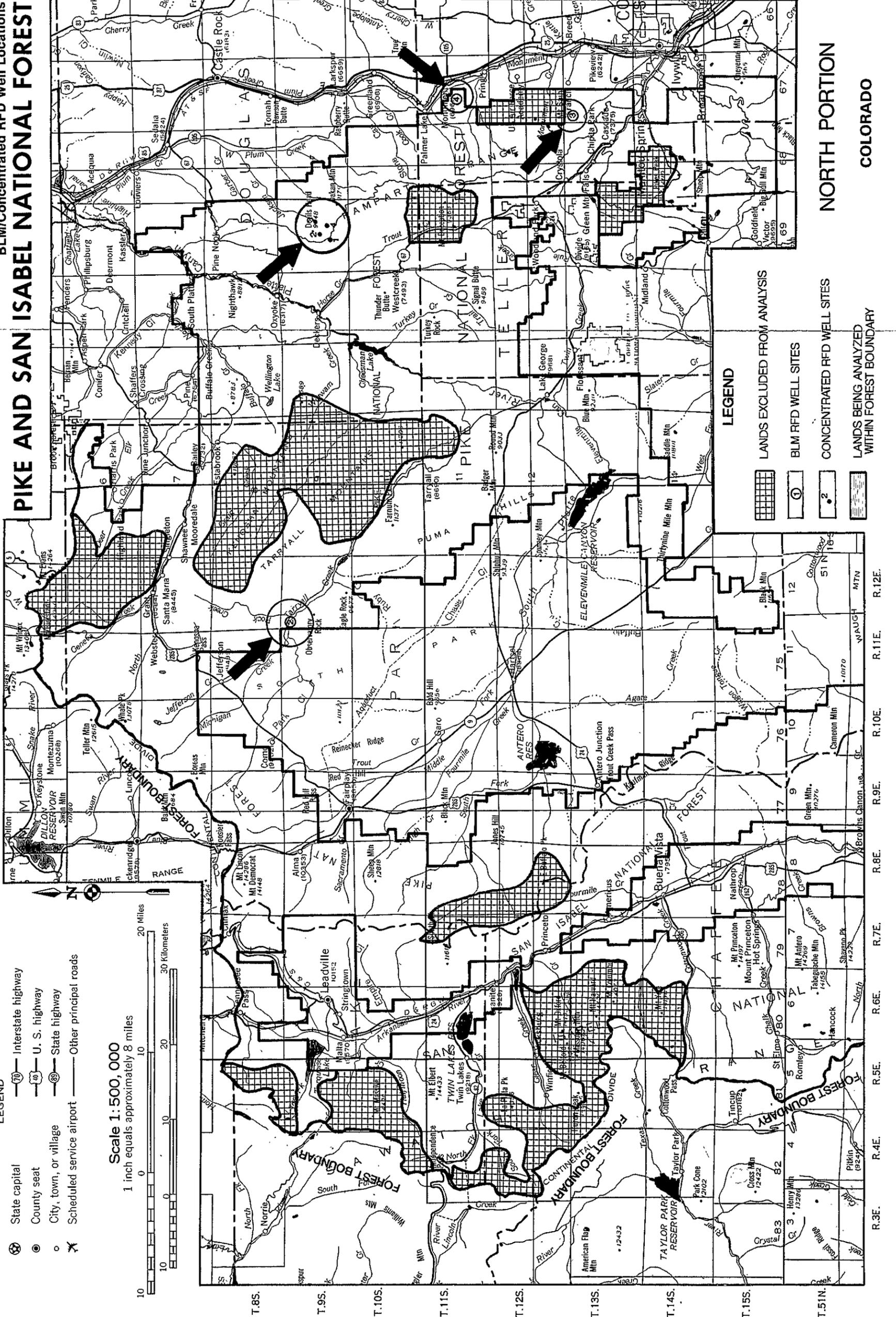
Administratively this alternative calls for site-specific environmental analysis and decisions in response to individual lease applications. The Forest Service will conduct site-specific environmental analysis as required by NEPA on a case-by-case basis as lease applications are received. The Oil and Gas Regulations require full disclosure of available lands that can be leased, and the environmental effects from a projected RFD on those available lands. This alternative would not make the specific land decision at this time. That decision would be made for each proposed parcel based on individual parcel analysis.

When a new lease parcel is proposed, that parcel will undergo a site-specific environmental analysis to determine if development can be allowed and what stipulations are necessary to protect resource values. The Forest Supervisor may authorize the Bureau of Land Management to offer the individual parcel for lease, subject to stipulation. To evaluate effects of this alternative, the RFD wells were analyzed applying current Forest Plan direction.

The difference between Alternatives I and III are primarily in administrative processes. This Alternative requires the analysis and documentation of the effects of individual leases on a site-specific case-by-case basis as lease applications are received. Alternative III makes that decision in this document and applies additional protection.

The environmental consequences resulting from the leasing analysis conducted for this alternative based on the projected RFD are discussed in Chapter IV, Environmental Consequences, of this EIS. Based upon the RFD's (BLM and Concentrated), Figures II-4 through II-9 and Tables II-2 and II-3 describe environmental effects of Alternative I.

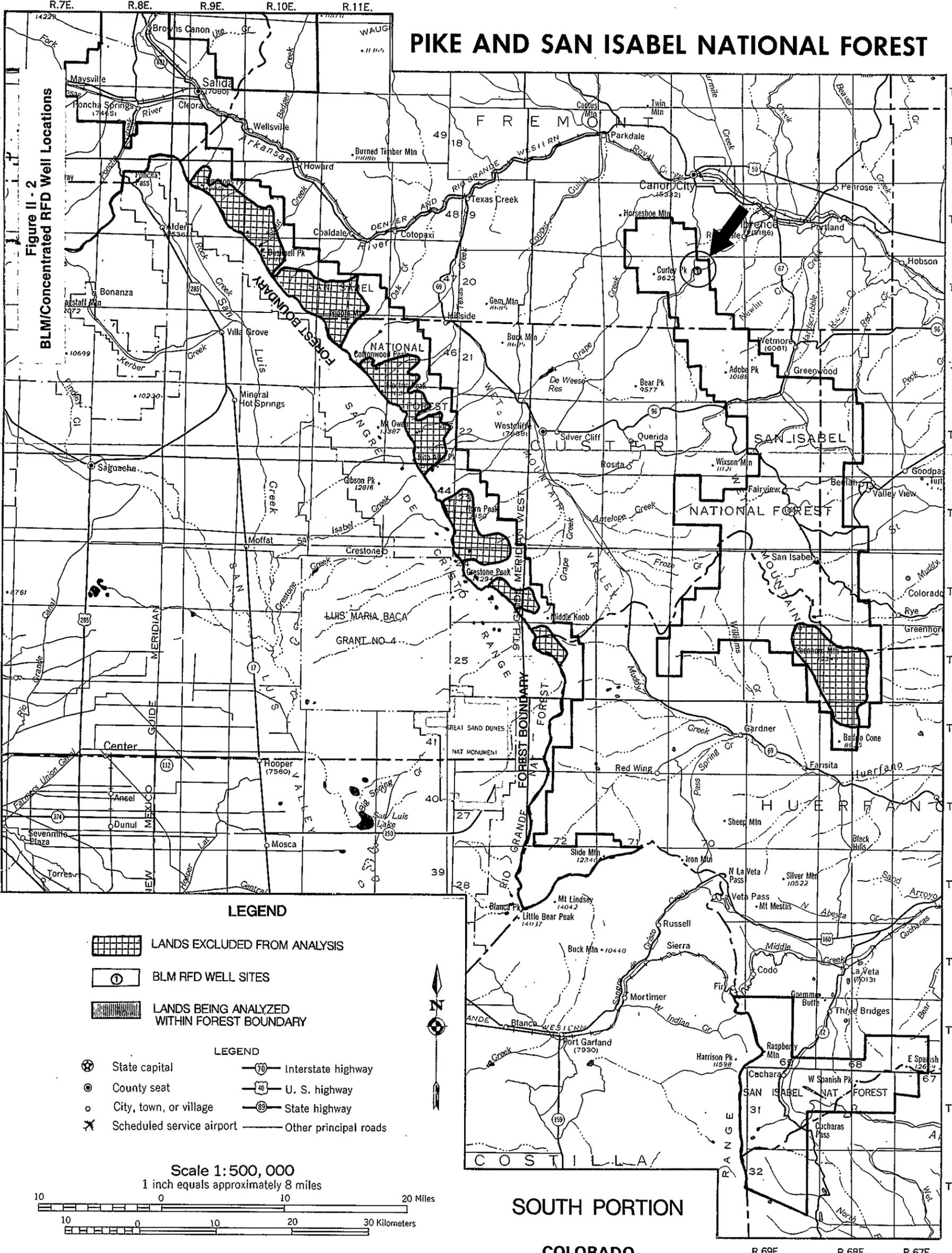
Figure II - 1  
BLM/Concentrated RFD Well Locations  
PIKE AND SAN ISABEL NATIONAL FOREST



NORTH PORTION  
COLORADO

# PIKE AND SAN ISABEL NATIONAL FOREST

Figure II - 2  
BLM Concentrated RFD Well Locations



- LEGEND**
- LANDS EXCLUDED FROM ANALYSIS
  - BLM RFD WELL SITES
  - LANDS BEING ANALYZED WITHIN FOREST BOUNDARY
- LEGEND**
- State capital
  - County seat
  - City, town, or village
  - Scheduled service airport
  - Interstate highway
  - U. S. highway
  - State highway
  - Other principal roads

Scale 1: 500, 000  
1 inch equals approximately 8 miles

10 0 10 20 Miles

10 0 10 20 30 Kilometers

SOUTH PORTION

COLORADO

R.69E. R.68E. R.67E.



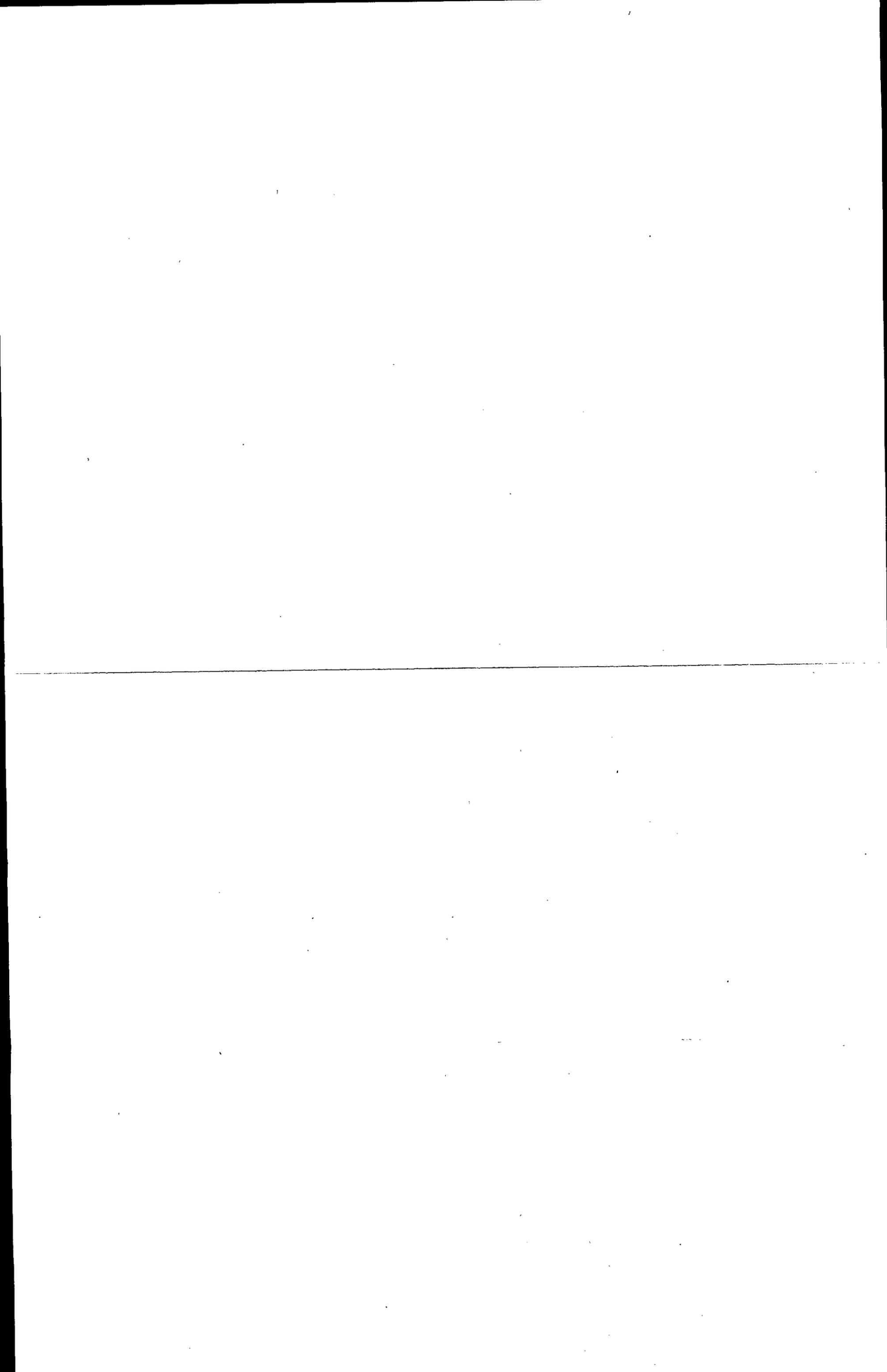
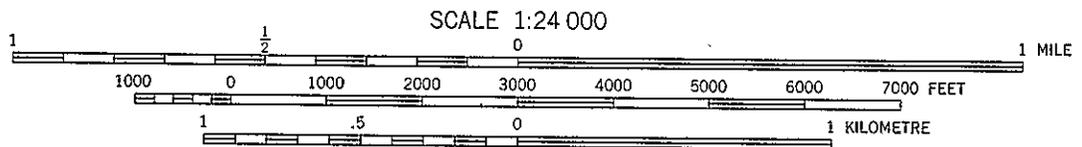
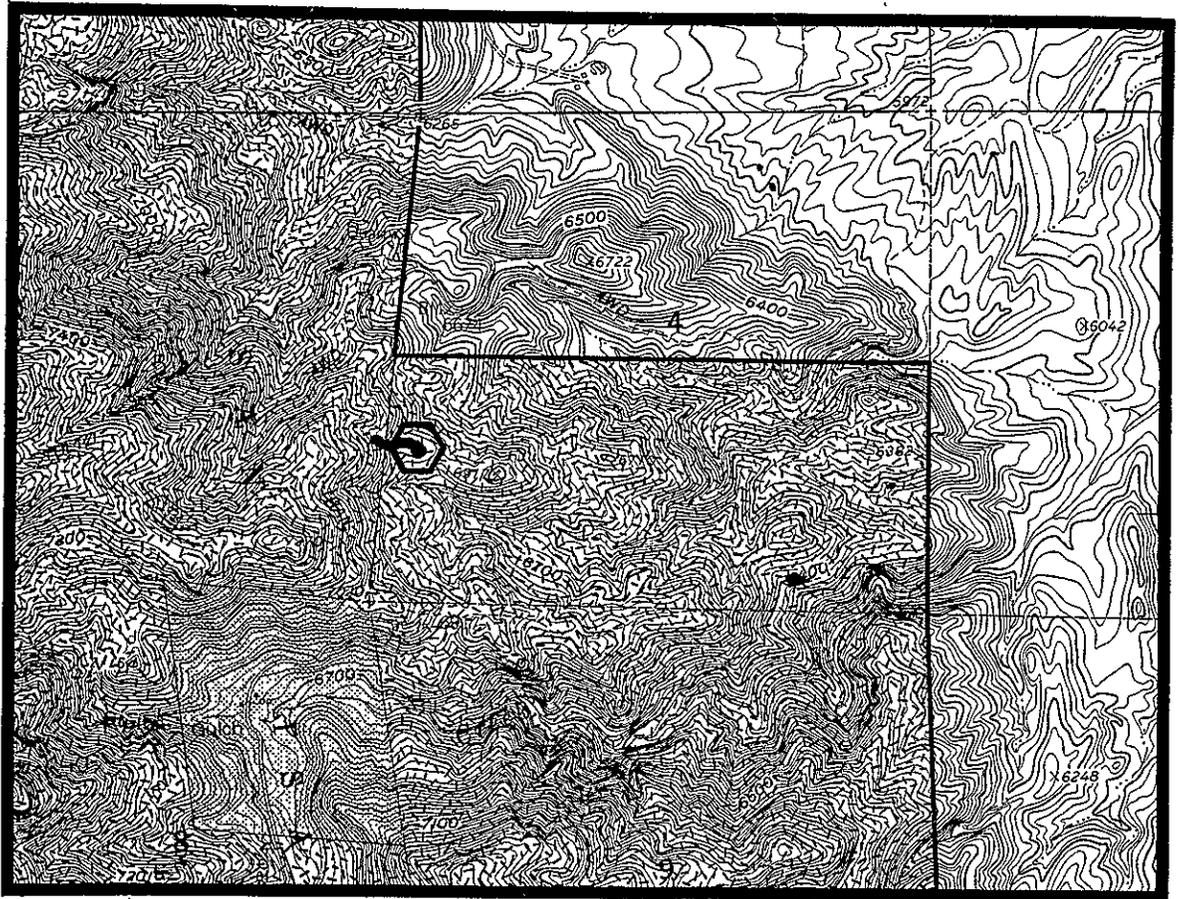


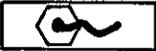
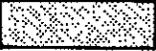
Figure II - 4  
 Alternative I - BLM RFD Well Site 1

T20S R70W Sec. 04 NWSW



CONTOUR INTERVAL 40 FEET  
 DATUM IS MEAN SEA LEVEL

LEGEND

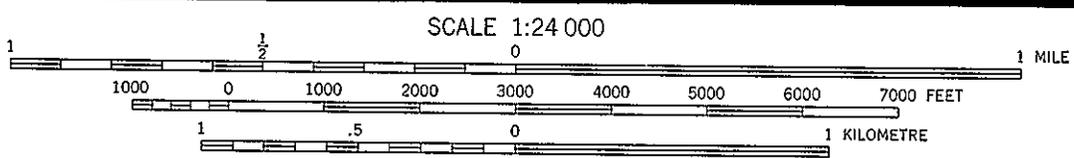
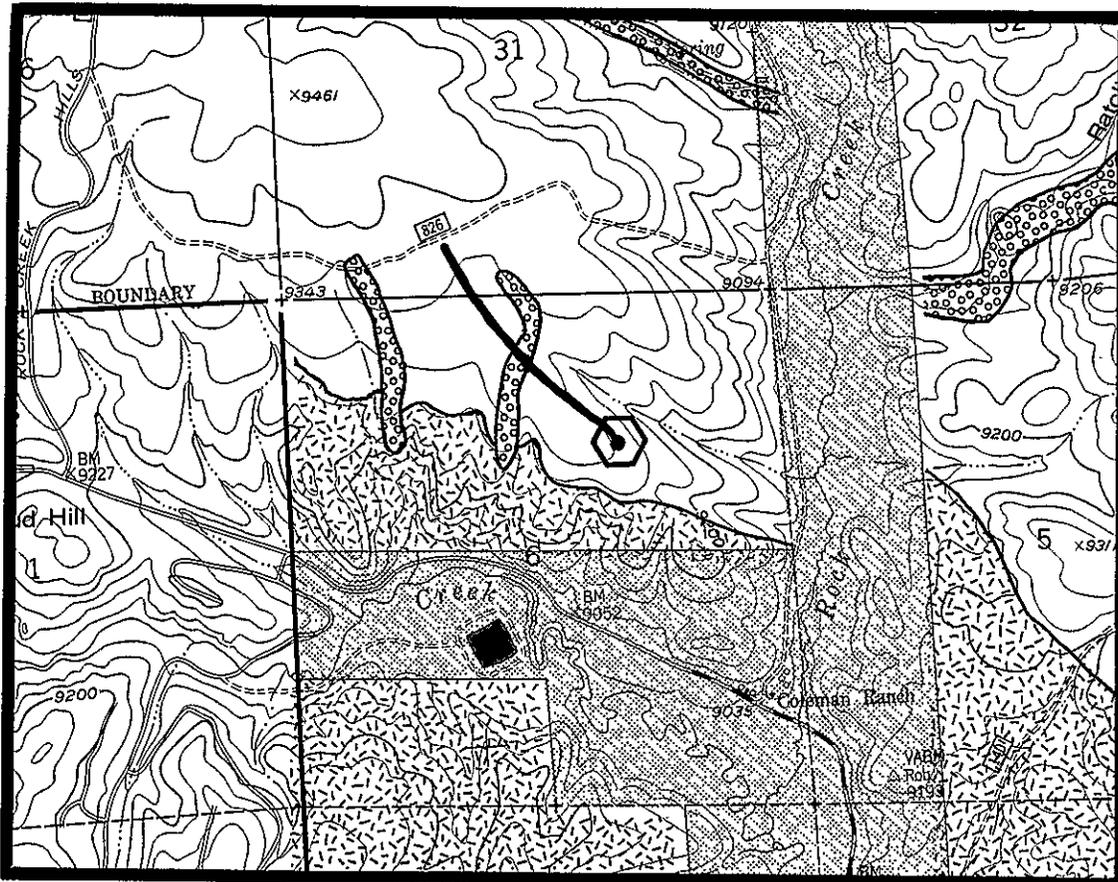
- |   |                                     |
|---|-------------------------------------|
|  | <b>WELL SITE &amp; ROAD</b>         |
|  | <b>NO SURFACE OCCUPANCY (NSO)</b>   |
|  | <b>CONTROLLED SURFACE USE (CSU)</b> |
|  | <b>PRIVATE PROPERTY</b>             |



**Note:** Based upon the application of supplemental stipulations, BLM RFD well site 1 is located in a controlled surface use area. Special operating constraints will be applied to protect the soil, visual and cultural resources as described in Appendix B and displayed on maps in Appendix G.

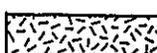
Figure II - 5  
 Alternative 1 - BLM RFD Well Site 2

T9S R74W Sec. 06 SWNE



CONTOUR INTERVAL 40 FEET  
 DATUM IS MEAN SEA LEVEL

LEGEND

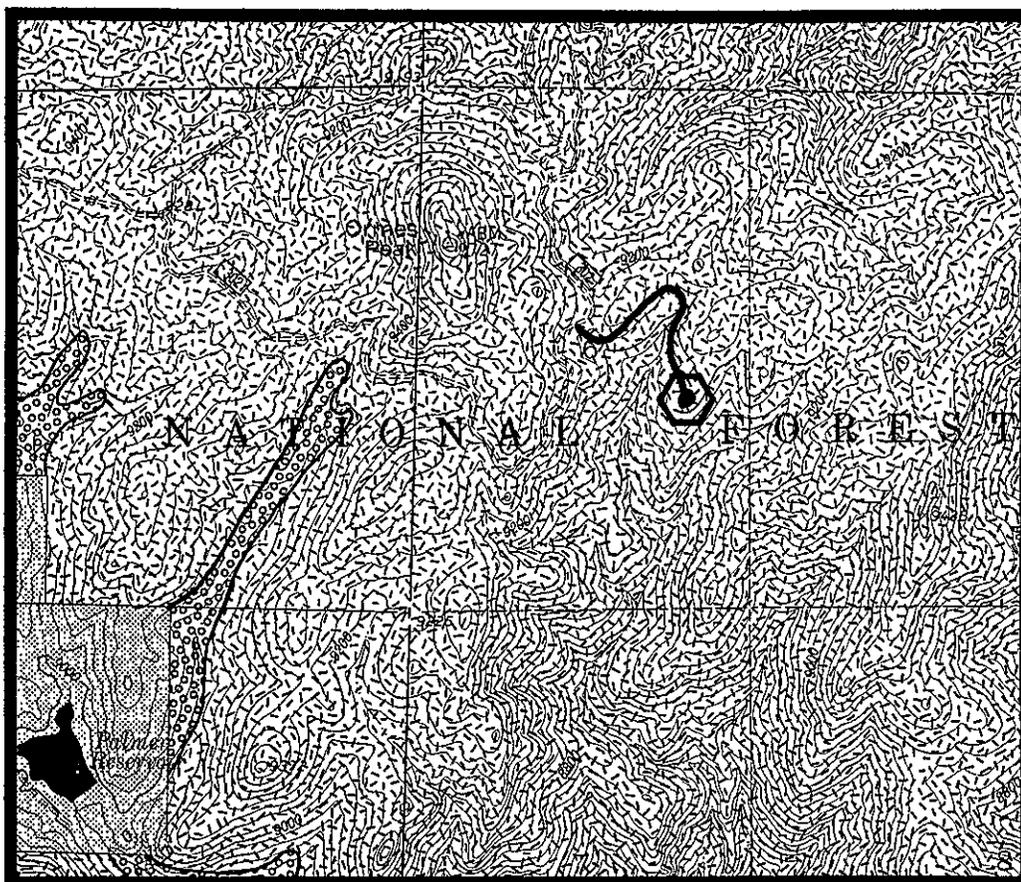
-  WELL SITE & ROAD
-  NO SURFACE OCCUPANCY (NSO)
-  CONTROLLED SURFACE USE (CSU)
-  PRIVATE PROPERTY



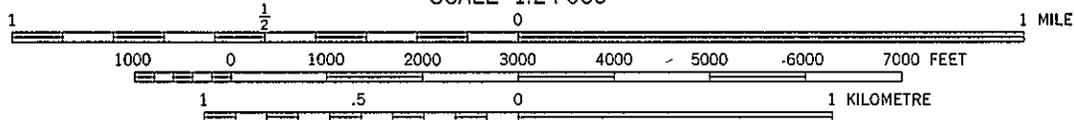
**Note:** Standard lease terms as identified by BLM will be sufficient to protect resource values on BLM RFD well site 2. No supplemental stipulations apply.

Figure II - 6  
 Alternative I - BLM RFD Well Site. 3

T13S R67W Sec. 06 NESE



SCALE 1:24 000



CONTOUR INTERVAL 40 FEET  
 DATUM IS MEAN SEA LEVEL

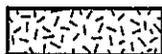
LEGEND



WELL SITE & ROAD



NO SURFACE OCCUPANCY (NSO)



CONTROLLED SURFACE USE (CSU)



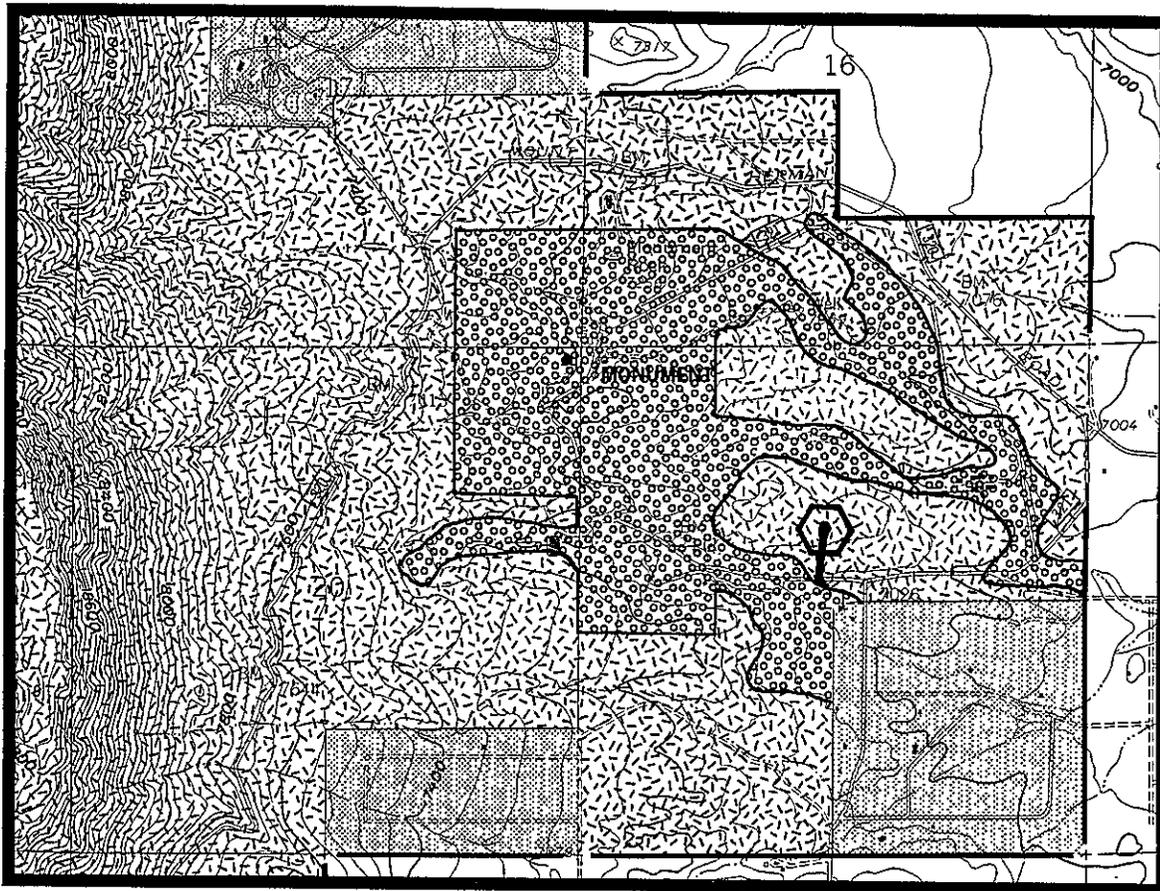
PRIVATE PROPERTY



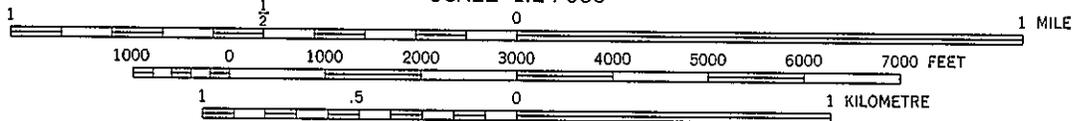
**Note:** Based upon the application of supplemental stipulations, BLM, RFD well site 3 is located in a controlled surface use area. Special operating constraints will be applied to protect the soil and watershed resources as described in Appendix B and displayed on maps in Appendix G.

Figure II - 7  
 Alternative I - BLM RFD Well Site 4

T11S R67W Sec. 21 SWNE



SCALE 1:24 000



CONTOUR INTERVAL 40 FEET  
 DATUM IS MEAN SEA LEVEL

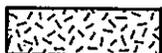
LEGEND



**WELL SITE & ROAD**



**NO SURFACE OCCUPANCY (NSO)**



**CONTROLLED SURFACE USE (CSU)**



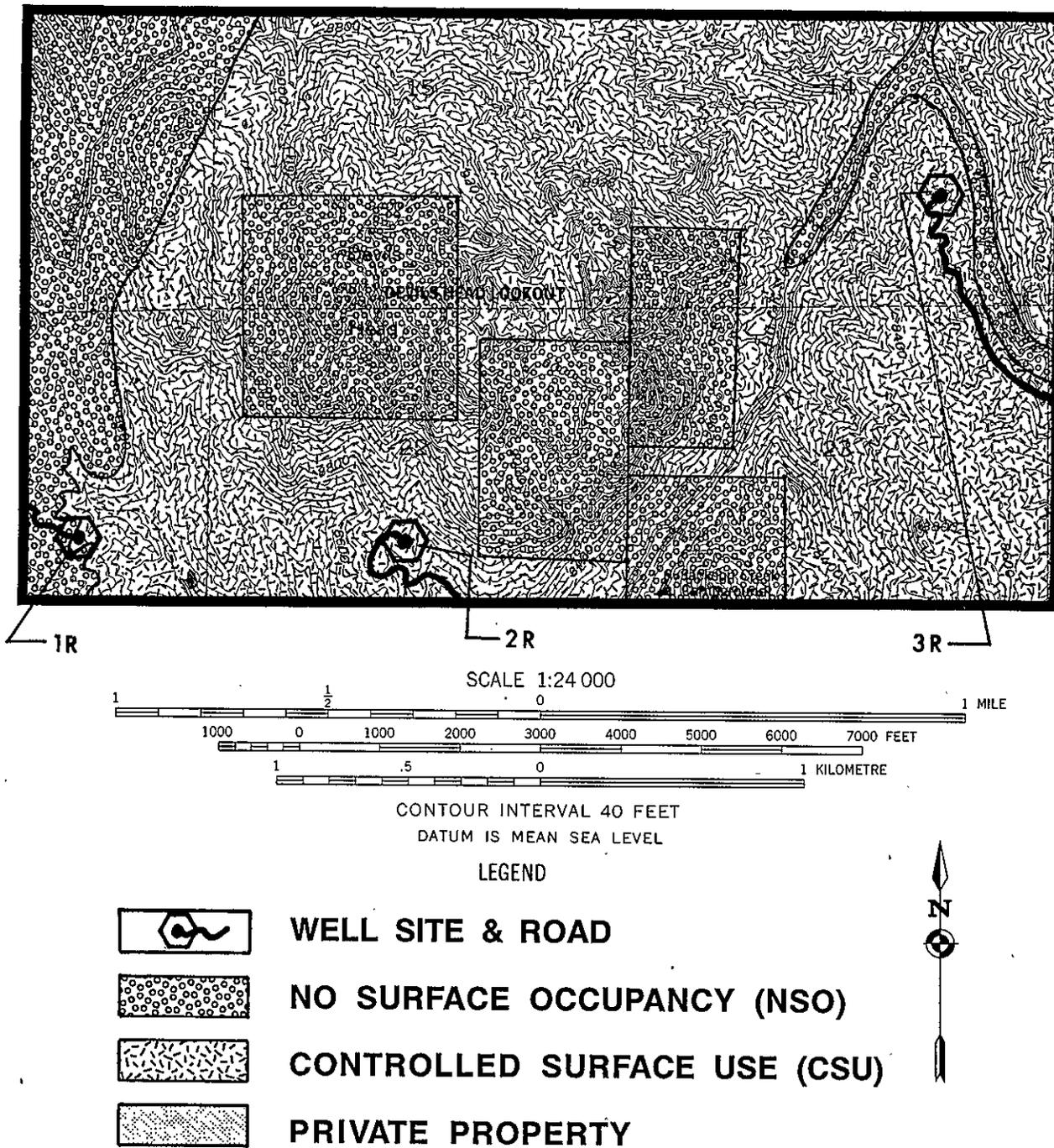
**PRIVATE PROPERTY**



**Note:** Based upon the application of supplemental stipulations, BLM, RFD well site 4 is located in a controlled surface use area. Special operating constraints will be applied to protect the watershed resources as described in Appendix B and displayed on maps in Appendix G.

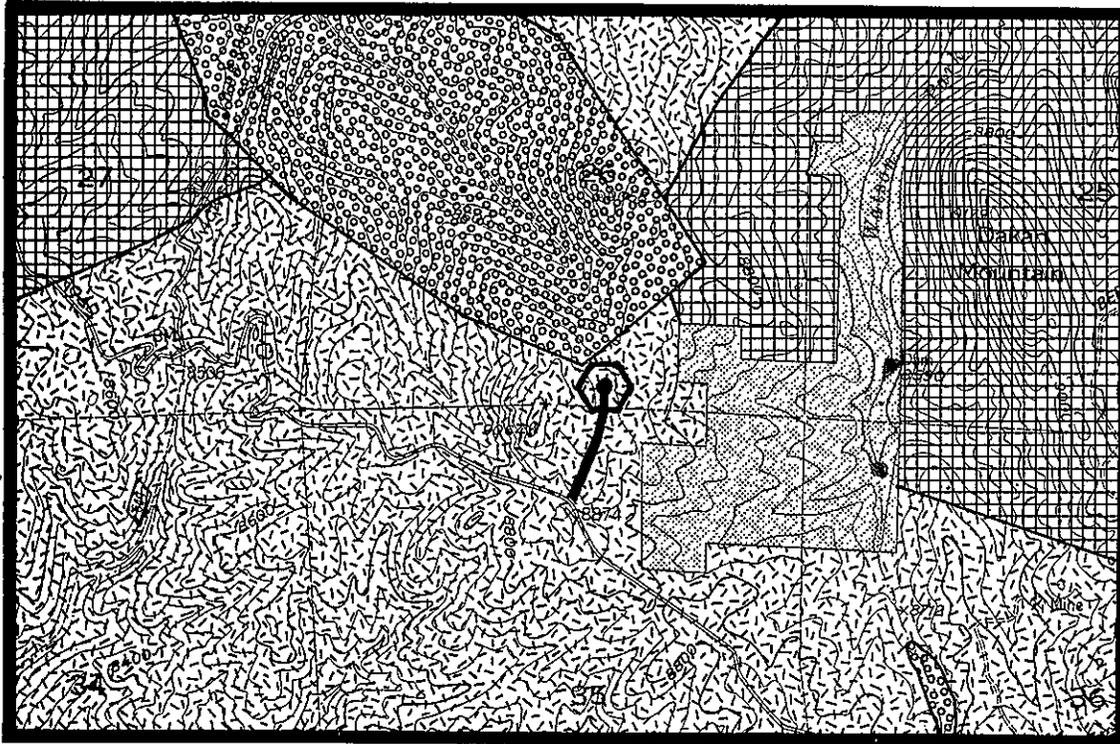
Figure II - 8  
 Alternative I - Concentrated RFD Well Sites 1R - 3R

Site 1R - T9S R69W Sec. 21 SWSE  
 Site 2R - T9S R69W Sec. 22 NESW  
 Site 3R - T9S R69W Sec. 14 SWSE

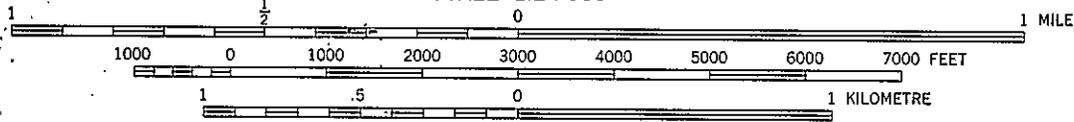


**Note:** Based upon the application of supplemental stipulations, Concentrated well sites 1R, 2R and 3R are located in a controlled surface use area. Special operating constraints will be applied to protect the soil, visual and watershed resources as described in Appendix B and displayed on maps in Appendix G.

Figure II - 9  
 Alternative I - Concentrated RFD Well Site 4R  
 T9S R69W Sec. 26 SWSE

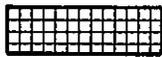
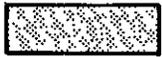


SCALE 1:24 000



CONTOUR INTERVAL 40 FEET  
 DATUM IS MEAN SEA LEVEL

LEGEND

-  WELL SITE & ROAD
-  NO SURFACE OCCUPANCY (NSO)
-  TIMING LIMITATION (SEASONAL)
-  CONTROLLED SURFACE USE (CSU)
-  PRIVATE PROPERTY



**Note:** Based upon the application of supplemental stipulations, Concentrated well site 4R is located in a controlled surface use area. Special operating constraints will be applied to protect the soil, visual and watershed resources as described in Appendix B and displayed on maps in Appendix G.

**Table II-2  
Alternative I - Well Disturbance Acres  
National Forests**

BLM RFD		Concentrated RFD	
Well	Disturbed	Well	Disturbed
1	4	1R	8
2	5	2R	9
3	5	3R	8
4	4	4R	4
Total	18	Total	29

**Table II-3  
Alternative I - Well Distribution and Disturbance Acres  
National Grasslands**

	Major Soil/Ecosystem Type			
	Sandy Lands	Hard Lands	Canyon Lands	Riparian
Number of Wells				
Cimarron	101	57	0	7
Comanche	30	15	0	0
Total	131	72	0	7
Disturbed Acres				
Cimarron	241	136	0	17
Comanche	54	27	0	0
Total	295	163	0	17

## ALTERNATIVE II All NFS Lands Available for Standard Development

Under this alternative, the Forest Service will lease all legally available NFS lands except those removed under the Discretionary No Lease (DNL) authority. Those removed under DNL authority include Research Natural Areas areas and Ski Areas where Forest Plan direction specifies withdrawal from leasing, but the withdrawal process has not been completed, as well as those for which the management plans have not been completed to determine the protection needed. See Table II-11 for a listing of lands available for leasing. The BLM will authorize leasing on privately-owned split-estate lands. The Oil and Gas Regulations require the Forest Service to analyze potential impacts from post-leasing activities as a result of the projected Reasonably Foreseeable Development. All NFS lands being analyzed as a result of the projected RFD will be available subject only to the terms and conditions of the standard oil and gas lease form. Protective

measures for post-leasing activities will be determined at the time of APD subject to approval of a surface use plan of operations.

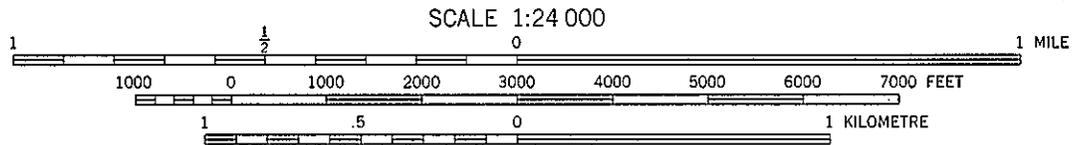
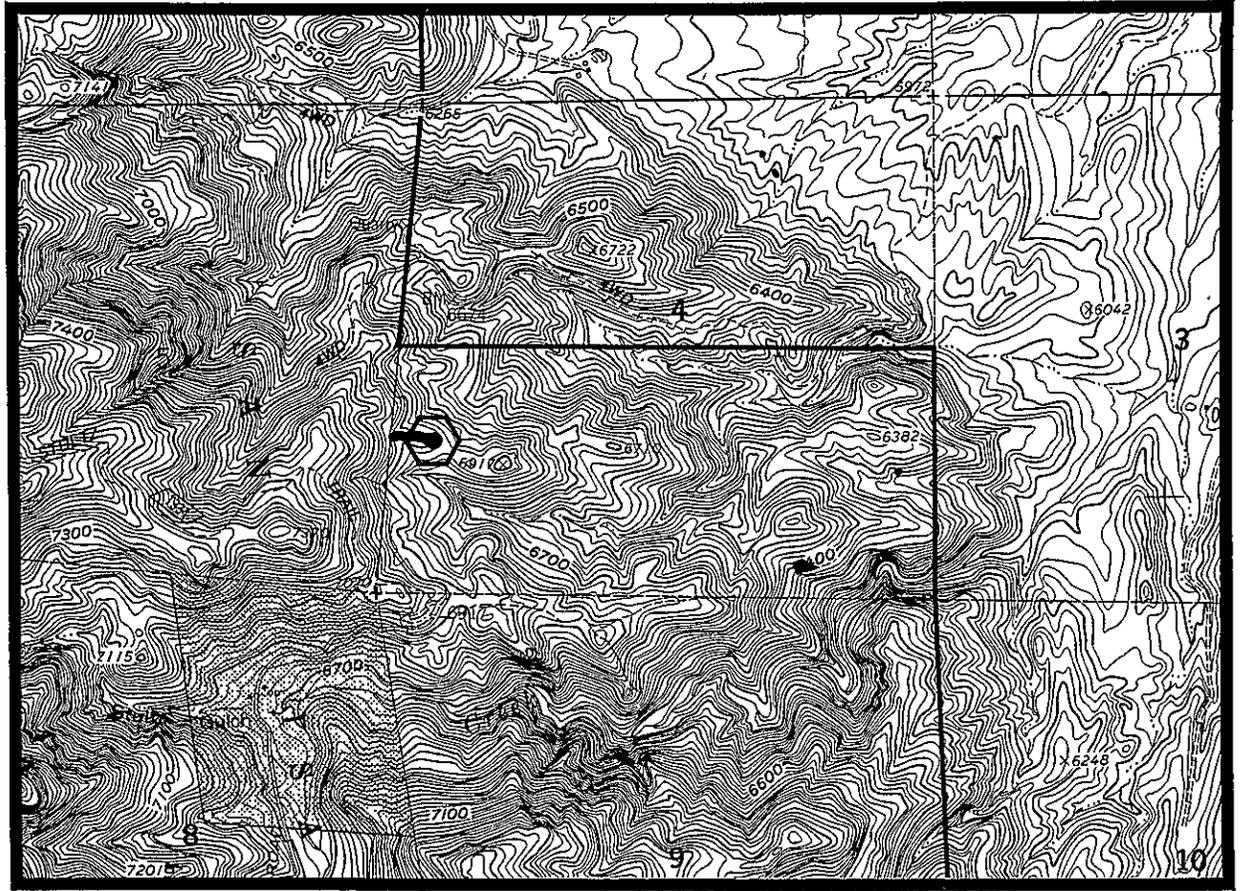
This alternative is not consistent with current management direction in the Forest Plan. The application of Standard Lease Terms will conflict with Forest-wide standards and guidelines on some lands. The level of protection would be limited to that which could be applied using existing laws, executive order, and other statutory requirements. Lands on which Forest Plan direction would not be met, were leasing to occur, include slopes over 60% with high erosion potential and watersheds with extreme sedimentation.

Mineral exploration, discovery and development activities will occur subject to the terms and conditions of the lease, the operating requirements of the BLM 3160 Regulations and all applicable Notices to Lessees and Operators. The Standard Lease Terms will be used to mitigate impacts on the affected environment.

The environmental consequences resulting from the leasing analysis conducted for this alternative based on the projected RFD are discussed in Chapter IV, Environmental Consequences, of this EIS. Based upon the RFD's (BLM and Concentrated), Figures II-10 through II-15 and Tables II-4 through II-6 further describe the alternative.

Figure II - 10  
Alternative II - BLM RFD Well Site 1

T20S R70W Sec. 04 NWSW



CONTOUR INTERVAL 20 FEET  
DATUM IS MEAN SEA LEVEL

LEGEND



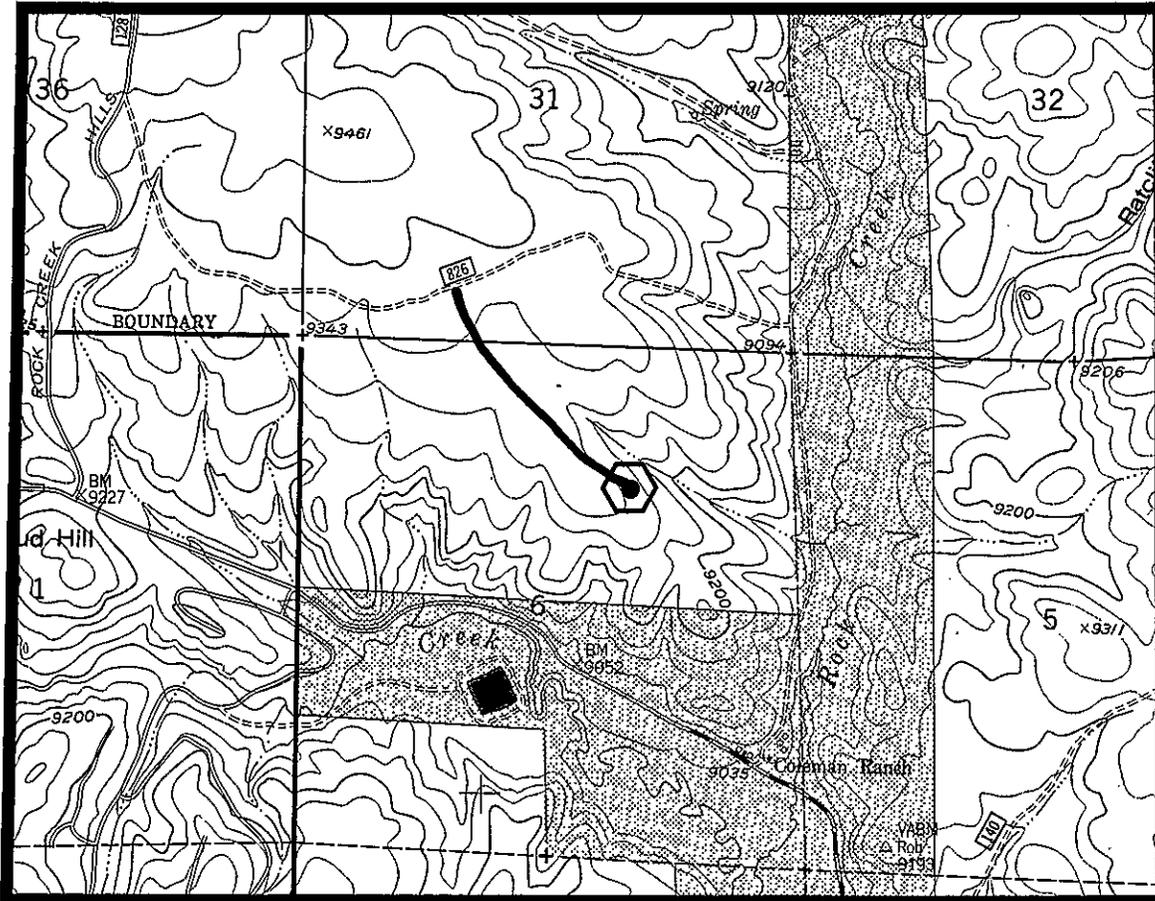
WELL SITE & ROAD



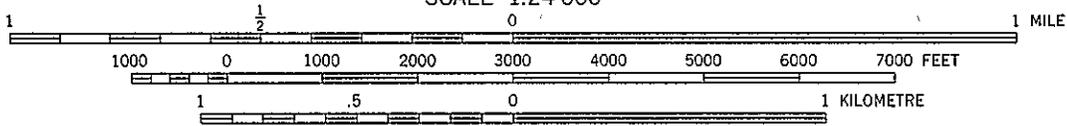
Note: Standard lease terms will be used to mitigate impacts in the affected environment.

Figure II - 11  
 Alternative II - BLM RFD Well Site 2

T9S R74W Sec. 06 SWNE



SCALE 1:24 000



CONTOUR INTERVAL 20 FEET  
 DATUM IS MEAN SEA LEVEL

LEGEND

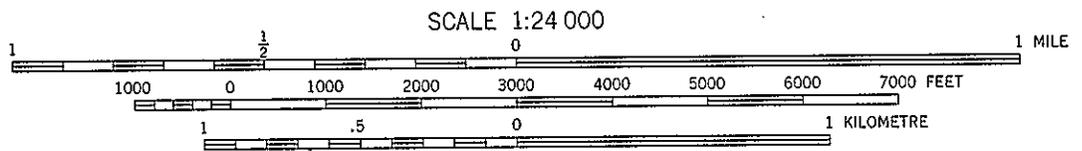
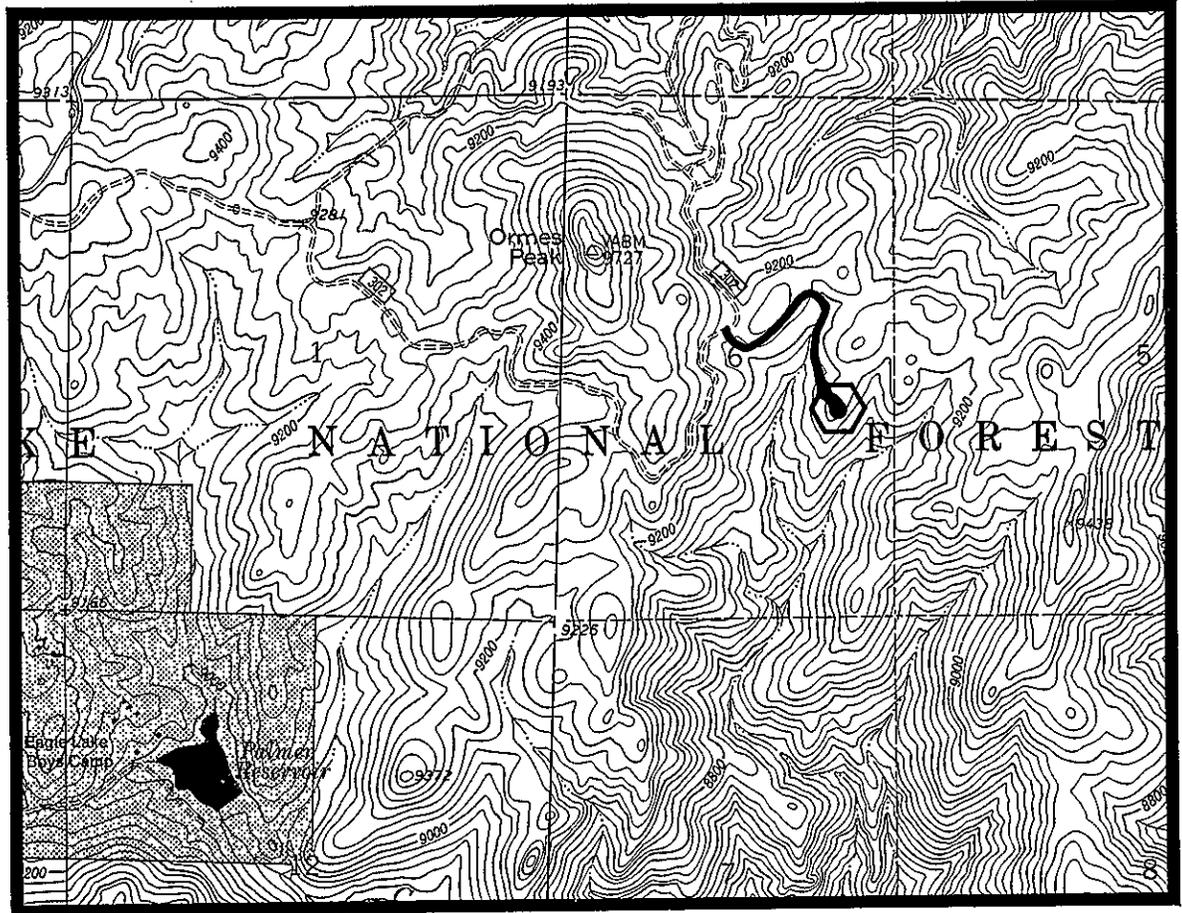


**WELL SITE & ROAD**



Note: Standard lease terms will be used to mitigate impacts in the affected environment.

Figure II - 12  
 Alternative II - BLM RFD Well Site 3  
 T13S R67W Sec. 06 NESE



CONTOUR INTERVAL 20 FEET  
 DATUM IS MEAN SEA LEVEL

LEGEND



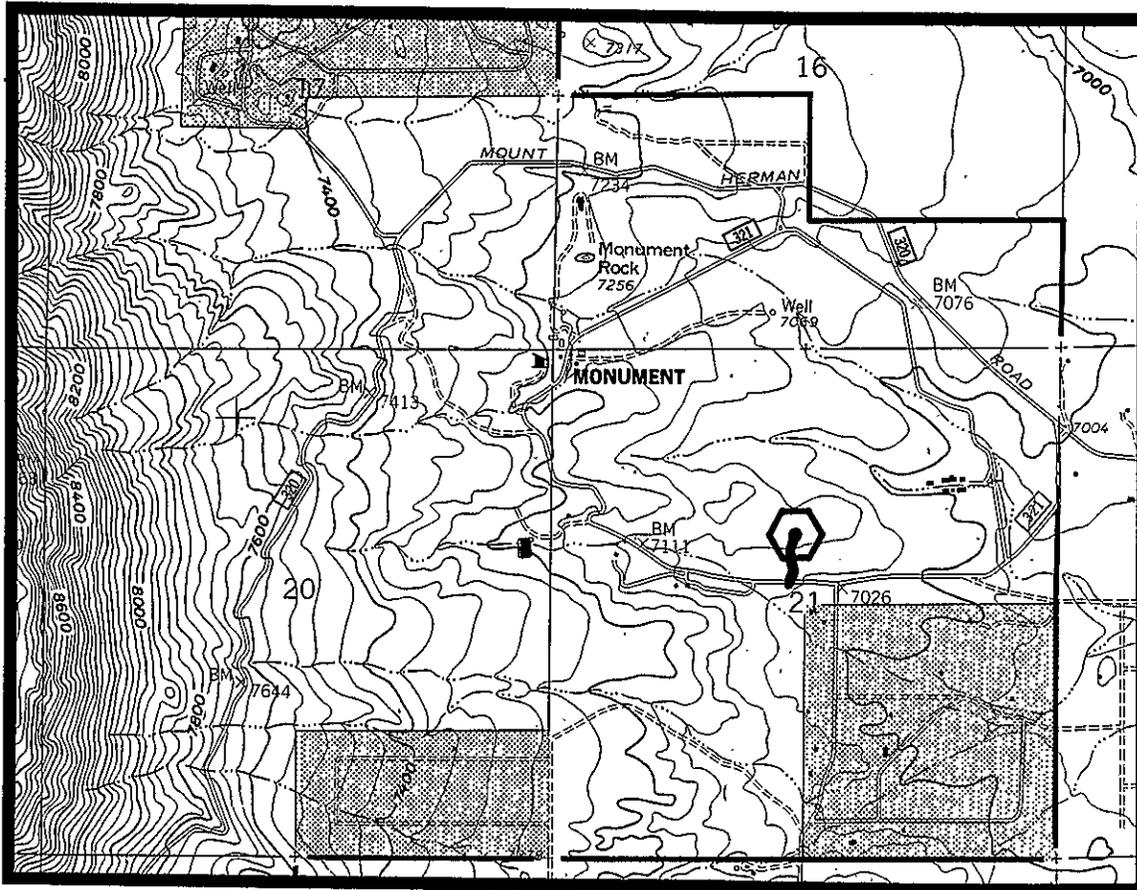
WELL SITE & ROAD



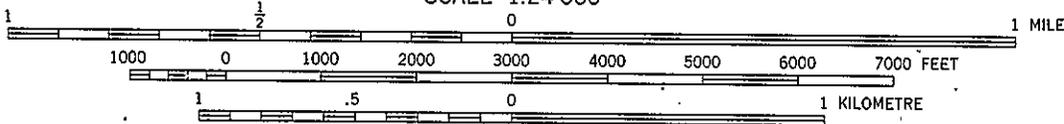
Note: Standard lease terms will be used to mitigate impacts in the affected environment.

Figure II - 13  
Alternative II - BLM RFD Well Site 4

T11S R67W Sec. 21 SWNE

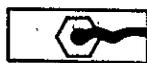


SCALE 1:24 000



CONTOUR INTERVAL 20 FEET  
DATUM IS MEAN SEA LEVEL

LEGEND



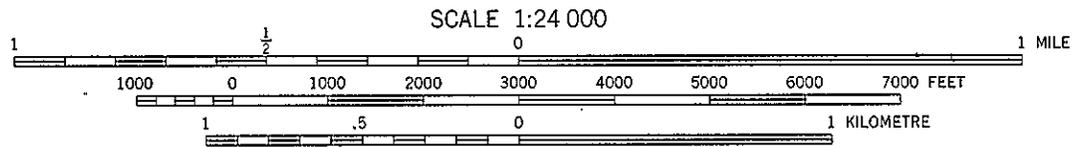
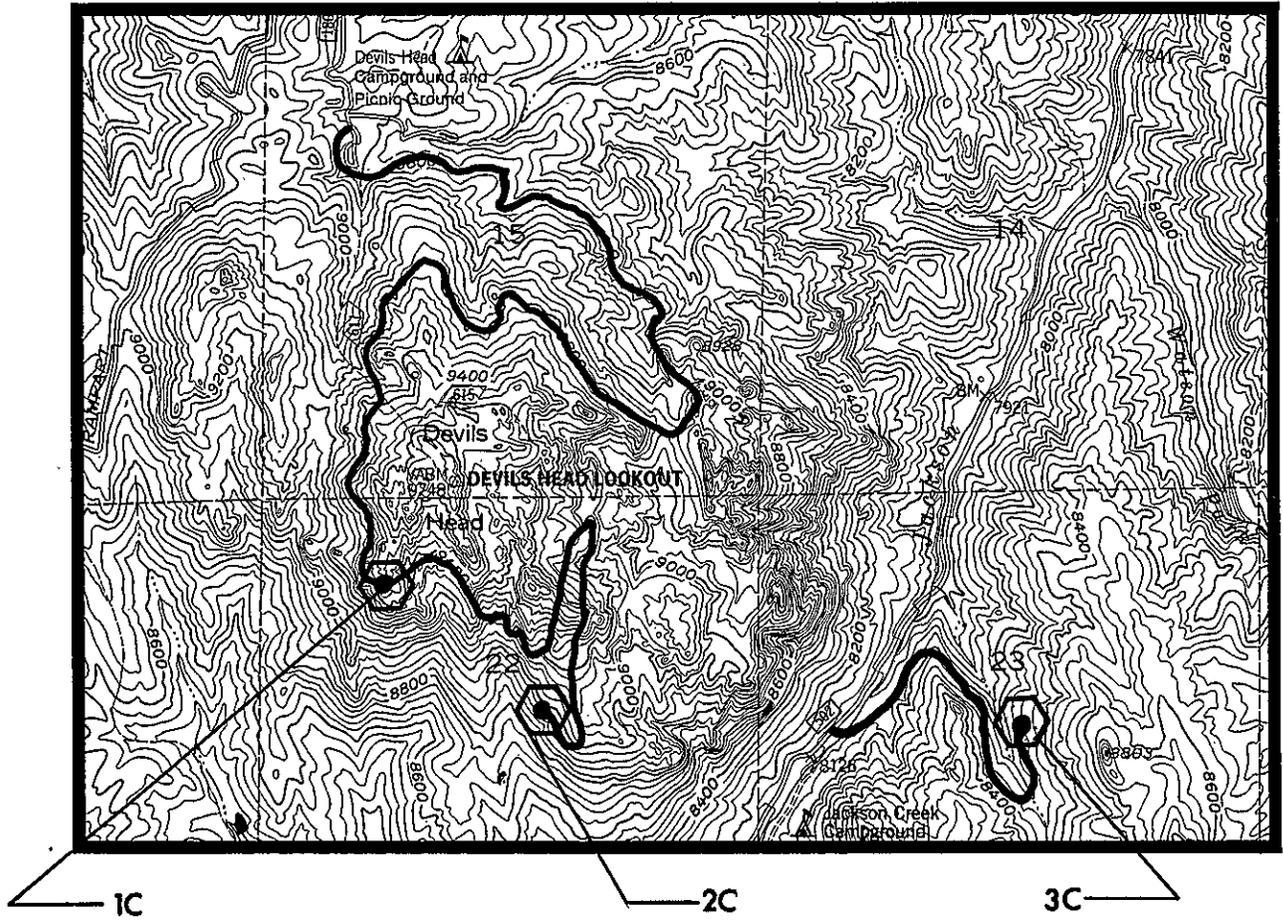
WELL SITE & ROAD



Note: Standard lease terms will be used to mitigate impacts in the affected environment.

Figure II - 14  
 Alternative II - Concentrated Well Sites 1-3

- Site 1C - T9S R69W Sec. 22 NWNW
- Site 2C - T9S R69W Sec. 22 SWNE
- Site 3C - T9S R69W Sec. 23 NWSE



CONTOUR INTERVAL 20 FEET  
 DATUM IS MEAN SEA LEVEL

LEGEND

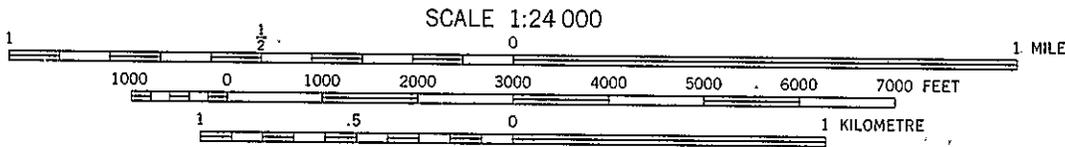
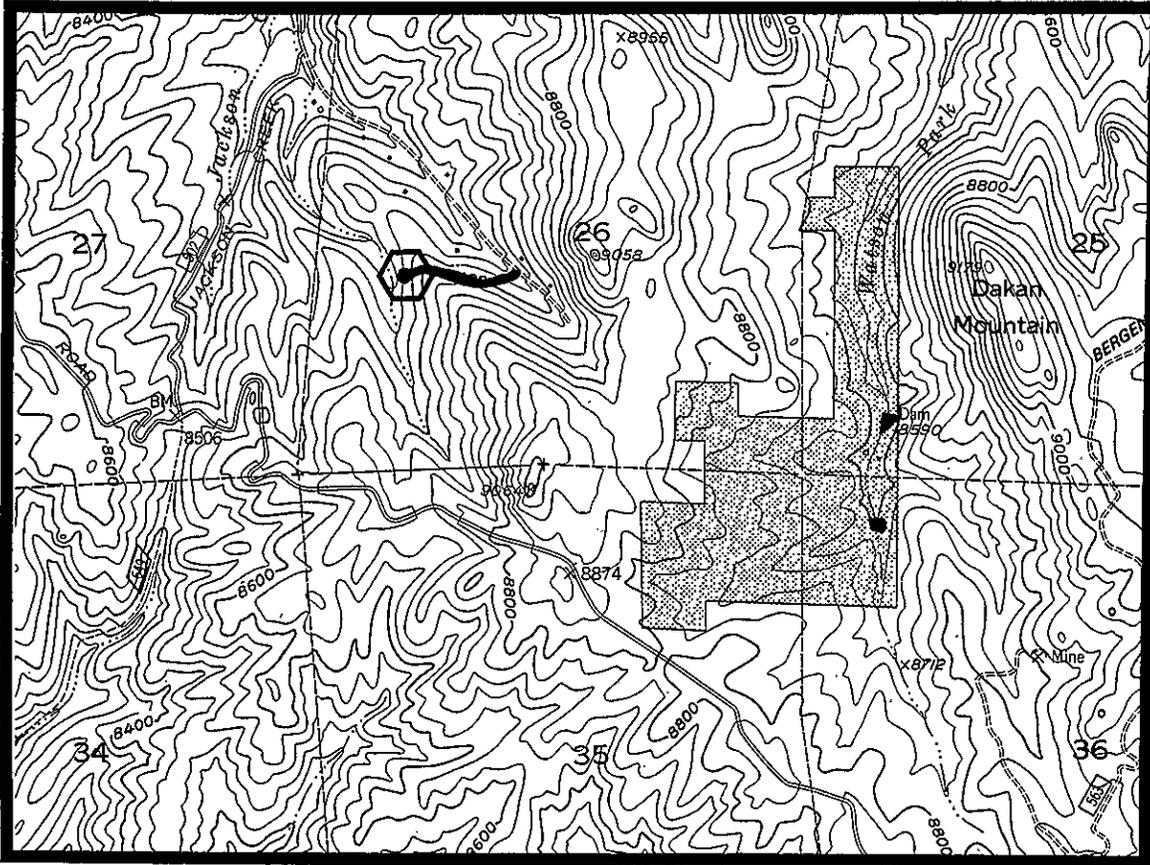


WELL SITE & ROAD



Note: Standard lease terms will be used to mitigate impacts in the affected environment.

Figure II - 15  
 Alternative II - Concentrated Well Site 4C  
 T9S R69W Sec. 26 NWSW



CONTOUR INTERVAL 20 FEET  
 DATUM IS MEAN SEA LEVEL

LEGEND



WELL SITE & ROAD



Note: Standard lease terms will be used to mitigate impacts in the affected environment.

**Table II-4  
Alternative II - Land Distribution by Management Requirement  
National Forests and National Grasslands**

Management Requirement	Acres Leased
Standard Lease Terms	2,194,942

**Table II-5  
Alternative II - Well Disturbance Acres  
National Forests**

BLM RFD		Concentrated RFD	
Well	Disturbed	Well	Disturbed
1	4	1C	13
2	5	2C	11
3	5	3C	11
4	4	4C	9
Total	18	Total	44

**Table II-6  
Alternative II - Well Distribution and Disturbance Acres  
National Grasslands**

	Major Soil/Ecosystem Type			
	Sandy Lands	Hard Lands	Canyon Lands	Riparian
Number of Wells				
Cimarron	101	57	0	7
Comanche	30	13	1	1
Total	131	70	1	8
Disturbed Acres				
Cimarron	241	136	0	17
Comanche	54	23	2	2
Total	295	159	2	19

### **ALTERNATIVE III**

#### **NFS Lands Available for Lease**

#### **With Both Standard and Stipulated Terms**

Under this alternative, NFS lands will be made available for oil and gas leasing subject to supplemental lease stipulations. The supplemental stipulations of this alternative are designed to assure protection of surface resources in the affected environment including the human environment. The BLM will authorize leasing privately-owned split-estate lands. Stipulations are applied that reduce the amount of land available under standard lease terms.

Supplemental stipulations are shown in Appendix A (Mitigation) which also discusses why the stipulations are needed to protect resource values. Maps in Appendix D show the supplemental stipulations that are applied to various areas on the Unit.

In conformance with the management direction of the Forest Plan, supplemental site-specific stipulations will be applied when necessary for the protection of surface resources and the human environment. Protective restrictions imposed by supplemental stipulations may exceed the Forest Plan requirements and further restrict surface activities. For example, a supplemental stipulation may require longer timing restrictions than the standard lease term of 60 days to protect the use of critical habitat during critical periods.

Under this alternative 100,271 acres are removed from leasing through application of the Discretionary No Lease authority. A map identifying NFS lands with discretionary no lease or supplemental stipulations applied can be found in Appendix D. Figures II-16 through II-18, and tables II-7 through 9 and 11 further describe the alternative.

The proposed term of discretionary no lease varies. Legislatively proposed wilderness outside of Wilderness Study Areas (WSA) is removed until legislation is passed designating them as wilderness or until the 102nd Congress ends. Aspen Ridge is adjacent to a BLM WSA which they have recommended as wilderness. Due to topographical features Aspen Ridge might logically be included. The South Platte and Badger Creek corridors shall be removed until studies for wild and scenic river eligibility have been completed. Many diverse cultural resource sites will be removed until the Forest Plan revision, when the need for special management or release to multiple-use will be determined. Oil and gas activities allowed upon release of those lands to multiple-use management will be consistent with the Record of Decision for this document.

Implementation of Alternative III will require a Forest Plan amendment.

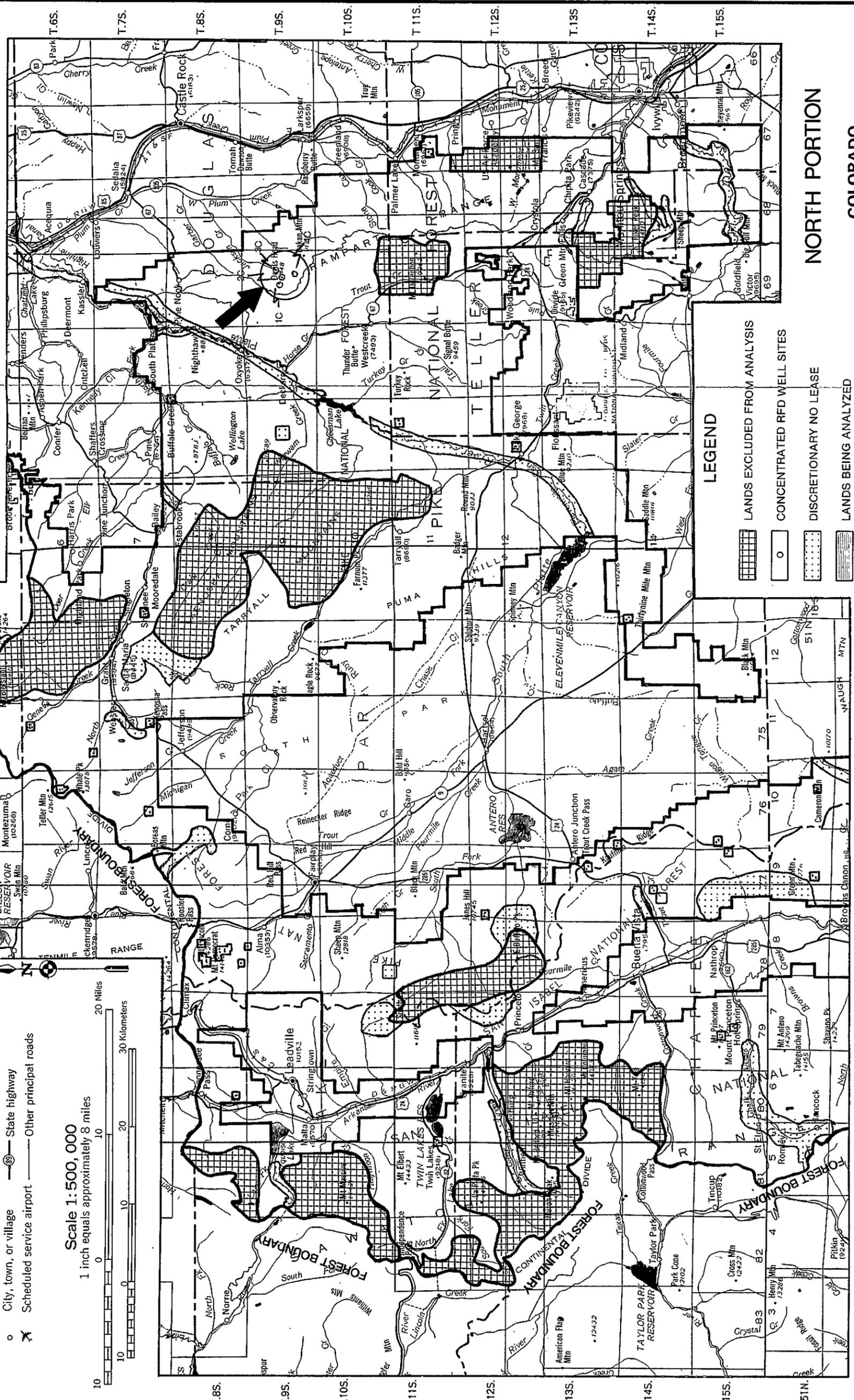
The environmental consequences resulting from the leasing analysis conducted for this alternative based on the projected RFD are discussed in Chapter IV, Environmental Consequences, of this EIS. Supplemental stipulations imposed for sensitive and critical environments are justified by the analysis. Information on specific supplemental stipulations imposed and required for post-leasing activities for surface resource protection are discussed in Appendix A of this EIS. A general map delineating supplemental stipulations is in Appendix D with more specific resource values mapped in Appendix E.

The difference between Alternatives I and III are primarily in administrative processes. This alternative allows us to make the availability determination and disclose the total effects of anticipated development in one document. Alternative I provides for the analysis and documentation of the effects of individual leases only on a site-specific case-by-case basis as lease applications are received.

BLM RFD and Concentrated RFD well locations are the same as in Alternative I. Reference Figures II-4 through II-9 to review these well locations. Well locations are different than in Alternative II because of the supplemental stipulations applied.



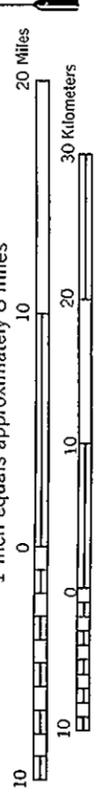
**Figure II-16**  
**Alternative III -**  
**Concentrated RFD Well Locations**  
**PIKE AND SAN ISABEL NATIONAL FOREST**



**LEGEND**

- ⊙ State capital
- ⊙ County seat
- City, town, or village
- ✈ Scheduled service airport
- Interstate highway
- U. S. highway
- State highway
- Other principal roads

**Scale 1:500,000**  
 1 inch equals approximately 8 miles

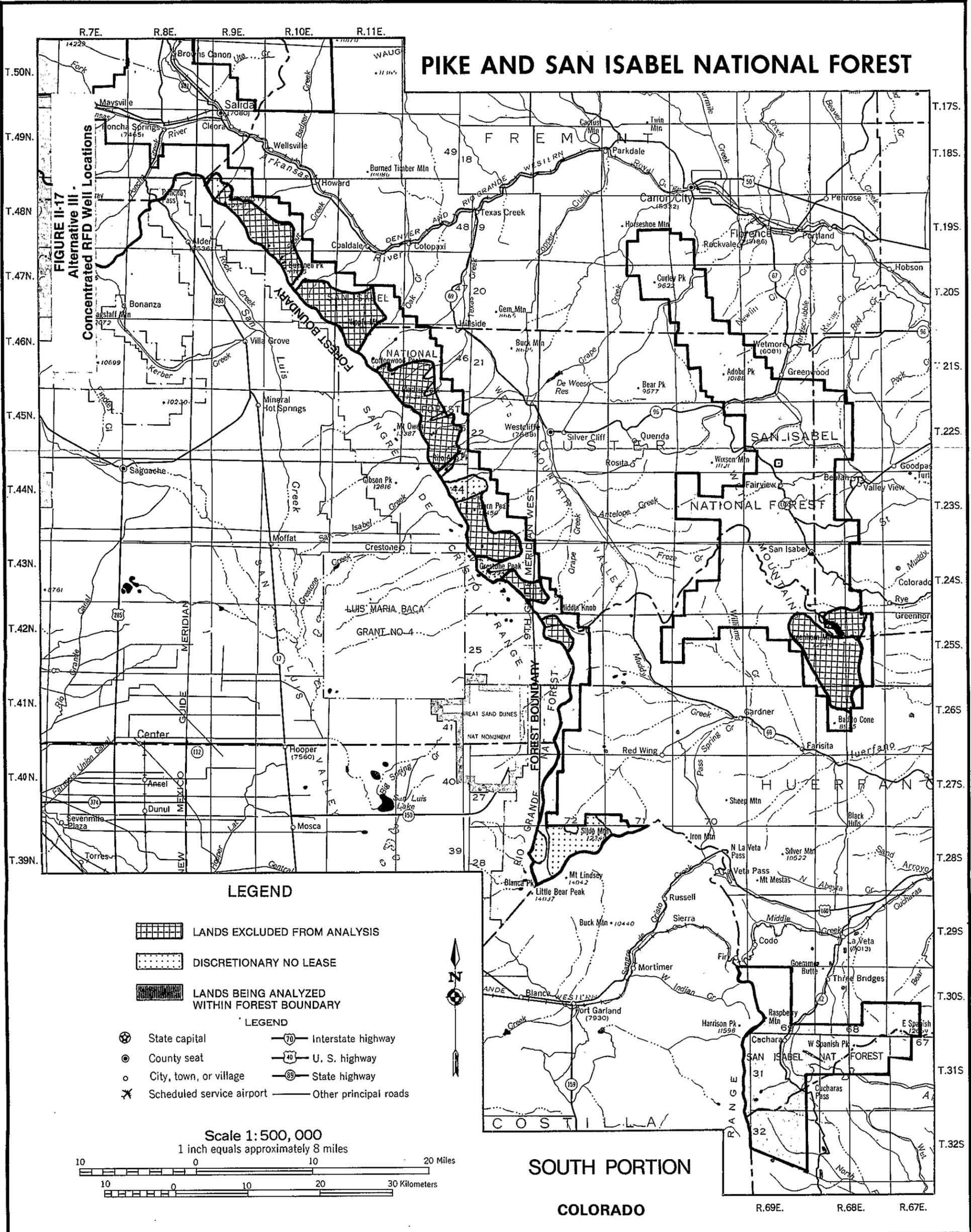


**LEGEND**

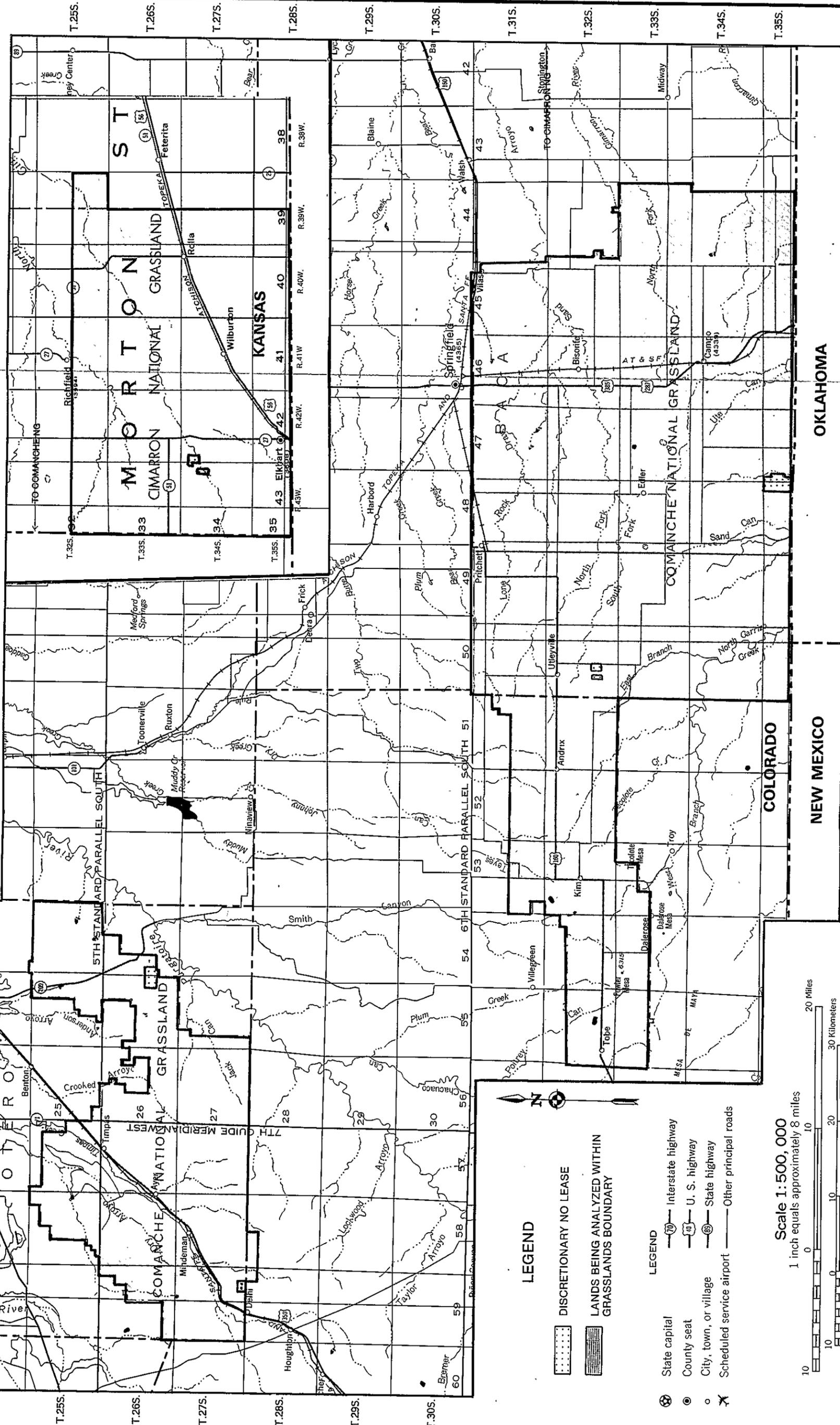
- ▨ LANDS EXCLUDED FROM ANALYSIS
- CONCENTRATED RFD WELL SITES
- ⋯ DISCRETIONARY NO LEASE
- ▨ LANDS BEING ANALYZED WITHIN FOREST BOUNDARY

**NORTH PORTION**  
**COLORADO**

# PIKE AND SAN ISABEL NATIONAL FOREST



**Figure II - 18**  
**Alternative III -**  
**Concentrated RFD Well Locations**  
**CIMARRON AND COMANCHE NATIONAL GRASSLAND**



**LEGEND**

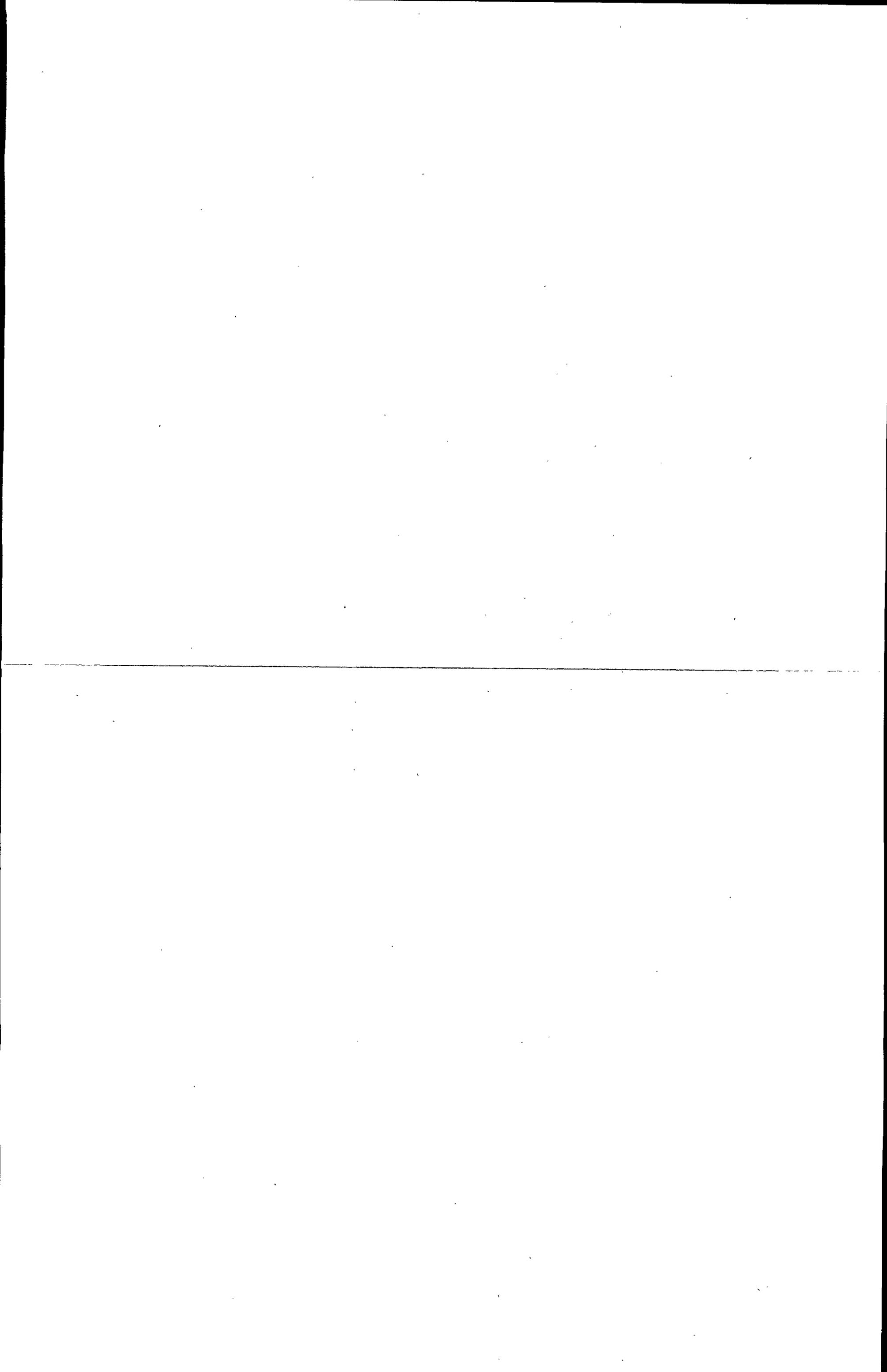
DISCRETIONARY NO LEASE  
 LANDS BEING ANALYZED WITHIN GRASSLANDS BOUNDARY

**LEGEND**

State capital  
 County seat  
 City, town, or village  
 Scheduled service airport  
 Interstate highway  
 U. S. highway  
 State highway  
 Other principal roads

**Scale 1:500,000**  
 1 inch equals approximately 8 miles

0 10 20 Miles  
 0 10 20 30 Kilometers



**Table II-7**  
**Alternative III - Land Distribution by Management Requirement**  
**National Forests and National Grasslands**

Management Requirement	Acres
Supplemental Stipulations: No Surface Occupancy Controlled Surface Use Timing Limitation	203,967 1,109,219 591,162
Standard Lease Terms	829,238
Discretionary No Lease	100,271

**Table II-8**  
**Alternative III - Well Disturbance Acres**  
**National Forests**

BLM RFD		Concentrated RFD	
Well	Disturbed	Well	Disturbed
1	4	1R	8
2	5	2R	9
3	5	3R	8
4	4	4R	4
Total	18	Total	29

**Table II-9  
Alternative III - Well Distribution and Disturbance Acres  
National Grasslands**

	Major Soil/Ecosystem Type			
	Sandy Lands	Hard Lands	Canyon Lands	Riparian
Number of Wells				
Cimarron	107	58	0	0
Comanche	31	14	0	0
Total	138	72	0	0
Disturbed Acres				
Cimarron	256	138	0	0
Comanche	56	25	0	0
Total	312	163	0	0

**ALTERNATIVE IV  
No NFS or Split-Estate Lands Available for Leasing**

Under this Alternative, no NFS lands or split-estate lands will be available for future oil and gas leasing. Existing federal oil and gas leases which are not extended by production will be allowed to expire. Exploration and development could occur on existing leased lands subject to Standard Lease Terms and applicable supplemental stipulations. Information on NFS lands currently under lease is available at the Forest Supervisor's Office, 1920 Valley Drive, Pueblo, Colorado. A map of leased lands is found in Appendix C of this document.

Forest Service Oil and Gas Regulations (36 CFR 203.102(c)(1)(iii)) require that this alternative be analyzed.

Implementation of this alternative would require a Forest Plan amendment to remove lands from mineral leasing.

The projected RFD is not affected by this alternative because the most probable location for drilling is on currently leased lands. There are 135,031.95 acres of NFS lands currently under federal lease.

**Table II-10**  
**Alternative IV - Land Distribution by Management Requirement**  
**National Forests and National Grasslands**

Management Requirement	Acres Leased
Total acres available for Oil and Gas Leasing	0
NFS Acres Currently Leased	135,031.95
Split-Estate Acres Currently Leased Federal Land/Private Minerals Federal Minerals/Private Land	13,588.09 10,018.75
Total Acres Currently Leased	158,638.79

## ALTERNATIVES CONSIDERED AND ELIMINATED FROM DETAILED STUDY

**(1) LEASE ALL AVAILABLE NFS LANDS WITH MODERATE TO HIGH POTENTIAL OF BEING REQUESTED FOR LEASE.**

Under this alternative, the Forest Service would consent to lease lands having a potential of moderate to high for oil and gas. Consent would also be given to reoffer currently leased lands with low potential for oil and gas when the current leases expire. The BLM would issue leases on split-estate lands with federal minerals within Forest boundaries. This alternative would allow oil and gas exploration and development to occur subject to the terms and conditions identified.

We eliminated this alternative from further study because it is desirable to base alternatives on resource values. Also, the Forest Service does not have the expertise to determine mineral potential, and as technology increases, lands that appear to be low in potential now may prove to have a high potential for oil and gas.

**(2) LEASE ALL AVAILABLE NFS LANDS WITH A HIGH POTENTIAL OF OIL AND GAS, AND LANDS CURRENTLY LEASED WITH LOW TO MODERATE OIL AND GAS POTENTIAL.**

Under this alternative, the Forest Service would consent to lease available lands identified as containing a high potential for oil and gas, and consent to reoffer leases on lands with low potential as the current leases expire. The BLM would issue leases on split-estate lands with federal minerals within Forest Boundaries. This alternative would allow oil and gas exploration and development to occur subject to the terms and conditions identified.

We eliminated this alternative from further study because it is desirable to base alternatives on resource values. The Forest Service does not have the expertise to determine mineral potential and, as technology increases, the potential of many lands may increase.

(3) **CONTINUE TO LEASE ONLY THOSE LANDS CURRENTLY UNDER AN OIL AND GAS LEASE.**

Under this alternative, the Forest Service and BLM would continue to lease only those lands where federal leases currently exist. This alternative would allow additional oil and gas exploration and development to occur in these areas subject to the terms and conditions identified.

This alternative was eliminated because it does not conform to the oil and gas regulations (36 CFR228.102(c) which requires that an area or Forest-wide leasing analysis be conducted.

## **COMPARISON OF ALTERNATIVES**

This section compares alternatives by:

- Land acreage available for leasing
- Environmental effects resulting from the projected RFD
- Ability of each alternative to meet Forest Plan Direction
- Ability of each alternative to conform the the 1987 Leasing Reform Act and the Forest Service implementing regulations

Table II - 11 shows the land acreage available for leasing under each alternative. Also shown are the acres withdrawn from leasing under the Discretionary No Lease Authority.

**Table II-11  
Availability of Lands for Leasing by Alternative**

	Alt. I Acres	Alt. II Acres	Alt. III Acres	ALT. IV Acres
Total National Forest and Grasslands	2,752,378	2,752,378	2,752,378	2,752,378
Lands Removed By Law: Wilderness, and WSA	550,872	550,872	550,872	550,872
Total Acres With Federal Mineral Considered in Analysis	2,201,506	2,201,506	2,201,506	2,201,506
Standard Lease Terms	2,035,481	2,194,442	829,238	
Controlled Surface Use	131,897		1,109,219	
Timing Limitation			591,162	
No Surface Occupancy	34,128		203,967	
Discretionary No Lease				
Wilderness Bill SR1029				
Greenhorn			712	
Sangre de Cristos			24,728	
Buffalo Peaks			7858	
Lost Creek			12,605	
BLM WSA				
Aspen Ridge			15,044	
Wild & Scenic Rivers				
South Platte			14,700	
Badger Creek			2,560	
Special Acres				
Cultural Resources			15,500	
Research Natural	4,499	4,499	4,499	
Ski Areas	2,065	2,065	2,065	
Total Acres DNL Not Available	6,564	6,564	100,271	2,201,506
Total Acres Available Oil and Gas Leasing	2,194,942	2,194,942	2,101,235	0

Note: Some stipulations overlap, therefore, the total may add up to more than the total acres administratively available.

Table II-12 shows the comparison of environmental effects resulting from the amount of protection provided under each alternative.

**Table II-12  
ALTERNATIVE COMPARISON  
(Direct/Indirect Environmental Effects)**

	Alt. I	Alt. II	Alt. III	Alt. IV
Vegetation	0	0	0	0
Soils	0	0	0	0
Water Quality	+	+	0	+
Wildlife	0	+	0	+
Aquatic & Riparian	+	+	0	+
T & E Species	0	0	0	0
Range	0	0	0	0
Visual	+	+	0	+
Cultural	0	0	0	0
Paleontological	0	0	0	0
Caves	0	0	0	0
Recreation	0	0	0	0
Special Areas	0	+	0	0
Mineral Resources	+	+	+	+
Human & Community	0	0	0	+
Transportation	0	0	0	0
Air and Noise				
Pollution	0	0	0	0

Key:

(0) = Effects are either nonexistent or non-significant

(+) = Indicates potential significant effects

Table II-13 shows whether or not each alternative conforms to the current Forest Plan Direction and the Forest Service Regulations for implementing the 1987 Reform Act. A "no" to meets Forest Plan means that a Plan amendment would have to be prepared.

**Table II-13 - Conformance with Direction and Policy**

	Alt. I	Alt. II	Alt. III	Alt. IV
Meets Forest Plan	yes	no	no	no
Forest Service Oil & Gas Regulation	no	yes	yes	no

# THE PROPOSED ACTION

Alternative III is the preferred alternative. It makes 100,271 acres of land (4 percent of total legally available land area) unavailable for leasing because of resource sensitivity to oil and gas leasing activities. It provides the best protection of surface resources through the application of supplemental stipulations in addition to the BLM standard lease terms.

## AMENDMENT TO THE LAND AND RESOURCE MANAGEMENT PLAN<sup>1</sup>

Selection of an alternative resulting from this EIS other than Alternative I, Current Management (No Action), will result in a need to amend the Land and Resource Management Plan (the Forest Plan).

The Forest Plan was developed to direct management of the Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands. A revision of the Forest Plan is required every fifteen years and necessary changes may be made any time that monitoring and evaluation indicate the need for change.<sup>2</sup>

By regulation (36 CFR Part 219.10 (e)), all activities proposed for National Forest System lands must be consistent with management requirements in both the Forest Direction and Management Area Direction sections of the Forest Plan.<sup>3</sup> Amendments may be made in the management requirements and other aspects of the Forest Plan to accommodate new developments and changing social needs. Changes to the Forest Plan are made through a process of amendment which conforms to 36 CFR Part 219.10 (f).<sup>4</sup>

Oil and gas lease stipulations contained in Appendix A and other requirements described in this EIS will be incorporated into the Forest Plan by amendment upon approval of the Record of Decision relative to this document.

## NOTES

<sup>1</sup> USDA Forest Service Handbook 1909.12 - Land and Resource Management Planning Handbook: Part 219 - Planning, Subpart A - National Forest System Land and Resource Management Planning; Part 219.10 (f) Amendment.

<sup>2</sup> USDA Forest Service Handbook 1909.12 - Land and Resource Management Planning Handbook: Part 219 - Planning, Subpart A - National Forest System Land and Resource Management Planning; Part 219.10 (f) Amendment, and Part 219.12 (k) Monitoring and evaluation (A.R. Vol. II, Part 2, p. 890 and p. 894).

<sup>3</sup> USDA Forest Service Handbook 1909.12 - Land and Resource Management Planning Handbook: Part 219 - Planning, Subpart A - National Forest System Land and Resource Management Planning; Part 219.10 (e) Plan implementation.

<sup>4</sup> USDA Forest Service Handbook 1909.12 - Land and Resource Management Planning Handbook: Part 219 - Planning, Subpart A - National Forest System Land and Resource Management Planning; Part 219.10 (f) Amendment.

## **CHAPTER III**

# CHAPTER III

## AFFECTED ENVIRONMENT

### INTRODUCTION

This chapter describes the environment likely to be affected by the two leasing decisions described in Chapter I, and the anticipated post-leasing activities. The Bureau of Land Management (BLM) cooperated in the identification of Reasonable Foreseeable Post-Leasing Development, referred to here as "Reasonably Foreseeable Development" (RFD), on both the National Forests and National Grasslands. RFD includes exploratory drilling and construction of oil and gas production facilities.

This affected environment generally includes all the National Forest System lands of the Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands, and adjacent split-estate lands (analysis area). Post-lease activities, such as exploratory drilling or oil and gas production, are highly speculative. This is particularly true for the mountains of the National Forests, which have few known or probable oil or gas deposits. Therefore, we have limited the scope of the affected environment to that which we can reasonably expect to be impacted in a predictable way. We have not considered the effects of these leasing decisions on a more extensive area than the affected environment described above because we cannot reliably predict global effects. We have not included the cities, towns or much of the other private and public lands of the Region in our definition of the affected environment. Oil and gas drilling operations generally take place on very small areas of land (2 to 15 acres) and do not require large construction efforts. Their environmental impacts do not extend very far across the land surface, and are generally relatively short-lived. Therefore, we expect most of the direct, indirect, and cumulative environmental effects of these leasing decisions to be confined to the lands, both public and private, within and immediately adjacent to the Pike & San Isabel National Forests and Comanche and Cimarron National Grassland boundaries.

The physical, biological, social, and economic characteristics of the Affected Environment have been extensively catalogued in the Environmental Impact Statement (EIS) which accompanies the Forest Plan. We will incorporate much of that material into this document by reference. This chapter describes the affected environment in the analysis area. Chapter III of the Forest Plan EIS describes: the Physical and Biological Setting (geography, topography, climate, animal and plant life); the Social and Economic Settings; the Resource Elements (current use, management and demand trends for the Forests' resources); and the Support Elements (activities to maintain and develop resources). Projections of supply and demand for Forest resource outputs incorporated by reference in this EIS are described in the Forest Plan, Chapter II, pages 26-73. Both documents may be reviewed at the Supervisor's Office in Pueblo, at Ranger District Offices, and at many area public libraries.



We will describe the affected environment from general to specific in four "stair-stepped" levels. Each level analyzes a different level of environmental effects starting from the very broad Forest-wide analysis area to the site-specific analysis of RFD locations and representative well locations. More site-specificity will be provided on leases for which an Application for Permit to Drill (APD) is received (second NEPA process). The following figure illustrates the four levels of analysis and what the Oil and Gas Regulations dictate for each level of analysis.

#### Level 1

For purposes of the Leasing Analysis decision (36 CFR 228.102(c)-Land Availability), and for general reference, we will make a broad description of the physical characteristics of the National Forests and the National Grasslands (the Unit).

#### Level 2

For purposes of developing the RFD to be used in the effects analysis (36 CFR 228.102(c)(4)), the analysis area was divided into areas of similar environmental characteristics. The mountainous environment of the National Forests differs greatly from the plains of the National Grasslands, so they will be described separately. The grasslands were separated because of the high variation in expected development and potential of effects between the two grasslands.

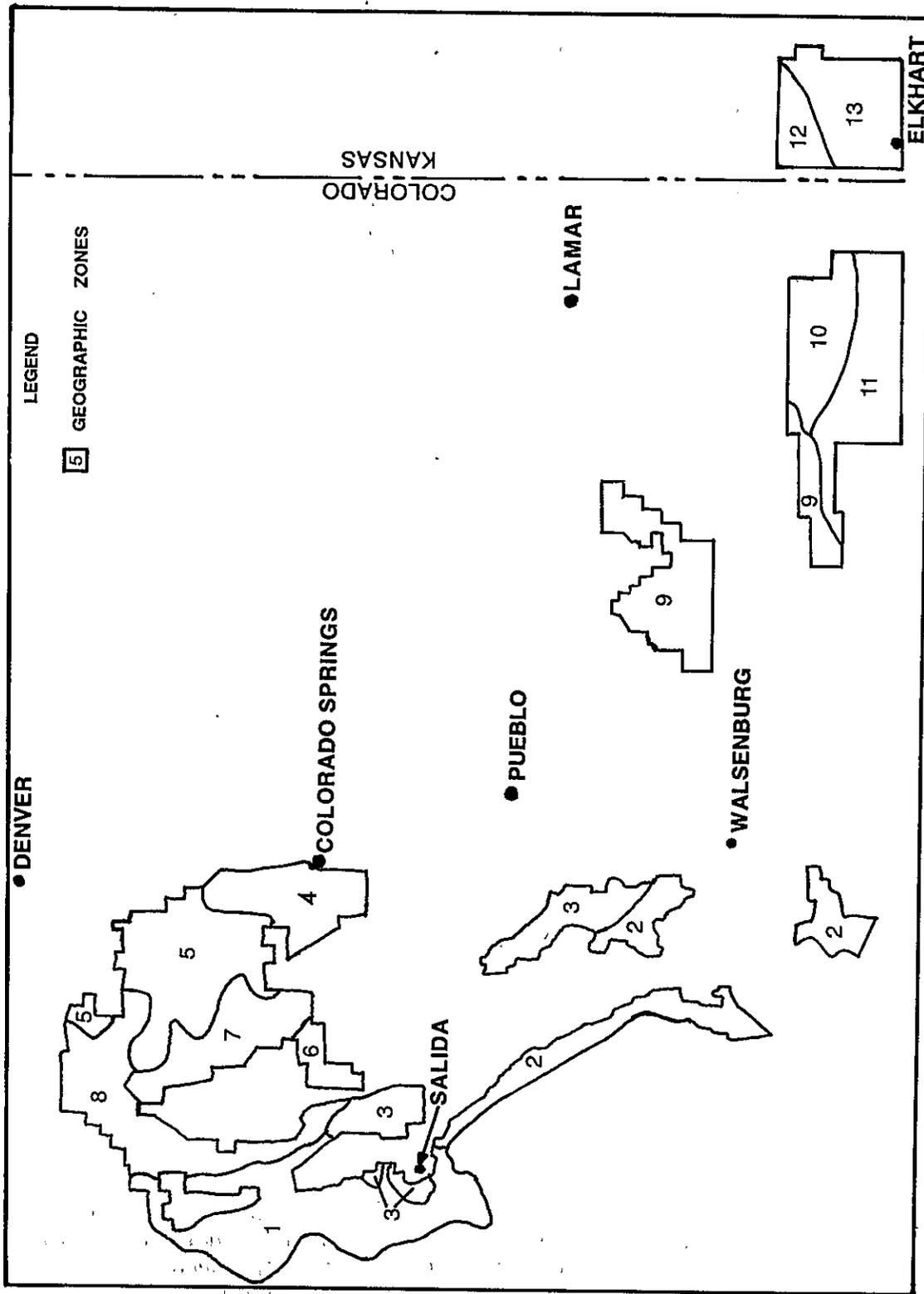
#### Level 3

For purposes of displaying the need for supplemental lease stipulations (36 CFR 228.102(c)(ii)-why they are necessary and justifiable), the analysis area was divided into 13 Geographic Zones. The 13 Geographic Zones are illustrated on the maps in Figure III-2 and described in detail later in this chapter, as well as in Chapter IV.

#### Level 4

Finally, for purposes of disclosing the effects of different management scenarios for leasing on the National Forests and National Grasslands, we will analyze the site-specific effects of the RFD (36 CFR 228.102(c)(4)). RFD site locations were identified in cooperation with Bureau of Land Management (BLM) experts as being "reasonable and foreseeable post-leasing activity" [See Appendix B].

Figure III-2  
Geographic Zones



# **UNIT-WIDE DESCRIPTION OF AFFECTED ENVIRONMENT (LEVEL 1)**

## **Location**

The Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands (Unit) are located in central and southeastern Colorado, with the Cimarron located in southwestern Kansas. National Forest System (NFS) lands are intermingled with other public lands and privately-owned land.

The Unit lies in parts of nineteen counties. The seventeen in Colorado are Baca, Chaffee, Clear Creek, Custer, Douglas, El Paso, Fremont, Huerfano, Jefferson, Lake, Las Animas, Otero, Park, Pueblo, Saguache, Summit, and Teller. The two in Kansas are Morton and Stevens. The Unit has eight Ranger District offices located in Canon City, Colorado Springs, Fairplay, Lakewood, Leadville, Salida, and Springfield, Colorado, and Elkhart, Kansas.

## **Social and Economic Setting<sup>1</sup>**

This section describes the social environment of the area in or near the administrative boundaries of the Pike and San Isabel National Forests, Comanche and Cimarron National Grasslands. A description of the social and economic setting of the Forest contained in Chapter II of the Forest Plan (pages II-1 through II-14) and in Chapter III of the Forest Plan FEIS (pages III-15 through III-52) has been incorporated by reference. These documents are available for review at the Supervisor's Office, Pueblo, at Ranger District Offices on the Forests and Grasslands, and at many public libraries in the area. The social environment is made up of about 50 small to medium-sized towns or cities and about 65 small settlements.

The area's cultural and economic survival and development are tied to some degree to National Forest System (NFS) land and resource management. Dependency on and use of NFS lands are important to much of the public in or near the analysis area. They form a large part of the community identity. Their large size and the fact that they provide a large variety of uses ranging from recreation to timber, grazing, and mineral development account for extensive attraction of people from out of the region, as well as from local areas.

Important social influence results from the Forest's proximity to the Denver Standard Metropolitan Statistical Area (SMSA) which includes seven counties (Adams, Arapaho, Boulder, Denver, Douglas, Gilpin, and Jefferson). The Denver SMSA is a major influence on the management of the Forest, because its population generates a large portion of the recreational uses that occur on the Forest, particularly along the "Front Range".

In the Grasslands portion, agriculture and ranching rely extensively on public lands for grazing of livestock. Cattle production is one of the principal industries in the social unit providing a significant portion of the economic base. The oil and gas industry plays an important role in the use of the Grasslands and provides large quantities of energy fuels for the nation. The Grasslands are

important wildlife habitats generating large amounts of hunting-related revenue for the area's economy.

Additional information on the social characteristics of the analysis area in this EIS is found in Appendix H, Socio-economic and Cost Efficiency Analysis.

## Physical and Biological Setting

The analysis area lies in two physiographic provinces, the Great Plains Physiographic Province on the east which includes the Comanche and Cimarron National Grasslands, and the Rocky Mountains Physiographic Province on the west which includes the Pike and San Isabel National Forests, the BLM lands, and parts of the Rio Grande and Arapaho National Forests. Additional information pertaining to the geology of the analysis area is found in the Forest Plan, Chapter III. Maps of specific resource areas are found as Exhibits 1 through 4 of that chapter.

The health, distribution, and diversity of the vegetation on the Forests and Grasslands affects most other Forest and Grassland resources. Changes to the existing vegetation situation will correspondingly have some effect on other resources of primary concern for this analysis, notably wildlife habitat, visual quality, soils and water.

On the Forests and Grasslands there are hundreds of individual species, each with its own utility to the environment and to society. Grouping vegetation into broad vegetation types of similar attributes will allow reasonable brevity in assessing environmental effects from disturbance or change. Similar plant communities will be grouped into forest vegetation types or non-forest vegetation types, hereafter referred to as forest types or non-forest types, or collectively as vegetation types.

Refer to Exhibit III-1 for listings of the major vegetation types found on the Forests and Grasslands.

## Climate

The analysis area covers a broad range of elevations, from 14,433 feet at Mt. Elbert to 3,150 feet where the Cimarron River leaves the Cimarron National Grassland in southwest Kansas. This wide elevation range partly accounts for extreme differences in climate. Average growing season extends from about 170 days in the lower Arkansas Valley to about 82 days in the Leadville area. Average mean temperatures range from 52 degrees to 37 degrees for those respective areas.

The high mountains of the Continental Divide dominate and influence year-long precipitation patterns. Moist air flowing from the west rises over the Rocky Mountains and in the process loses much of its moisture to the western slope. Although higher elevations of forest land receive over 30 inches of precipitation per year, other areas such as the South Park or Upper Arkansas Valley areas lying in the "Rain Shadow" of the mountains receive only 10 inches or less per year. Average snowfall ranges from 125 inches at Leadville to about 24 inches or less in the eastern part of the analysis area and summer thunderstorms are common. High winds, occurring usually in the spring and early summer across the plains, contributed to the dust bowl conditions of the 1930's and are still considered a threat when accompanied by drought, high temperatures, and the absence of cover vegetation.

# **Air Quality**

The Clean Air Act (Prevention of Significant Deterioration provisions) designated those Wildernesses over 5000 acres, established as of August 7, 1977, as Class I airsheds.<sup>2</sup> Other lands not meeting these criteria, but meeting air quality standards, were designated Class II airsheds. The Forest has both classifications.

Specific data about Forest air resources is lacking. The biggest sources of air pollution on the Forest are fire, both prescribed and unplanned, and dust from unpaved roads. Out-of-state airborne acid precursors may affect air quality; however, we do not know those effects. Expectations of Forest users and of people who reside or recreate adjacent to the Forest partly define the demand for quality air. State and Federal standards that concern not only ambient air, but also related values such as visibility, water quality and vegetation productivity further define the demand. Sensitivity to air pollution is a public issue in large urban areas on the Colorado Front Range. This influences attitudes of those who recreate on the Forest.

## **SUB-UNIT DESCRIPTION OF THE AFFECTED ENVIRONMENT (LEVEL 2)**

### **The Mountain Environment (The Pike and San Isabel National Forests)**

#### **VEGETATION**

Forest vegetation types (80%) are intermixed with non-forest vegetation types (20%). Coniferous forests are often 90 to 130 years old; aspen forests are typically 70 to 100 years old. Older vegetation persists in areas which were not affected by wildfires or cleared by large-scale logging operations near the turn of the century. The mountain environment is broken up into 11 vegetation types (Aspen, Lodgepole Pine, Douglas-Fir, Engelmann Spruce/Subalpine Fir, Ponderosa Pine, Pinyon-Juniper, Bristlecone Pine, Mountain Mahogany, Gambel Oak, Sagebrush, and Mountain Grasslands. Refer to Exhibit III-2 in this chapter for more detailed descriptions of the 11 vegetation types on the Mountain districts. Riparian will be discussed separately in this document.

#### **SOILS**

The kind of soil that develops in any given place depends on the interaction of parent material (geology), climate, living organisms, topography, and time. Significant variations in any one of these five soil-forming factors can cause large differences in soil properties. This is especially true in mountainous terrain where it is common to find variations in one or more of these factors within short distances. Each kind of soil or miscellaneous land type feature is associated with a particular topographic position on the landscape.

Soils of the Rocky Mountains, including the Pike and San Isabel National Forests, have developed in response to extreme physiographic differences in slope, aspect, and elevation. Subsequently,

soil properties are highly variable in depth, texture, inherent fertility, and age. Soil depth varies from shallow (less than 20 inches) on ridges and steep side slopes to deep (greater than 40 inches) in valley floors. Coarse to medium soil textures have generally developed from intrusive-igneous and metamorphic parent materials. Much of the rugged topography contains young soils that are weakly developed and have low inherent fertility. Shallow, infertile soils are especially evident on steep south and west facing aspects with sparse vegetation and limited ground cover protection. Young soils are also found in drainageways and unstable slopes where erosion has taken place. On steep slopes, natural erosion may practically keep pace with soil development, and soils may remain immature because of the removal of surface materials and deposition of relatively unweathered parent materials. The steeper areas are often difficult to reclaim when disturbed because soil productivity is limited by depth, the physical and mineralogical composition of the parent materials, and harsh climatic conditions. Climate is the primary factor to consider because it places the most severe limits on successful revegetation of a particular soil or ecosystem. Older, more productive soils typically occur on stable uplands and gently sloping landforms in areas with higher precipitation. Soils with deep, well-developed profiles typically reflect dense vegetation and optimum surface protection. There are no prime farmlands identified within the mountain environment according to the Forest Plan, Chapter IV, p. 80.

The combinations of certain soil-forming factors produce "fragile" soils that erode severely when the natural cover is removed. Major areas of highly erosive soils have been identified along the Front Range that pose special problems in planning, designing, and implementing projects. If surface erosion becomes concentrated it may develop into gully erosion. Broad areas of the Forests have topography and soil types that are conducive to gully initiation, and widespread evidence of this type of impact makes it a significant management concern.

Mass movements of earth (geologic hazards) include slumping, slope failures, and debris flows. Potentially unstable soils exist on slopes exceeding 60 percent along the mountain peaks of the Continental Divide.

Concave landscape positions such as swales and areas with fine textured soils are especially vulnerable to compaction problems. This type of detrimental impact commonly occurs when soils are moist; soils are most susceptible to damage during the spring thaw.

Modern soil surveys describe the properties, potentials, limitations, and hazards of many different kinds of soils. The fundamental purpose of a soil survey is to make predictions that can help avoid soil-related failures for different land use activities. Information about soils and other ecological components can be used to adjust land uses to the limitations and potentials of natural resources and the environment.

Soil inventory information has been collected as part of the National Cooperative Soil Survey process for approximately 90 percent of the Pike and San Isabel National Forests. An integrated approach was used to describe and map biotic and abiotic features of geology, landform, climate, vegetation, and soils. Publication of this data is scheduled for 1993. Soil-specific information about soils and other landscape features is available for a variety of purposes from the U.S. Forest Service, Pueblo, Colorado.

## **WATER**

### **Surface Water**

Streams, lakes and wetlands provide habitat for certain plants and animals, as well as water for drinking, irrigation, recreation, etc. The streams and lakes on the Pike and San Isabel National

Forests are the headwaters to two major river systems, the Arkansas River and the South Platte River.

The amount of water and sediment carried by a stream determines width, depth, velocity, slope, sediment size and roughness or size of channel material in relation to water depth. The amount of sediment being carried in the stream is one factor in determining the quality of the stream (i.e., fish habitat, etc.). Streams with too much sediment (they are at their Sediment Threshold Limit, or within 10% of it) on the forest are: Badger Creek, South Platte River (from Elevenmile to confluence with North Fork of the South Platte River), Trail Creek, Thirtynine Mile Mountain, Twin Creek, Jackson Creek, Stark/Gove Creek, Beaver Creek, Fourmile Creek, Link Creek, Kaufman Ridge, West Creek, Spinney Mountain, Elevenmile, Bailey, Elk Creek, Bear Creek, Rampart, East Beaver Creek, Spruce Grove, Pulver Gulch, Hackett Gulch, Newlin Creek, and North Fork Purgatoire River.

Streams in the Pike and San Isabel National Forests are very similar to other streams in mountainous areas. Many small headwater tributaries begin in the alpine and subalpine zones. Their channels usually have steep gradients and the bed material is mostly boulders and cobble with some gravel. The streams are fairly straight and have a stepped appearance caused by a fairly regular sequence of riffles dropping into pools. The channels are usually confined with very little floodplain development evident. The streams are narrow and deep, usually with a depth ratio of less than 10.

When the streams reach the flatter valleys, whether they are high alpine valleys or the lower main stream valleys, the channel material decreases in size. Cobble and gravel predominate although a few boulders may be present. The channels become more sinuous and change from a riffle-drop pool sequence to meandering channel type. The pools are located in meanders near the concave banks and the riffles are located in the straight reaches between the meanders. The streams are wider than they are deep, with a width to depth ratio greater than 10. The streams are not confined and they have obvious floodplain development. These are the reaches that have the greatest amount of riparian area. They are also more sensitive to impacts due to the finer material making up the bed and banks. Eroded banks are more evident in these reaches.

There are also stream reaches that have characteristics between the steep stream types and the flat stream types. These reaches have moderate gradients, usually between 1.5 to 4 percent. They are moderately confined, are slightly sinuous and have a width to depth ratio between 5 and 20. The channel material is usually cobble and gravel with small boulders.

Most of the stream segments within the Pike and San Isabel National Forests carry the State's recreation and cold water aquatic life classifications. They have few pollutants associated with human activities such as industrial chemicals, sewage, petroleum, etc., unless they have been impacted by mining activity or are located in heavily mineralized zones. The alkalinity levels are low, usually around 35-50 parts per million (ppm). Low alkalinity levels interfere with buffering effects on heavy metals which can be extremely toxic to aquatic life. The pH rate for the streams is from 7 to 8 which is neutral to slightly alkaline. Streams that are impacted by mine drainage or are in heavily mineralized zones are acidic; they have low pH levels, usually around 5 to 6 and sometimes lower. Dissolved oxygen levels tend to be high in these streams.

### **Ground Water<sup>3</sup>**

The National Forests have two major ground water regions: the South Platte River Basin and the Southern High Plains. The South Platte River Basin is comprised of two very dissimilar regions: the high, rugged mountainous headwaters to the west and the low-precipitation plains to the east. The

relative lack of surface water in these two regions and the abundance of ground water have resulted in extensive development of this resource throughout the area.

It has been estimated that over 130 million acre feet of recoverable ground water is within the South Platte River Basin. However, due to the large size and varying structural conditions found within the basin, the amounts of water recovered from any one aquifer can vary considerably within short distances.

## WILDLIFE AND FISHERY RESOURCES

### Wildlife

The Forest Plan, Chapter III, provides the goals, direction and Standards and Guidelines for management for wildlife and fish resources. Some of the Forest Plan goals include:

- Increase diversity for wildlife and fish habitat improvement.
- Increase winter range habitat capacities for deer and elk.
- Improve fish habitat on suitable streams and low elevation ponds and lakes.
- Protect riparian areas and wetlands from degradation.

The number of vertebrate species which occur on the Pike and San Isabel National Forests are as follows:

**Table III-1  
Vertebrate Species - Mountains**

Vertebrate species	Number
Amphibians	6
Birds*	273
Fish	22
Mammals*	86
Reptiles	10
<b>Total</b>	<b>397</b>

\* Includes migratory species.

Certain wildlife species were selected as Management Indicator Species (MIS) for the Forest. They have been selected to be the focus of habitat management on the Forest, and to assess the effects and influences of land uses on wildlife and fish (36 CFR Part 219.19 (a)(1)). These species and the reason for their selection as an indicator species can be found in Exhibit III-3.

Approximately 280,000 acres of critical deer and elk winter range have been identified on the Forest by the Colorado Division of Wildlife using their Wildlife Resources Information System (WRIS). Refer to Geographic Zone narratives in Chapter IV for a more complete description of winter range conditions and population estimates.

Management Indicator Species (MIS) represent broad ecological niches on the Forest and Grasslands and do not necessarily represent the needs of all other wildlife species. However, by providing habitat for the designated MIS, the habitat needs for a wide range of species is provided.

Forest Direction requires that a minimum of 40 percent of potential habitat be maintained for every native vertebrate wildlife species.

## **Fishery Resources**

Numerous streams, lakes, and reservoirs in the analysis area provide habitat for a variety of game as well as non-game fish. Several different trout species, including brown, brook, cutthroat and lake trout are the most abundant and intensively managed game fish in the mountain areas. However, several other gamefish (e.g., northern pike, kokanee salmon and arctic grayling) are periodically planted and managed to provide angling variety. Fish are stocked in areas where natural reproduction is absent or not sufficient to support the intense fishing pressure. Stocking is coordinated with the Colorado Division of Wildlife (CDOW). The estimate is that fishing use of the Forests and Grasslands exceeds 4.5 million hours annually.<sup>4</sup> Resident anglers from major metropolitan areas on the Front Range, as well as non-resident anglers, contribute to the relatively high use. Fishing is becoming more popular, and the trend for growth of this recreational activity is expected to continue throughout the planning period. Watersheds which have been degraded due to human activities or natural phenomena are being prioritized and restored by the U.S. Forest Service in cooperation with the CDOW and various public groups.

In addition to gamefish, there are a number of less conspicuous non-gamefish. Primarily they are members of the sucker and minnow families and are important components of the aquatic ecosystem. They provide a valuable food source for mammals, birds and other fish. In addition, they are also valuable indicators of environmental conditions and many are quite colorful during some months of the year.

## **RIPARIAN RESOURCES**

Riparian areas consist of riparian ecosystems, aquatic ecosystems and wetlands.<sup>5</sup> These areas may be associated with lakes, reservoirs, estuaries, potholes, marshes, springs, bogs, wet meadows, and intermittent or perennial streams where free and unbound water is available. A variety of factors in a particular watershed, including geology, climatic conditions, gradient and basin size can singly or in combination affect the type and size of the riparian area. For example, a watershed which is located in a high elevation of the Forest may exhibit a variety of different characteristics from a lower, more arid watershed. Riparian areas are also dynamic systems, undergoing change in response to land use practices, flooding, scouring and depositions.

Three categories are included in this riparian area analysis: soil types, vegetation types, and aquatic ecosystems. Soils which are periodically saturated, flooded or ponded long enough during the growing season to develop anaerobic conditions in the upper portion of the soil profile are considered riparian or hydric soils.<sup>6</sup> These soils can be further broken down into organic soils (histosols) which are derived from organic materials or histic epipedons, which are soils near the surface that are saturated for 30 or more days during the growing season. Riparian soils are frequently young, in terms of geologic time, and are usually formed in alluvial deposits. However, they may be found in narrow headwater and broad-valley positions as well as land depressions not associated with running water. Hydrophytic vegetation is any plant growing in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content.<sup>7</sup> In addition, some riparian vegetation such as cottonwoods may be located in areas where the water table is close enough to the surface for root penetration but not saturation of the surface soils. Common riparian vegetation types include willows and sedges. Aquatic ecosystems include perennial streams, ponds, marshes, lakes and other areas saturated to the point of visible surface water throughout the year.

Although the relative land area is small, riparian areas are important sources of diversity within extensive upland ecosystems. Riparian vegetation stabilizes stream banks, and reduces erosion-caused sedimentation which is detrimental to aquatic life. Riparian vegetation also provides stream shading and possible filtration of nutrients to improve water quality. Accelerated streambank erosion can reduce agricultural land and transport valuable soils downstream.

Total acres of riparian for each of the geographic zones is presented in Exhibit III-4. The values calculated are from soil survey maps as well as the National Wetland Inventory (NWI) maps.<sup>8</sup> The two classifications generally overlapped where they were conducted simultaneously, with smaller isolated areas included. The relatively small percentage of riparian area found in these geographic zones is primarily the result of its restriction to narrow stream valleys and isolated standing water habitats.

The riparian ecosystem is probably the single most productive type of wildlife habitat, benefiting the greatest number of species.<sup>9</sup> After mapping significant wildlife habitats for 12 of Colorado's 63 counties, Schrupp concluded that riparian areas must be *"...rated as one of, if not the most important habitat types for wildlife from the multi-species perspective."*<sup>10</sup> However, Colorado's aquatic and riparian ecosystems are a limited resource which is being lost at a high rate. Riparian areas are being lost to such activities as dewatering, pollution, overgrazing, reservoir construction, mining, road construction, and channelization.

## ALPINE

Alpine occurs from timberline to the tops of mountain ranges. Alpine ecosystems have short growing seasons, cold temperatures, great diurnal variations in temperatures and often high winds. Due to harsh climatic conditions and very slow soil formation, alpine areas are fragile ecosystems which are sensitive to a variety of ground disturbing activities.

Woody plants are restricted to small areas protected from wind. Other vegetated areas are dominated by perennial plants with short to very short growth forms. Large areas dominated by rock of various sizes are much more common in the alpine than below.<sup>11</sup> Geomorphology, extent of vegetation cover and slopes vary greatly from area to area, largely as a result of past glaciation.<sup>12</sup>

Alpine areas are valued for their scenic beauty and high elevation recreational opportunities, particularly in the Sangre de Cristos, the Spanish Peaks and the Collegiate Peaks.

## THREATENED AND ENDANGERED SPECIES

The Endangered Species Act of 1973 (Public Law 93-205) provides means whereby ecosystems on which endangered and threatened species depend may be conserved for the continued survival of these species, or improved for managed and protected habitat. Threatened and endangered wildlife species under consideration are listed in Exhibit III-5.

Forest direction and standards and guidelines for the management of T&E species on the National Forests are found on pages 31, 32, 57, and 58 in Chapter III of the Forest Plan.

The mountainous areas are considered to be within the historical distribution range of the greenback cutthroat trout. Endemic to the mountainous areas of the South Platte and Arkansas River drainages, this colorful trout has been eliminated throughout most of its original range as a result of competition and hybridization with non-native species, as well as degradation of its habitat by man. The greenback cutthroat is currently listed as a federally threatened species, and has been the focus of an intensive interagency effort to reintroduce it into its original habitats.<sup>13</sup>

In addition to the greenback cutthroat trout the yellowfin trout was historically found in Twin Lakes. However, this subspecies is currently considered to be extinct, unless isolated or currently unknown populations exist.

The Pike and San Isabel National Forests have several plants that are being considered for listing either as federal or state T&E species. These species will be protected from deterioration pending completion of suitability examinations and subsequent decisions concerning listing as a T&E species. These plants and their current status are outlined in Exhibit III-6.

Refer to each Geographic Zone in this Chapter for complete discussions of T&E species.

## **RANGE RESOURCE**

There are approximately 305,401 acres of suitable range on the two National Forests. This acreage figure is based on data contained in the Forest Service Range Management Information System (FSRAMIS). Suitable range is defined as land accessible and capable of producing forage on a sustained yield basis.

There are 68 grazing allotments on the National Forests. In 1989, there were eight vacant allotments (five sheep and three cattle) that were suitable for restocking.

Refer to Exhibit III-7 for suitable range and permitted grazing use for each geographic zone.

## **VISUAL RESOURCE**

The diverse environment of the Forests accounts for their high visual resource value. Natural features include: high mountain peaks, unique geological formations, steep valleys, alpine meadows, canyons, aspen fall color, lakes, streams, and wildlife. Many historical and cultural features exist as well.

Because of the unique combination of features, sightseeing is the primary recreation activity on the Forests. Scenery benefits tourism directly by providing a backdrop that draws visitors to the Forests for a variety of recreational activities in addition to sightseeing itself. We expect the importance of scenery to intensify as demands for recreation and natural resources increase correspondingly with population growth.

Presently there are no oil and gas developments on the National Forests. The perceived impacts of oil and gas developments may be either positive or negative depending upon the character of the surrounding landscape. Linear clearings along roads, soil color contrasts, and site clearing are intrusions in otherwise natural settings. Impacts are a result of the contrasts to the natural landscape caused by these intrusions. Although communities in the National Forests' vicinity are not accustomed to oil and gas activity, the Forest environment has a higher visual absorption capability (VAC) than the Grasslands. This is due to the landform and vegetative cover available for screening.

See Exhibit III-8 in this chapter for information about visual quality objectives and a list of evaluation criteria that will be used to determine impacts of oil and gas development.

## **CULTURAL, PALEONTOLOGICAL, AND CAVE RESOURCES**

Cultural resources often have recreational, interpretive and educational values that may not be protected by implementation of the National Historic Preservation Act. Cultural sites can be used

to illustrate important aspects of American cultural heritage so that the student or hobbyist can gain a more comprehensive and accurate perception of his/her interests. Cultural resources can enhance outdoor recreation experiences through their intrinsic scenic, artistic, and educational values. Cultural site types that may contain recreational, interpretive, and educational values include, but are not limited to, American Indian game drives and scarred trees, historic trails, wagon roads and passes, mines and smelters, ghost towns, railroad grades, sawmills and homesteads. The known cultural sites on the Forests that contain these values are displayed in Exhibit III-9.

The religious and heritage values that American Indians or other ethnic groups might assign to cultural sites (recognized as "traditional cultural properties") are not obvious through the National Register criteria, but should be considered when evaluating the significance of a cultural site.

As of June, 1991, approximately 925 cultural resource properties have been recognized and recorded on the Pike and San Isabel National Forests. These resources represent approximately 10,000 years of human use of alpine, mixed conifer forest, and foothill parkland and shrubland environments by diverse prehistoric and historic human groups. The sizes of the individual resources (sites) range from about 500 square feet to over 160 acres for point resources, although the mean size is under one acre. Linear resources (trails, railroad grades and roads) range from under 1 mile to nearly 20 miles. Of the approximate 925 known cultural properties, 10 now have official status as significant cultural resources. These include one National Historic Landmark (Pikes Peak on the Pikes Peak Ranger District) and nine properties on the National Register of Historic Places [Exhibit III-9]. In addition, approximately 100 properties have been recommended as eligible to the National Register, and an additional 175 as potentially eligible to the National Register. Additional research on properties in the last category must be done before making a certain National Register determination.

By the end of June, 1991, only about 2.0 percent of the lands administered by the Forest (45,000 acres) had been systematically investigated for cultural resources and an additional 9 percent or 250,000 acres had been surveyed for cultural properties. Therefore, the potential for discovering additional significant cultural resources is very high. There probably are more than 250 cultural properties on the Forests that are "significant" and eligible to the National Register of Historic Places.

The criteria for determining significance are listed in 36 CFR Part 60.4. The following summary lists categories of significant and potentially significant cultural resources that comprise the affected cultural resource environment of the Forests.

## **Prehistoric Resources**

Prehistoric American Indian groups used the Colorado Rocky Mountains east of the Continental Divide and the eastern Colorado Piedmont since the close of the last Pleistocene Ice Age or about 10,000 years ago. Professional literature describing the prehistory of montane Colorado divides this long span of prehistoric occupations into a series of periods. The periods (stages) are based on variations in material culture and deduced lifestyles. The relationship of an individual cultural resource to this chronology influences significance determination for that resource. The major units within this chronology are as follows:

- (1) the Paleoindian Period (10,000 - 5500 BC),
- (2) the Archaic Period (5500 BC - AD 500),
- (3) the Ceramic Period (AD 500 - 1550),
- (4) the Protohistoric Period (AD 1550 - 1800),
- (5) the Contact Period (AD 1800 - 1880).

Some of the prehistoric cultural properties recorded on the Forests and Grasslands may be categorized as more than one type if one considers their entire use history. The types are as follows: (1) camps, (2) quarries, (3) game drives, (4) culturally scarred trees, (5) rock art, (6) trails, (7) burials, and (8) other phenomena. Significant prehistoric cultural resources currently known for the Forests are included in Exhibit III-10 at the end of this chapter. Exact locations of the known significant resources are protected by the Archaeological Resources Protection Act. A more detailed discussion of the significant prehistoric resources of the Forests is presented in the cultural resources technical report in the Administrative Record for this document.

## Historic Resources

The historic record of the Forests begins with early Spanish exploring expeditions from Mexico and New Mexico beginning in the 16th century. One famous Spanish explorer known to have visited the Forests is Bishop de Anza who passed through the San Isabel National Forest in pursuit of the Comanche leader Cuerno Verde and his tribe in the late 1700's. This was also the period of the fur traders and several of the famous mountain men including Big Bill Williams, Kit Carson, and Jim Beckwourth who trapped beaver in the Forests. The Wahatoya, now called the Spanish Peaks, were landmarks for the travelers on the Santa Fe Trail in the 19th century. Several of the early exploring expeditions commissioned by the government of the United States were directed to examine this area; the two most famous were the Pike Expedition of 1806-1807 which traveled the Arkansas Valley and the fringes of Pikes Peak, and the ill-fated Fremont Expedition which crossed the Wet Mountains and the Sangre de Cristos before meeting disaster during the winter of 1848.

The early forays by small groups left little record of their passing except the names of prominent landmarks. The true transition of prehistoric lifeways to history in the Forests is logically related to the Colorado Gold Rush of 1858-1859 and specifically to discovery of gold placer deposits at California Gulch near Leadville in the San Isabel National Forest in the latter year. The gold deposits soon played out, but richer silver ores were discovered a decade later near Leadville and all along the Sawatch and Mosquito Ranges. The Silver Boom led to the creation of overnight mining communities and was the foundation of the history of the Forests. Both forests contain a vast record of the boom times, including famous mines, mills and smelters, and ghost towns. Many subsidiary industries and subsequent history were spun off from the boom including railroad and wagon road transportation, logging (the mines needed timber supports and the railroads needed ties) and the charcoal industry. Most significant Forest historical resources are related to this boom period.

Overviews of the history of the Forests have been prepared by the responsible federal agencies and the historic preservation offices of Colorado. These documents are the basis for evaluating the significance of historic resources and are organized by dominant historic themes. In addition to being closely associated with these themes, historic resources in the Forests also may contain noteworthy engineering and/or architectural values and valuable archaeological deposits. A preliminary survey of the historic resources on the Forests suggests that as a whole, our resources can contribute strongly to some themes and weakly or not at all to others. Using the pertinent overviews the historic themes particularly relevant to the Forests and the resource or site types with potential significance are as follows:

- (1) Mining: placer and hydraulic mining areas, mines, mills and smelters, mining camps, mining cultural landscapes, and other mining resources.
- (2) Logging: sites reflecting the charcoal industry, sawmills, and sites associated with tie-hacking.
- (3) Railroads: preserved portions of railroad beds and line, features (bridges, trestles, tunnels, sidings) on the line, stations, and labor construction camps.
- (4) Trails and roads: famous mountain passes, wagon and stage roads, and stations.
- (5) Farming and ranching: mountain homesteads.
- (6) Recreation and tourism: hotels and resorts, summer homes, recreational trail and roads, Forest Service recreation developments.
- (7) Forest Service history: ranger stations, nurseries, fire lookouts.
- (8) The military: military facilities on National Forest lands.
- (9) The Depression: placer mining operation and mountain habitations of the Depression Era, prohibition stills, Civilian Conservation Camps and activity areas.

Significant historic resources currently known on the Forests are listed in Exhibit III-10 in this chapter. Exact locations are not provided and are protected by the Archaeological Resources Protection Act.

## **Paleontological Resources**

No significant paleontological point resources have been discovered on lands administered by either the Pike or San Isabel National Forests. However, fossil-bearing geological rock formations are present within the boundaries of the Forests; therefore, the potential for discovering significant paleontological resources exists. The Florissant Fossil Beds National Monument is adjacent to Pike National Forest lands in the vicinity of Elevenmile Canyon, so the potential for discovery of significant fossils in this area is high. Rich fossiliferous deposits have been reported in the vicinity of Hayden Creek on the eastern slopes of the Sangre de Cristo Mountains, San Isabel National Forest. Other locations in the Sangres are known to contain fossiliferous deposits with yet-to-be-assessed degrees of significance. For example, the Marble Mountain area near Music Pass has large outcrops of limestone that contain crinoid fossils, but their extent or scientific worth has not been studied.

## **Cave Resources**

Several cave systems have been identified in the mountain districts of the Forests and the potential exists to discover additional caves or cave systems in unexplored areas. Known cave systems on the Pike National Forest include the Cave Creek Caverns south of Fairplay and the Lost Creek Caves in the Lost Creek Wilderness southwest of Bailey. The Lost Creek cave system contains many individual caves and many are interconnected. This system is especially significant because of its popularity among spelunking groups and because its internal structure is virtually unique among reported cave systems of the world. Smaller caves have been reported near Black Mountain on the south edge of South Park and on the Great West Mine claims near Fairplay.

The San Isabel National Forest also contains several large known cave systems. The most prominent is the Marble Mountain Caverns on the east flank of the Sangre de Cristos above timber line west of Westcliffe. There are seven identified major individual caves and several "potholes"; the individual caves are interconnected to form a complex labyrinthine system. According to folklore, the caverns were the site of an early Spanish gold mine, although this has never been confirmed. Caves have been reported in the eastern foothills of the Wet Mountains (San Carlos District) near the town of Beulah. The Beulah caves are situated in the local limestone cliffs which form the walls of the major canyon drainages in the area, including Spring Creek, Middle Creek and the St.

Charles River. It appears that a few of the more prominent caves, such as Mace's Cave and Lamb's Cave may be on Forest Service land. Significant cave systems on the Forests are included in Exhibit III-10 of this chapter.

## RECREATION

Outdoor recreation contributes importantly to economies in the vicinity of the Pike and San Isabel National Forests. These public lands are an important resource providing for a wide variety of recreational activities. We expect the demand for recreation opportunities to continue to increase. The popularity of recreation activities on the Forests is summarized for 1990 in Exhibit III-11 of this chapter.

Forest Service planning for recreation used the Recreation Opportunity Spectrum (ROS) as described in the *ROS Users Guide*. ROS provides a framework for defining types of outdoor recreation available on the Forests and Grasslands. ROS classes include Primitive, Semiprimitive (motorized and nonmotorized), Roaded Natural, Rural and Urban. Exhibit III-12 in this chapter shows the activity by ROS class and whether land based, water based or snow/ice based. The relationship of the Forests' and Grasslands' present ROS class composition and use is shown in Exhibit III-13 of this chapter.

Approximately 84 percent of the recreation use on the Unit occurs within the Roaded Natural, Rural and Urban classes. The remaining 16 percent takes place in Primitive and Semiprimitive classes. Exhibit III-13 in this chapter illustrates the relationship between existing ROS class and type of use.

The Forest Service manages two types of recreational situations on public lands. Most of our public lands are managed to maintain freedom of recreational choice with a minimum of regulations. There are limited facilities and supervision on these lands. Recreation opportunities on such lands are referred to as "dispersed recreation." Where resources attract intensive recreational use, we make major investments in recreational facilities and visitor assistance. Specific management direction for these areas is to provide for resource protection and for public health, safety and enjoyment. These sites are referred to as "developed recreation."

Both kinds of recreation use occur in Roaded Natural settings which include scenic drives, highways, timber harvest areas, and adjacent lands. Because Roaded Natural areas are located on relatively gentle terrain with abundant access, most of the total acreage is usable.

The acreage breakdown of the Unit according to ROS class is as follows:

**Table III-2  
Acres by ROS Class**

ROS Class/Location	Acres
Primitive ROS: National Forests	82,552
Semiprimitive Nonmotorized ROS: National Forests	660,417
Semiprimitive Motorized ROS: National Forests	495,312
Roaded Natural ROS: National Forests	941,141
Roaded Natural ROS: National Grasslands	493,590
Rural ROS: National Forests	35,786
Rural ROS: National Grasslands	33,548
Urban ROS: National Forests	14,298
<b>Total Acreage:</b>	<b>2,756,644</b>

### **Developed Recreation**

The Forest has 263 developed recreation sites including 94 campgrounds with 1,922 camp sites, 33 picnic grounds, 10 group use sites, as well as boat ramps, trailheads, fisherman parking lots, overlooks, observation sites, and interpretive sites. The 263 developed sites have a capacity of 21,071 People at One Time (PAOT) with 9,610 PAOT's being accommodated in the family campgrounds. There are currently 61 fee campgrounds and 9 fee group sites. Campground user fees collected in 1990 were approximately \$382,000, a 32 percent increase over the 1985 season. There are 10 family campgrounds and 7 group sites available for reservations under a nationwide campground reservation system.

Many of the campgrounds are adjacent to lakes, reservoirs, and streams. Although the water is generally too cold for any water contact sports, fishing and boating are popular.

Most developed recreation sites (particularly campgrounds) are located in 0-15 percent valley bottoms slope range. Other developed sites, such as picnic grounds, fisherman parking lots, and trailheads are located in the 16-40 percent slope range, as well as valley bottoms, because smaller usable areas are adequate for such developments.

### **Dispersed Recreation**

Dispersed recreation activities in the Forests, excluding the Wilderness areas, account for approximately 65 percent of all recreation use.

The leading dispersed recreation activity is automobile travel for scenic enjoyment which is 37 percent of total use. The high incidence of this activity can be attributed to the exceptional scenery along travel routes. Camping and hiking are the next two most popular activities, followed by picnicking and fishing.

There are over 1,200 miles of trails in a variety of settings available to nonmotorized and motorized users. The Barr Trail to the summit of Pikes Peak and Devil's Head Trail to a historic fire lookout are two National Recreation Trails on the Forests. The Continental Divide National Scenic Trail will

traverse an extensive area of the Forests when completed. About half of the 400-mile Colorado Trail is on these Forests. This nationally prominent trail extends from Denver to Durango. The Rampart Range Motorcycle Area has been specifically developed and managed for motorcycle riding. With over 120 miles of trails for all classes of riders, this area is becoming increasingly popular each year.

The Forests have almost 4,000 miles of roads with approximately 2,400 miles classified as graded or paved. Several state and federal highways through the Forests provide excellent opportunities to view and photograph the scenery. The Pikes Peak toll road, a 19 mile drive to the summit of one of the most well-known attractions on the Forest, is a popular summer drive. The Highway of Legends between Trinidad and Walsenburg and Guanella Pass between Grant and Georgetown are Colorado Scenic Byways and National Forest Scenic Byways. There are 10 passes over the Continental Divide, some of which are for four-wheel drive (4WD) vehicles only. Other 4WD roads go to historical mines, follow abandoned railroad grades or old wagon and timber roads. Beautiful fall colors of aspen and oakbrush reward those who drive Forest roads during the fall. Several areas are noted statewide and are visited annually by those seeking viewing and photographic opportunities.

Off-road vehicle (ORV) use on the Forests is seven percent of the total use. Because of the rugged terrain and lack of available challenging primitive roads, most of the users of motorbikes and 4X4s limit their use to designated routes or areas open to motorized use.

Most of the Forests' primitive and semiprimitive nonmotorized recreation use occurs within Wilderness and Wilderness Study Areas. This is because these areas possess outstanding recreational, scenic, and geological attributes, including most of the lakes and high mountain peaks. Dispersed recreation settings include forest roads, highways and trails, backcountry areas, rivers and streams, and Wilderness. The ROS settings include the semiprimitive (motorized and nonmotorized), roaded natural, and rural classifications.

Semiprimitive settings include areas managed for both motorized and nonmotorized uses. Those open to trail vehicles offer an opportunity to ride on designated routes. Semiprimitive motorized settings are generally open to vehicles designed for trail use (including snowmobiles), or they may include primitive two-track roads for 4WDs. Semiprimitive settings provide remoteness, challenge, and solitude in a backcountry setting. Location of semiprimitive areas, access, and attractions within them are some of the factors that contribute to use levels. As with developed sites throughout the Forest, some semiprimitive areas are used very lightly, and others attract enough use that crowding and user conflicts have occurred. In these settings, terrain and trail access may limit the area usable for recreation. Although the total acreage in the setting may be high, relatively little of the area is actually usable for recreation unless the terrain is unusually gentle.

Many semiprimitive areas on the Forests have desirable attractions, but use is limited largely by lack of information about them that is available to the public. Areas such as system trails, the fourteeners, fishing lakes and streams, all roads including 4WD and the areas adjoining the roads, have information readily available and these areas tend to receive the dispersed use. Development of attractive trailhead facilities and road access, signing, and publications have contributed to the use of dispersed areas.

## **WILDERNESS**

There are five classified Wilderness Areas (Mt. Evans, Lost Creek, Holy Cross, Mt. Massive, Collegiate Peaks) on the Forest consisting of 258,934 acres. The Wilderness Act of 1964 (P.L. 88-577) withdrew Wilderness acres from mineral leasing.

The Colorado Wilderness Act of 1980 (P.L. 96-560) designated four Wilderness Study Areas (Buffalo Peaks, Greenhorn Mountain, Sangre de Cristo, Spanish Peaks) in the Pike and San Isabel National Forests. NFS lands in three study areas (Greenhorn Mountain, Sangre de Cristo, Buffalo Peaks) consisting of 120,017 acres were recommended for Wilderness designation. The Federal Onshore Oil and Gas Leasing Reform Act of 1987 prohibits the issuance of any oil and gas leases on those lands recommended for Wilderness allocation by the surface managing agency.

The Spanish Peaks Wilderness Study Area and portions of the Buffalo Peaks and Sangre de Cristo Wilderness Study Areas were not recommended for Wilderness designation. These lands "not recommended" remain subject to Sec. 105(c) of P.L. 96-560 which provides that, with respect to oil and gas exploration and development activities, such lands shall be administered according to the laws generally applicable to the National Forest System. Section 17 of the Act of February 25, 1920, as amended by the Reform Act of 1987, is generally applicable to the National Forest System. Section 17(h) grants the Secretary of Agriculture consent/denial authority over the issuance of any oil and gas leases on National Forest System lands reserved from the public domain. Section 17(h) is therefore applicable to the Wilderness Study Area lands that were "not recommended" as well as adjacent lands that may be considered for Wilderness designation; pursuant to this discretionary authority, the alternatives of leasing or not leasing these lands are addressed in this EIS.

## **SPECIAL AREAS**

### **Wild and Scenic Rivers**

A segment of the South Platte River extending 23 miles from Elevenmile Canyon Reservoir to Cheesman Reservoir has been determined to be eligible for inclusion in the National Wild and Scenic Rivers System. Pending a suitability study, the river and a one-half mile wide corridor is being managed to preserve its eligibility characteristics.

Pending the completion of the eligibility study, a one-half mile corridor on the remaining segment of the South Fork of the South Platte from Cheesman Dam to the forest boundary at Kassler will be managed to preserve its potential inclusion in the National Wilderness Scenic Rivers System. The additional segment of the South Fork is approximately 25 miles.

An 8-mile segment of Badger Creek within the National Forest boundaries will be managed to preserve its potential for wild, scenic or recreational river classification.

### **Experimental Areas**

The Manitou Experimental Forest is located 28 miles northwest of Colorado Springs, Colorado in Teller County, and is 26 square miles. It was established by the Forest Service in 1938. By virtue of the authority vested in the President by Act of June 4, 1987, 30 Stat. 34, 36, (16 U.S.C. 473) and otherwise, and pursuant to Executive Order No. 10355 of May 26, 1952 (17 F.R. 4831), subject to valid existing rights, the Manitou Experimental Forest was withdrawn from all forms of appropriation under the public land laws including the Federal mining laws but not the general leasing laws (PL 1137). The lands were reserved for use of the Forest Service, Department of Agriculture, in connection with research projects being conducted in furtherance of the Act of May 22, 1928, 45 Stat. 699, as amended. It was selected as an area representative of the foothills and low mountains of eastern Colorado and highly suited for research in range and watershed management.

The Chief, U.S.D.A., Forest Service withdrew consent to the BLM for leasing lands within the Manitou Experimental Forest.<sup>14</sup>

## Research Natural Areas

There are three Research Natural Areas designated or proposed on the Pike and San Isabel National Forests. These areas are the Hurricane Canyon, Saddle Mountain and Hoosier Ridge RNA's. These RNA's are covered in more detail in the individual Geographic Zone narratives in this Chapter.

## Special Interest Areas

There are nine Special Interest Areas in existence or proposed for the Pike and San Isabel National Forests. These areas are listed in the following table:

**Table III-3  
Special Interest Areas  
Pike and San Isabel National Forests**

Special Interest Area	Acres
Windy Ridge Bristlecone Pine Scenic Area	150
Queen's Canyon Geologic Area	1,130
Mt. Bross Botanical Area	105
West Hoosier Ridge Botanical Area	54
Iron Mountain Botanical Area	100
Lost Lake Botanical Area	160
Lost Park Botanical Area	160
Spout Lake Botanical Area	120
Dronney Gulch Botanical Area	20

Some of these areas contain plants that are being considered for listing as threatened or an endangered species. These areas are discussed in more detail in the Geographic Zone narratives in this chapter.

Because of the nature of Research Natural Areas and Special Interest Areas, they will be treated differently than other Forest lands. This could range from Controlled Surface Use (CSU) to No Surface Occupancy (NSO). In some cases there may be a combination of CSUs, NSOs and timing restrictions.

The San Isabel National Forest contains one area that is listed on the register of National Natural Landmarks. This is the Spanish Peaks National Natural Landmark which is located in the Spanish Peaks - Sangre de Cristo Portion of the Forest south of La Veta. The national landmark encompasses 44,160 acres of public and private lands of which 23,770 acres are National Forest System lands. The national natural landmarks program is administered by the U.S. Department of Interior National Park Service, and recognizes sites that illustrate our nation's natural heritage. The Spanish Peaks are recognized as an outstanding example of volcanically formed peaks and radiating dikes. The geological formations that are the basis for the landmark should be protected during oil and gas development on the San Isabel National Forest.

## Withdrawals

Withdrawals are a management action for withholding an area of National Forest System land from settlement, sale, location, or entry under some or all of the general land laws, including the mining and mineral leasing laws. Limiting activities under those laws is for maintaining other public values in the area or for reserving the area for a particular public purpose or program.

National Forest System lands with reserved or public domain status are subject to entry under the General Mining Laws but may be withdrawn from mineral entry when a greater public value or benefit is identified.

Forest Service withdrawals have been made for the following purposes: administrative sites, developed recreation sites, natural areas, scenic areas, experimental areas, and other unique features. Other withdrawals include municipal watersheds, power withdrawals (Federal Energy Regulatory Commission), reservoir sites (Bureau of Reclamation), and military use (U.S. Air Force Academy).

The following is a tabulation of existing withdrawals:

**Table III-4  
Withdrawals**

Withdrawal	Acres
U.S. Forest Service	34,198
U.S. Fish and Wildlife Service	2,720
Department of the Air Force	8,858
Other Federal Agencies (BOR/FERC)	18,850
Municipal Watersheds (Act of Congress)	14,236

The above are withdrawn from mineral entry under the General Mining Laws, as amended. The Air Force withdrawal and the municipal watersheds withdrawal are also withdrawn from leasing under the Mineral Leasing Laws.

Each withdrawal is reviewed periodically to determine if the withdrawal is appropriate and still required. The Federal Land Policy and Management Act of 1976 required that all withdrawals be reviewed by 1991. The Pike and San Isabel National Forests completed this review in 1989.

## MINERAL RESOURCES

### Mineral Potential

A mineral potential evaluation was conducted to determine the possible existence of leasable mineral deposits on the Forest. Mineral potential levels were determined for energy fuels. A set of general criteria established includes known favorable geology and structure, known mineral occurrences and reserves (if data available), and field activity related to mineral exploration, development and production. The "potential levels," determined as high, medium, and low, are based on today's knowledge and prices and may change, depending on the mineral economy, technological advances, or further exploration.

High mineral potential includes favorable geology and structure, known economically valuable mineral occurrences and reserves (if data available), and field activity. Medium mineral potential includes favorable geology and structure, known mineral occurrences with insufficient evidence of present economic value, or sub-economic deposits, and occasional activity. Low potential includes geology considered unfavorable at this time, no known mineral occurrences, explored or prospected sites determined non-economic, and little or no present activity. The low potential level does not infer the lack of mineral deposits, but rather insufficient knowledge at this time.

Mineral potential maps were developed by gathering data from individuals and references, including historical production records. The mineral potential maps are a part of the planning records and are available for review in the Supervisor's Office, Pueblo, Colorado [see Appendix I]. Additional information on mineral occurrences, production, and geologic environment is found in the Mineral Potential Report for the Pike and San Isabel National Forests in Appendix H of the Forest Plan.

### Historical Exploration and Production

Although oil and gas production is not currently taking place on the Pike and San Isabel National Forests, several areas have been explored. Only one stratigraphic test drilling has occurred within the Pike National Forest. There is no historical evidence that any other exploratory drilling for oil and gas has occurred on either Forest. Potential for hydrocarbon accumulation exists in sedimentary rocks along the flanks of the Sangre de Cristo and Mosquito Ranges, and the Spanish Peaks. A producing carbon dioxide area adjacent to San Carlos Ranger District indicates potential carbon dioxide on the Forest. The Forest has two coal reserve areas, South Park Field and the Raton-Mesa Region. The South Park Field touches the Forest north of Jefferson and is inactive. The Raton-Mesa Region is a known recoverable coal resource area consisting of the Walsenburg and Trinidad coal fields. Potential for coal bed methane gas exists in these areas.

### TRANSPORTATION

Major federal and state highways provide convenient access from population centers through the main Forest units. An extensive network of County and Forest System roads further provided access to most areas of the Forest. Forest System roads consist of the following:

Table III-5<sup>15</sup>  
Forest Road Summary  
Miles

Function		Surface		Lanes		Jurisdiction	
Arterial	1208	Primitive	1621	Single	2712	County	1121
Collector	928	Graded	1327	Double	1220	Forest	2706
Local	1748	Aggregate	724	Other	2	Other	107
		Asphalt	106				
		Other	156				
Totals	3934		3934		3934		3934

Many Forest System roads overlap County System roads and are maintained by those counties to serve local public needs. In cases of primary maintenance responsibility, the Forest Service maintains roads to meet resource management needs and to provide for public safety. Future transportation needs reflect dramatic population increases in Colorado's Front Range. County and

state systems will absorb most of this impact while the Forest Transportation System will continue to meet resource management needs.<sup>18</sup> Additional information on transportation (i.e., Access, Travel Management, Demand Trends, etc.) can be found in the Forest Plan, Chapter II, pages 66-68.

## **SPECIAL USES**

Special use authorizations allow use of National Forest System lands by federal, state, and local agencies, and private industry and individuals. Laws and regulations govern use to best serve the interest of the public and the United States.

### **Existing Long-Term Special Uses**

Currently there are approximately 872 special use permits authorizing private and/or public use of 21,156 acres of National Forest System lands on the Pike and San Isabel National Forests. Uses vary from a simple trail shelter or fence to highly-developed winter recreation resorts or communication sites. Investment in the sites may be a few hundred dollars for a short road to several million dollars for a winter recreation resort or a communication site complex.

### **Short-Term Special Uses**

Annually, approximately 125 permits are issued for a term of less than one year. These authorizations include outfitter/guide permits, snowmobile rallies, cross-country skiing, seismograph activities, mineral materials, rock, etc. Oil and gas exploration and development would normally have little impact on these uses.

### **Utility Corridors**

Management Prescription 1D of the Forest Land and Resource Management Plan provides for the designation of transportation and utility corridors:

- (1) Electrical Transmission - Lines 69 KV or larger.
- (2) Pipelines - Lines 10 inches in diameter or larger (Gas/Oil/Water).
- (3) Telecommunications - All microwave paths and fixed telecommunication electronic sites.
- (4) Railways - Ten miles in length or longer.
- (5) Highways - All Interstate, Federal or State Highways.
- (6) Telephone Lines - Major transcontinental systems.

Existing corridors have been identified on the Forest Land and Resource Management Plan maps.

For additional information on the various types of special uses, refer to Exhibit III-14 in this chapter.

# **The Grassland Environment (Comanche and Cimarron National Grasslands)**

## **VEGETATION**

On the Comanche NG, dominant grassland types include shortgrass prairie (80%) and midgrass prairie (20%). On the Cimarron NG, dominant types include midgrass prairie (70%) and shortgrass prairie (30%). Pinyon-juniper and woody draws account for small percentages of the vegetation, but often provide valuable wildlife habitat and visual diversity to landscapes dominated by grasses. These types will be noted later in this chapter by Geographic Zone. Refer to Exhibit III-15 in this chapter for more detailed descriptions of the major grassland types.

## **SOILS**

Soils of the "High Plains," which include the Comanche and Cimarron National Grasslands, have properties that have been primarily influenced by differences in parent materials. In general, the grasslands are comprised of two distinct types of land that are often referred to as the "hard lands" and "sandy lands." The hard lands consist of loamy soils with variable depths that are well-developed from sedimentary, igneous, and loess deposit sources. The sandy lands are deep sandy soils with very little development from wind-deposited sands. There are no prime farmlands identified within the Grassland environment according to the Forest Plan, Chapter IV, p. 80. Current soil types have been highly influenced by the "Dust Bowl" of the early 1930's which removed most of the fertile topsoil on extensive areas of land. Dry climatic conditions coupled with over-farming and excessive grazing were primarily responsible for the Dust Bowl, and much has been learned about erosion-control management practices since that historic event. Vast areas of loose sands exist on both Grasslands, and soils are considered sensitive due to their high susceptibility to wind erosion. Rehabilitation practices are especially challenging in problem areas.

Soil survey information for the Grasslands may be found in published county reports (Baca, Otero, Morton Counties) and unpublished information (Las Animas County) prepared by the USDA Soil Conservation Service. Specific information about soils and other landscape features is available for a variety of purposes from the U.S. Forest Service, Pueblo, Colorado.

## **WATER**

### **Surface Water**

There are only two perennial streams on the Comanche National Grasslands. They are Timpas Creek and Carrizo Creek. There are no perennial streams on the Cimarron National Grasslands. Some man-made ponds provide additional surface water but few of these hold water throughout the year. Some of the windmills have overflow ponds associated with them. These are man-made and hold any water that overflows the stock tanks. They provide small but important riparian habitat.

Many of the intermittent drainages support riparian vegetation such as tamarisk, willow and cottonwood. They provide critical wildlife habitat.

## Ground Water<sup>17</sup>

In the Comanche National Grassland areas, wells furnish nearly all the water for domestic and stock needs. These wells vary in depth from 60 to 875 feet. Fortunately, deposits of water contained in stream-laid sand and gravel underlie most of the area. Water yields of the wells vary from the large amount produced by wells south of Vilas and Walsh to small or moderate amounts suitable only for domestic and stock use. The quality of the water varies somewhat with the type of formation. Some have such a high sulphate content that they are unsuitable for domestic use and of poor quality for livestock. A few have such a high iron and sulphur content that pipes last only a few years.

The entire population of the Cimarron National Grassland obtains its water supply from wells. The Ogallala aquifer underlies most of the Grassland. On the upland, the depth to the water table ranges from about 30 to 225 feet. The water-bearing material, Pliocene and Pleistocene undifferentiated sediments and Cockrum sandstone formation, ranges in thickness from about 60 to 400 feet. Wells for domestic use and for livestock furnish enough water almost anywhere they are drilled in the Grassland. Irrigation wells are not so easy to locate. Test holes have to be drilled to locate gravel or sand strata that will produce a large amount of water. The water is highly mineralized but is suitable for most uses. There are a few artesian wells, but the water from these wells is high in total salts.

## WILDLIFE AND FISHERY RESOURCES

The Forest Plan, Chapter III, provides the goals (pages 3-6), direction and Standards and Guidelines for management (pages 11-241) for wildlife and fish resources. Some of the Forest Plan goals apply to the Grasslands. These are:

- Increase diversity for wildlife and fish habitat improvement.
- Utilize programs that demonstrate wildlife habitat protection and improvement.
- Perpetuate woody vegetation.
- Protect riparian areas and wetlands from degradation.

Habitat diversity on the National Grasslands is best described in terms of plant species, topography, and the amount of uncommon habitat components such as trees, shrubs, rock outcrops, cliffs and water sources. Short and midgrass prairie is the primary habitat type. Diversity is generally managed through livestock grazing, and protection and propagation of trees, shrubs and water sources.

### Wildlife

The number of vertebrate species that occur on the Comanche and Cimarron National Grasslands are as follows:

**Table III-6  
Vertebrate Species - Grasslands**

Species Class	Comanche NG	Cimarron NG
Amphibians	12	10
Birds*	277	267
Fish	19	16
Mammals*	59	50
Reptiles	33	33
<b>Totals</b>	<b>400</b>	<b>375</b>

\* Includes migratory species

Refer to Exhibit III-3 for the Management Indicator Species found in the grassland environment by geographic zone.

Management Indicator Species (MIS) represent broad ecological niches on the Forest and Grasslands and do not necessarily represent the needs of all other wildlife species. However, by providing habitat for the designated MIS, the habitat needs for a wide range of species is provided. Forest Direction requires that a minimum of 40 percent of potential habitat be maintained for every native vertebrate wildlife species.

### Fisheries

There are numerous native as well as non-native fish species present in the Grasslands. Many of these fish have evolved to withstand the adverse conditions associated with the changing environments encountered there. The Timpas Creek and Purgatoire River contain the highest diversity of native fish species on the Comanche National Grassland, while the Cimarron River is the only river with fish on the Cimarron Grassland.

Several warm-water ponds provide important fisheries for sunfish and catfish species on the Comanche and Cimarron Grasslands. Stocking is coordinated with the Kansas Department of Wildlife and Parks and the Colorado Division of Wildlife.

### RIPARIAN RESOURCES

Riparian resources in the plains are largely restricted to narrow stream channels and depressions in the land which are periodically flooded. The exception is the Cimarron River, which has a relatively extensive riparian area. Woody riparian vegetation includes cottonwoods, willows and salt cedar. Herbaceous plants which inhabit the area include those species which have evolved to withstand periodic droughts and desiccation in the semiarid conditions, as well as those that are restricted to permanent water environments. The salt cedar was introduced from Asia and has been spreading in the Arkansas Valley since the 1890's. This hardy riparian species appears to have spread rapidly throughout the plains. Diversity of herbaceous plants was found to decline in the presence of salt cedar stands, with only those species tolerant of soluble salts produced by these trees able to survive.

## THREATENED AND ENDANGERED SPECIES

Exhibit III-5 outlines by geographic zone the T&E wildlife species found in the grassland environment.

There are currently no fish species which are formally classified as federally threatened or endangered in either of the Grasslands. However, there are several species which are sufficiently restricted in their distributions to make them a special concern, both in federal and state terms. These species are identified later in this chapter in the Geographic Zone discussions, under the appropriate zones.

Those Category 2 species which are candidates for official federal listing as threatened or endangered species (Federal Register, Vol. 40, No. 181, September, 1985; and Vol. 50, No. 188, September 27, 1985), or are state listed, presently have no legal federal protection under the Endangered Species Act; however, it is within the spirit of the Act to consider project impacts to potentially sensitive candidate species. Also, all of these Category 2 species are on either one or both of the threatened and endangered lists for Colorado and Kansas. Management of these peripheral and/or candidate species involves habitat and species surveys, protection of suitable habitat and identification of opportunities where habitat requirements can be better provided.

Plants which are being considered for listing on the federal or state level can be found in Exhibit III-6.

## RANGE RESOURCE

Almost all areas on the Grasslands are open and suitable for livestock use. Grazing use for 1990 was:

Table III-7  
1990 Grazing Use

Suitable Acres	Permitted numbers	AUM's
522,005	14,431	115,376

## VISUAL RESOURCE

The Grasslands have a relative lack of visual variety and a high level of existing impacts. The landscapes are dotted with cattle, windmills, oil and gas developments, homes, farms and a few recreation developments. However, some plains areas, and particularly the canyons in southeast Colorado, are undeveloped, but scenic and culturally important. Such areas are vignettes of the High Plains landscapes of the "Old West" as viewed by the Indians and early explorers. The rolling topography allows visitors almost endless views, broken occasionally by buttes and wooded stream corridors. Special management designations on the Grasslands are the Santa Fe National Historic Trail and the Cimarron River corridors.

The gentle topography and lack of major vegetation result in a low visual absorption capability (VAC), meaning that landscape modifications will have a high impact, which cannot be easily mitigated.

Exhibit III-8 in this chapter has information about visual quality objectives and a list of evaluation criteria that will be used to determine impacts of oil and gas development.

## **CULTURAL, PALEONTOLOGICAL, AND CAVE RESOURCES**

Grassland cultural sites may contain important educational, recreational and traditional place values that may not be protected by the National Historic Preservation Act. The Grasslands site types that might contain these types of values include American Indian and historic rock art, historic trails (including the Santa Fe National Historic Trail) and Depression Era homesteads. Known cultural sites on Grasslands that contain educational and recreational values are displayed in Exhibit III-10.

As of the end of June, 1991, approximately 330 cultural resource properties have been recognized and recorded on the Comanche and Cimarron National Grasslands. These resources reflect approximately 10,000 years of human use of the High Plains steppe and canyon land environments common to both Grasslands. The sizes of the individual resources (sites) range from about 500 square feet to over 160 acres for point resources, although the mean size is under one acre. Linear resources (trails and historic roads) range from under one mile to nearly 25 miles. Of the known properties, the Santa Fe Trail, with branches and features on both Grasslands, is officially recognized as a National Historic Trail. Several of the prehistoric sites have been determined eligible to the National Register of Historic Places, although they are not listed. Approximately 50 more sites are potentially eligible to the National Register; a clear determination is contingent on acquiring additional data regarding the nature of the archaeological deposits present at these resources. To date, all of the Cimarron National Grassland has been systematically surveyed for prehistoric resources, but only about 15 percent has been examined for historic resources. On the Comanche, approximately 10 percent has been systematically examined for both prehistoric and historic resources. The potential for discovering additional significant cultural resources is very high.

### **Prehistoric Resources**

Prehistoric man is believed to have inhabited the High Plains of western Kansas and southeastern Colorado, the general locations of the Cimarron and Comanche National Grasslands, for the last 10,000 years and possibly before that time. The same general chronology presented in the cultural resources discussion for the Forests is equally applicable here:

- (1) the Paleoindian Period (10,000 - 5500 BC),
- (2) the Archaic Period (5500 BC - AD 500),
- (3) the Ceramic Period (AD 500 - 1550),
- (4) the Protohistoric Period (AD 1550 - 1800),
- (5) the Contact Period (AD 1800 - 1880).

Virtually all prehistoric resources on both Grasslands date to the time period between 3000 BC and AD 1880. There is high potential for accidental discovery of resources dating before this time (to the Paleoindian Period or the early part of the Archaic Period), but such early resources are difficult to detect because they usually are buried under several feet or more of sediment. Significance criteria for prehistoric resources as presented in the cultural resources section for the Forests are also applicable to the Grasslands; sites that are associated with important events or persons are significant. Also, prehistoric sites that contain substantial archaeological deposits are significant if the data they contain are important for scientific research and construction. These and other topics in the archaeological research of High Plains prehistoric cultures are discussed in the pertinent state overviews for this area.

High Plains prehistoric properties can be classified according to types reflecting their use by prehistoric groups and their modern manifestations. For the Grasslands, several types of properties have been recorded; the ones with the greatest potential significance are habitation sites (including open campsites, campsites in rock shelters, and sites with masonry or stone-based structures) and rock art sites. The following are the sites with the greatest potential significance, according to period, based on the current state of knowledge.

- (1) The Middle and Late Archaic Periods. Open campsites often associated with extinct or seasonal playa lakebeds. Such locations are found on both Grasslands.
- (2) The Ceramic Period. Open campsites, campsites in rockshelters, sites with stone architecture (commonly associated with the Apishapa Culture), and sites with rock art panels. These site types are found on both Grasslands; highly sensitive areas include the Middle Spring area on the Cimarron, and several canyon land and high steppe locations on the Comanche.
- (3) The Protohistoric and Contact Periods. Open campsites (often with stone rings), campsites in rockshelters, and sites with rock art panels. These site types are found in numerous locations on both Grasslands.

## Historic Resources

The historic record for the Grasslands begins with the Coronado Expedition seeking the golden province of Cibola in 1540 and 1541. In the course of his futile search for riches, Coronado apparently visited the Point of Rocks area on the Cimarron National Grassland. The 1600's and 1700's were marked by further Spanish and French exploration of the High Plains and the beginning of the fur trade era. These early historic forays were by small groups who created few impacts and left little evidence of their passing. The opening of the Santa Fe Trail in the 1820's marked the beginnings of greater impacts by larger groups and the true end of the prehistoric period on the Grasslands. The traders and travelers on the Trail and the soldiers whose mission it was to protect the route were followed by various groups interested in exploiting the natural resources of the High Plains; ultimately, most of these commodity exploiters failed due to exhaustion of the targeted resources. Buffalo hunters slaughtered the large Plains herds in the 1870's. The prairie grasslands were then carved up into cattle empires in the 1880's and 1890's by a new wave of entrepreneurs. These large enterprises, dependent on the open range, dwindled with the arrival of the homesteaders a short time later. The homesteaders thrived during the first two decades of the 20th century, when annual precipitation was ample. Drought in the 1930's revealed that farmers had overextended onto marginal lands. The resulting Dust Bowl caused the loss of most of the area's population. To rehabilitate the area and to prevent further ravages, the federal government bought many of the former farms and ranches through the Resettlement Administration submarginal lands program and the Bankhead-Jones Act passed in 1937. Population is falling in some parts of the region, but is maintaining in others through new endeavors. These endeavors include oil and gas development whose beginnings can be traced to the turn of the century, and the military which has used the sparsely-settled High Plains for various training exercises and maneuvers since World War II. The themes which are most important in High Plains history and heritage are presented in the pertinent state historic society overview document. The following are the most important historic themes on the Grasslands and the resource types that commonly represent them.

- (1) The period of exploration. Resource types associated with this theme include rock inscription records of travelers. Several sites of this type are on the Comanche in the vicinity of Rock Canyon.

- (2) The Santa Fe Trail. Both Grasslands exhibit preserved sections of both main routes of the Trail (the Mountain branch on the Comanche NG and the Cimarron Cutoff on the Cimarron NG), portions of several lesser known branches, and prominent point locations along the trail routes. The main routes of the Trail have been mapped whether or not visible on the ground if they are considered significant. The point locations consist of frequently used camping spots, and "ranches" which provided food and a change of horses for stage line operators and passengers.
- (3) The Cattle Empire Era. Types of resources associated with this theme include ranch headquarters, line camps or cabins, and cattle trails.
- (4) Hispanic Settlement. The Picket Wire Canyonlands contain several resource types associated with this theme including the locations of settlements and ranches, rock art, and cemeteries.
- (5) Homesteading, the Dust Bowl and the Depression. The most common resource type associated with this theme are the remains of old homesteads occupied during the bracket date 1890-1940. When the lands were acquired by the federal government, it was the policy to destroy standing structures. Consequently, most of the homestead sites have lost their integrity and historic significance. A few homestead sites on the Comanche National Grasslands, such as the Rae-Smith homestead, were spared. Also, some homestead sites contain substantial preserved archeological deposits. Other types here include water control developments such as the Timpotero Farms dams and canals near Timpas on the Comanche National Grassland, and stills associated with Prohibition.

## Paleontological Resources

Fossil-bearing deposits are common in the bedrock geology of the Comanche National Grasslands, but comparatively rare on the Cimarron. The bedrock formations of the latter are virtually all of the Ogallala Formation, consisting of unconsolidated sands and gravels dating to the Pliocene and Pleistocene Periods. These sediments are not conducive to the preservation of large, intact fossil specimens although it is possible to find small specimens on occasion. A section of mammoth tusk, measuring about 10 cm. square was recovered from a gravel pit located in sediments of the Ogallala Formation and north of the Cimarron River in the 1970's. Discoveries of buffalo bones are common on the Cimarron National Grassland, primarily in erosional contexts. The discoveries usually consist of disarticulated scattering and are not reflective of entire skeletons. These finds probably represent scavenger-scattered carcasses dating to the 19th century (100-200 years ago). They are not thought to be significant because limited scientific data could be recovered from such phenomena. However, each case is evaluated by the Grassland staff to insure more substantial remains are not present. Whole skeletons or bone beds with several individual animals present are considered significant paleontological resources.

The Comanche National Grassland has much greater potential for significant fossil finds based on published descriptions and field examinations of the bedrock deposits. The Morrison Formation exposures of Jurassic age have the most potential for significant fossil discoveries. The Purgatoire River Dinosaur Trackway Site in the Picket Wire Canyonlands area is a paleontological resource of exceptional scientific significance. This resource has been described by paleontologists as the largest recorded trackway in the world. The trackway area is proposed as a Paleontological Area on the Grassland meriting specific protection measures. This particular resource and its immediate environment are of particular concern in the event of local oil and gas development projects. Very large tree fossils (long sections of trunks) originating from exposures of this formation in the Two

Buttes area north of the Grassland also have been reported. There is high potential for additional discoveries of significant resources where Morrison Formation deposits are exposed or being exposed by erosional forces. On the Comanche, there are several sensitive areas in this regard. There also are extensive Cretaceous Age exposures on the Comanche including calcareous shales and limestones of the Niobrara Formation and sandstones of the Dakota Formation. These deposits also contain fossils although they are smaller and not as spectacular as the Morrison Formation finds. Local residents have reported numerous small plant fossils and worm casts in these particular strata.

## **Cave Resources**

No known significant caves exist on either the Cimarron or the Comanche National Grassland, and the potential for identifying significant caves on either unit is very low, based on the characteristics of local bedrock geology.

## **RECREATION**

Outdoor recreation on the National Grasslands, although smaller in range of opportunities and numbers of users than the National Forests, provides unique and important activities for visitors. The Grasslands are comprised of the Roaded Natural and Rural classes of the Recreation Opportunity Spectrum (ROS) indicating that the Grasslands are in relatively close proximity to the road system that serves the Grasslands. There are 493,590 acres in the Roaded Natural ROS and 33,548 acres in the Rural class.

Total use in 1990 on the Comanche and Cimarron National Grasslands was 114,200 recreation visitor days (RVD's) as compared to 50,000 RVD's reported in 1986. Approximately 75 percent of the use occurs in the dispersed sector. The Comanche NG has three small developed sites (Carrizo Picnic Ground, Picture Canyon and Vogel Canyon) that are associated with the rock art in the area. All are located in scenic canyons with steep walls and varied vegetation that includes cedar trees. Intermittent streams also add to the attraction of the sites.

The Cimarron National Grasslands has several developed sites located in the shade of the cottonwood trees along the Cimarron River valley. Additional attractions in the area are the numerous dugouts that provide warm water fishing opportunities in this semiarid region. The Santa Fe Trail (a National Historic Trail) parallels the north side of the Cimarron River, because the early day travelers also sought the shade and water to be found in the vicinity of the river valley. Recreation activities associated with the Santa Fe Trail, such as viewing the historic wagon ruts or viewing interpretive signs, are popular activities with many visitors to the Grasslands.

Activities that visitors to the Grasslands participate in include driving to view the scenery, dispersed camping and picnicking, hunting and fishing and a variety of specialized activities including bird watching and nature study. Because of the mild climate of the Grasslands, recreation use occurs on a year-round basis with spring and fall activities very popular when the weather of the Grasslands is milder and use of the National Forests is often curtailed.

## **SPECIAL AREAS**

### **Wild and Scenic Rivers**

The Wild and Scenic Rivers Act of October 2, 1968 provided for a National Wild and Scenic Rivers System to protect and preserve in a free-flowing condition certain rivers which possess outstand-

ingly remarkable scenic, recreation, geologic, fish and wildlife, historic, cultural, or other similar values. In the Nationwide Inventory of Potential Wild and Scenic Rivers, the Cimarron River on the Cimarron National Grassland was listed as potentially eligible for designation. A 33-mile segment (from the Colorado-Kansas border to the point where the river exits the Cimarron National Grassland and one-fourth of a mile from each bank for the length of the stream) was identified as the study corridor.

Based on the guidelines for evaluating rivers for possible inclusion in the Wild and Scenic Rivers Act, the Cimarron River was determined not to be eligible due to lack of sufficient water to permit full enjoyment of water-related outdoor recreation activities envisioned in the Wild and Scenic Rivers Act. It will be evaluated again during the revision of the Forest Plan using criteria in effect at that time.

### **Experimental Areas**

The Southeastern Colorado Research Center is located approximately nine miles southwest of Springfield, Colorado, in Baca County. The Center is under special use permit to the Colorado State Board of Agriculture for the benefit and use of Colorado State University, Fort Collins, Colorado, to: conduct applied research on methods of preventing and controlling wind erosion on crop and rangeland in southeastern Colorado; experiment with various grazing systems and conduct range management studies; evaluate these methods in terms of costs and benefits to the farmer and rancher, and; establish time-tried and economically feasible systems of crop rotation, tillage management and reseeding which will minimize hazards of wind erosion and thereby stabilize the agricultural economy of the area.

### **Research Natural Areas**

Two RNA's exist or are proposed on the Comanche and Cimarron National Grasslands. These RNA's are the Campo on the Comanche NG and the Cimarron on the Cimarron NG. These two areas are fully discussed in the Geographic Zone descriptions later in this chapter.

### **Special Interest Areas**

Two Special Interest Areas occur on the Comanche NG. These are the Comanche Lesser Prairie Chicken Zoological Area and the Carrizo Botanical Area. There are no Special Interest Areas on the Cimarron NG. The two Special Interest Areas are fully described and discussed in the Geographical Zone Descriptions.

The same applies to the Experimental Areas, RNA's and Special Interest Areas on the Grasslands as it does on the mountain areas. In most cases there will be restrictions that provide for NSO, CSU, timing or a combination of all three.

## **MINERAL RESOURCES**

Federally-owned leasable minerals include fossil fuels (coal, oil, gas, oil shale, etc.), geothermal resources, potassium, sodium, carbon dioxide, phosphates, and sulphur in New Mexico and Louisiana. These minerals are subject to exploration and development under leases, permits or licenses granted by the Secretary of the Interior.

Oil and gas, as well as other leasable products, have been produced extensively in the Comanche and Cimarron National Grasslands. Helium and natural gas liquids are produced at several

facilities. About 26 percent of the ownership of oil and gas on both the Comanche and Cimarron National Grasslands exists in outstanding rights, or non-federal ownership. Currently there are two producing and five "shut-in" gas fields on the Carrizo Unit of Comanche National Grassland. Twenty-three oil and gas fields are producing on Cimarron National Grassland. It overlies one of the world's largest known accumulations of natural gas. This field, the Hugoton Known Geologic Structure, is over four million acres and has been producing both oil and gas since 1923. In 1981 Morton County, Kansas, oil production exceeded 1.7 million barrels; gas production surpassed 49 million cubic feet.

## **Previous and/or Existing Oil and Gas Activities**

The Forest Service has been involved with the implementation of the Mineral Reversion Management Procedures by the Regional Forester, Region-2, dated August 11, 1983, for the Comanche and Cimarron National Grasslands. The mineral reversion program on the Grasslands pertains to the expiration of mineral reservations made during the acquisition of lands under the Bankhead-Jones Farm Tenant Act by the United States.

During the land acquisition programs of the Department of Agriculture's Resettlement Administration in the 1930's, a significant number of properties were acquired by the United States subject to a reservation of mineral interests for a specific number of years. In most cases the vendor also reserved rights to use the surface in conjunction with development, production, and marketing of the reserved minerals. A mineral reservation is a mineral right retained by a grantor in a deed conveying land to the United States. A grantor or seller in this case sold the parcels of land to the United States and reserved their mineral holdings for a definite period, from 40 years to 100 years, with the most common term being 50 years.

In most cases, the language in the Warranty Deeds and other conveyance documents provides for a self-operative reversion of the mineral rights to the United States. A small percentage of variations were used which extended the reservation if production of oil and gas and other minerals was occurring at the agreed upon date of reversion.

The United States purchased a number of private lands under the provisions of Title III of the Bankhead-Jones Farm Tenant Act which were subject to existing outstanding minerals. An outstanding mineral right is a mineral right owned by a party other than the surface owner (grantor/seller) at the time the land surface is conveyed to the United States. Outstanding mineral rights including some producing privately-owned oil and gas leases are valid existing rights which must be verified and honored by the BLM before a lease can be issued for reverting minerals.

Many of these properties are now producing oil and gas under private leases. In accordance with the conveyance documents, all mineral development of reserved minerals was subject to rules and regulations of the Secretary of Agriculture. The first of these reserved interests began to revert to the United States in 1985 and will continue into the mid and late 1990's. There will be a significant increase in revenue credited to the general USDA Forest Service account as a result of these reversions.

Oil and gas interests have been developed extensively within the Grasslands. In 1979, Morton County oil production exceeded 45 million barrels, and gas production surpassed 67 billion cubic feet, with a value of approximately \$613 million. Formations of Permian, Upper and Lower Pennsylvania, and Upper Mississippian age are the sources for the oil and gas. The oil and gas reservoirs are found in the stratigraphic traps in this area.

Production methods vary in the Grasslands. Several fields are new while others are subject to controlled waterflooding. The number of secondary methods of recovery will continue to increase as the rates of recovery decrease.

The potential for discovery of hydrocarbons appears to be high. The Pennsylvania and Mississippian formations, which are currently producing, probably contain additional reserves. Adequate formation testing has not been conducted below the current production zones; however, these rocks do have favorable conditions and structure for hydrocarbon accumulation. Helium and natural gas liquids are produced at several local facilities. Helium is processed from gas recovered from the Greenwood Gas Area and the Sparks Field. The helium potential is considered high and extends into southeast Colorado. Natural gas liquids produced include propane, ethane, liquids petroleum gas, and natural gasoline.

## **TRANSPORTATION**

Most roads on the Comanche National Grassland are on section lines or access old home sites. Since most roads are on proclaimed county rights of way and are primarily farm to market roads, they have not been maintained on the Transportation Inventory System (TIS). Roads listed on the TIS are primarily roads in which the Forest Service has a direct interest for maintaining investment. The TIS lists approximately 613 miles of roads.

Most roads on the Cimarron National Grassland are on section lines or access old home sites. Since many roads are on proclaimed county rights of way and were primarily farm to market roads, they have not been maintained on the Transportation Inventory System (TIS). Roads listed on the TIS are primarily roads in which the Forest Service has a direct interest for maintaining investment. The TIS lists approximately 225 miles of roads.

## **SPECIAL USES**

### **Existing Long-Term Special Uses**

Currently there are approximately 278 special use permits authorizing private and/or public use of 6,217 acres of National Forest System lands on the Comanche and Cimarron National Grasslands. Oil and gas pipelines are the major type of special use on the Grasslands. Communication uses are also important.

For additional information on the various types of special uses on the Grasslands, refer to Exhibit III-16 in this chapter.

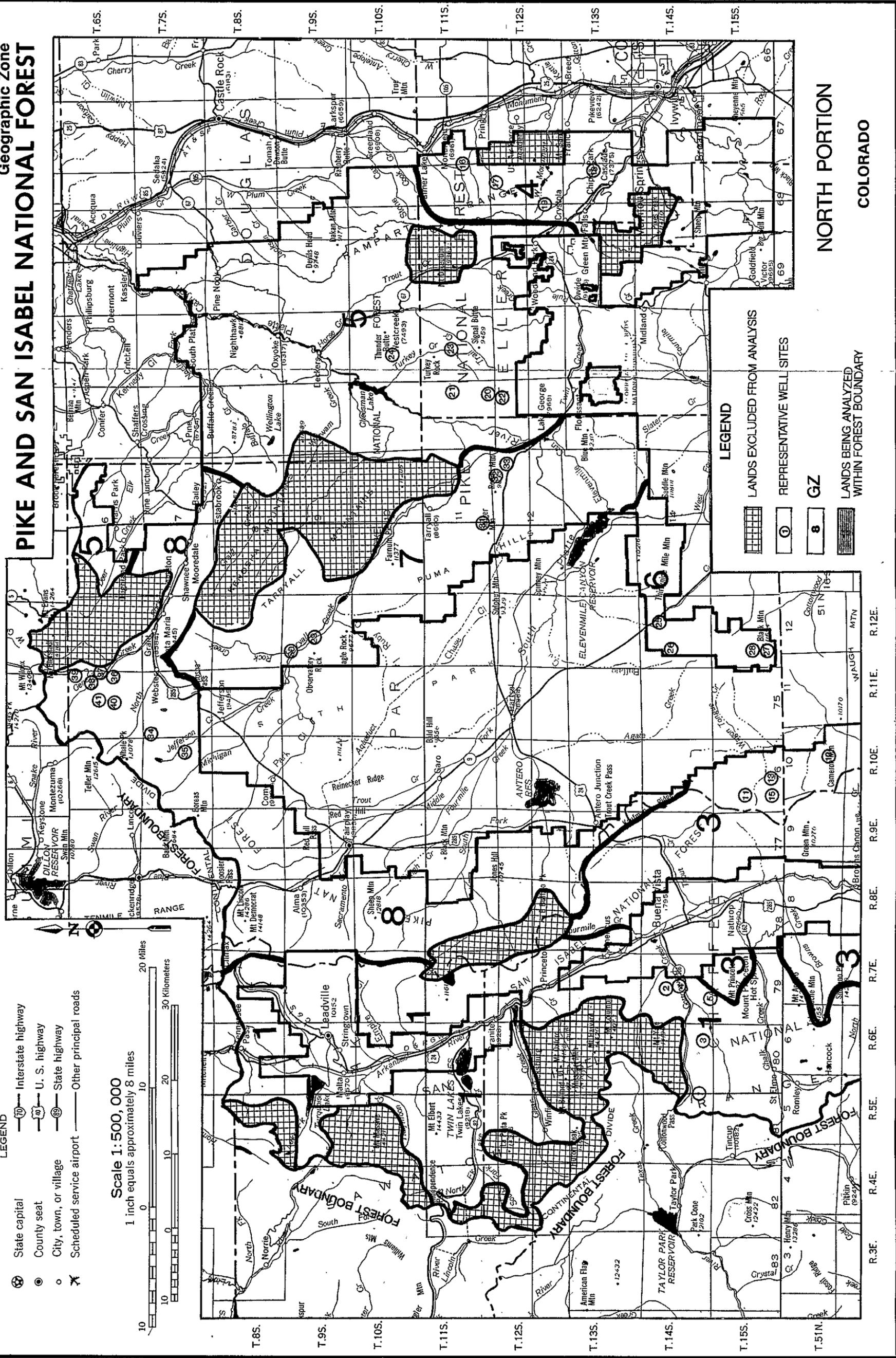
## **GEOGRAPHIC ZONE DESCRIPTION OF THE AFFECTED ENVIRONMENT (LEVEL 3)**

The Unit was divided into 13 geographic zones with similar environmental characteristics. Each geographic zone included one or more watersheds. The criteria used to determine similarity included land form, geology, climate, vegetation and soils. The Mountains were subdivided into 8 geographic zones. The Grasslands were subdivided into 5 geographic zones, including 3 zones

on the Comanche and 2 zones on the Cimarron. The locations of the 13 geographic zones on the Unit are shown in Figures III-4 through III-6

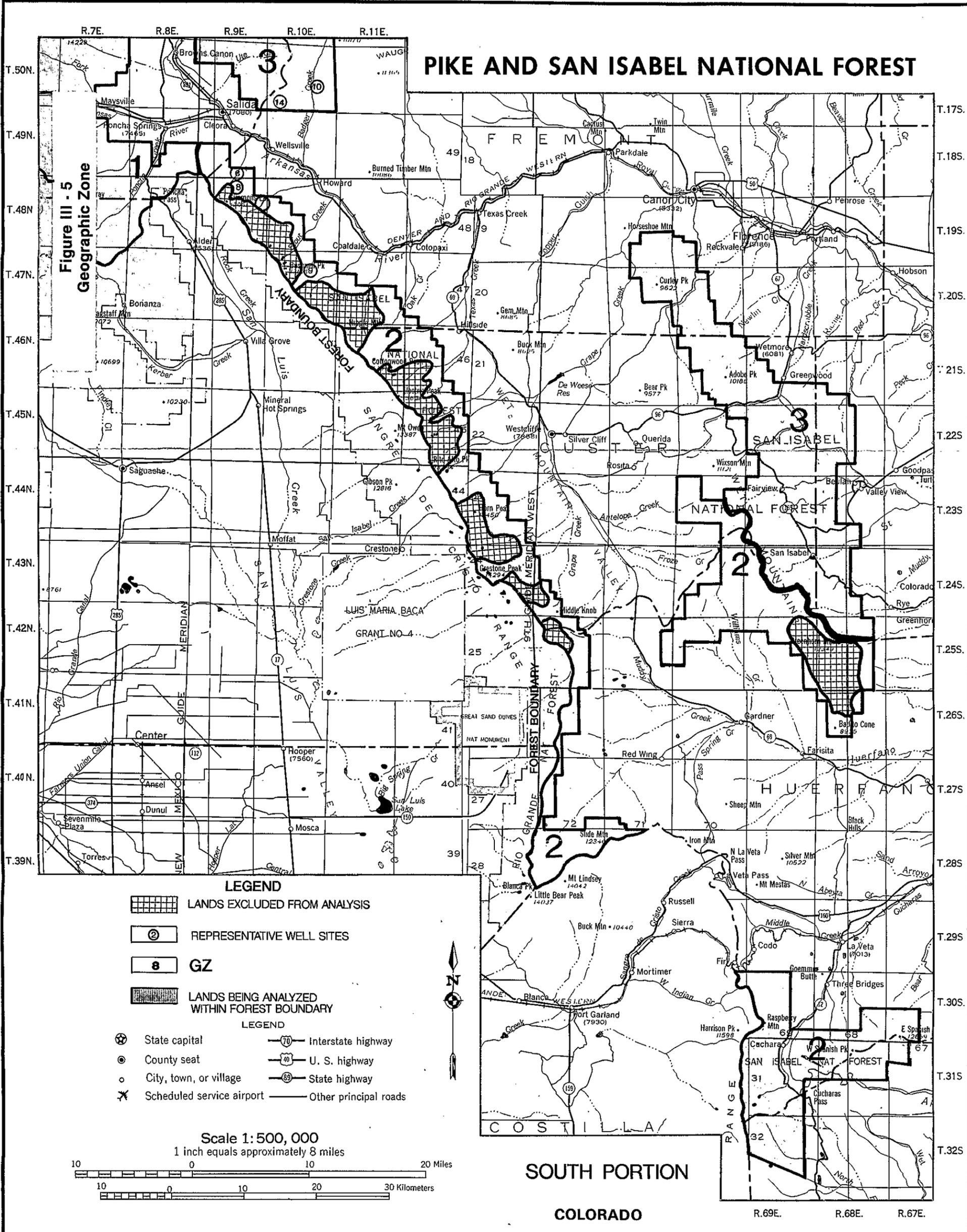
This section provides the reader with descriptions of the effected environments for the 13 geographic zones on the Unit. Geographic Zones 1 through 8 encompass the Mountain environment, while geographic zone 9 through 13 encompass the Grassland environment. The descriptions of the affected environment in the Forest Plan are incorporated in this chapter by reference.

Figure III - 4  
Geographic Zone  
PIKE AND SAN ISABEL NATIONAL FOREST

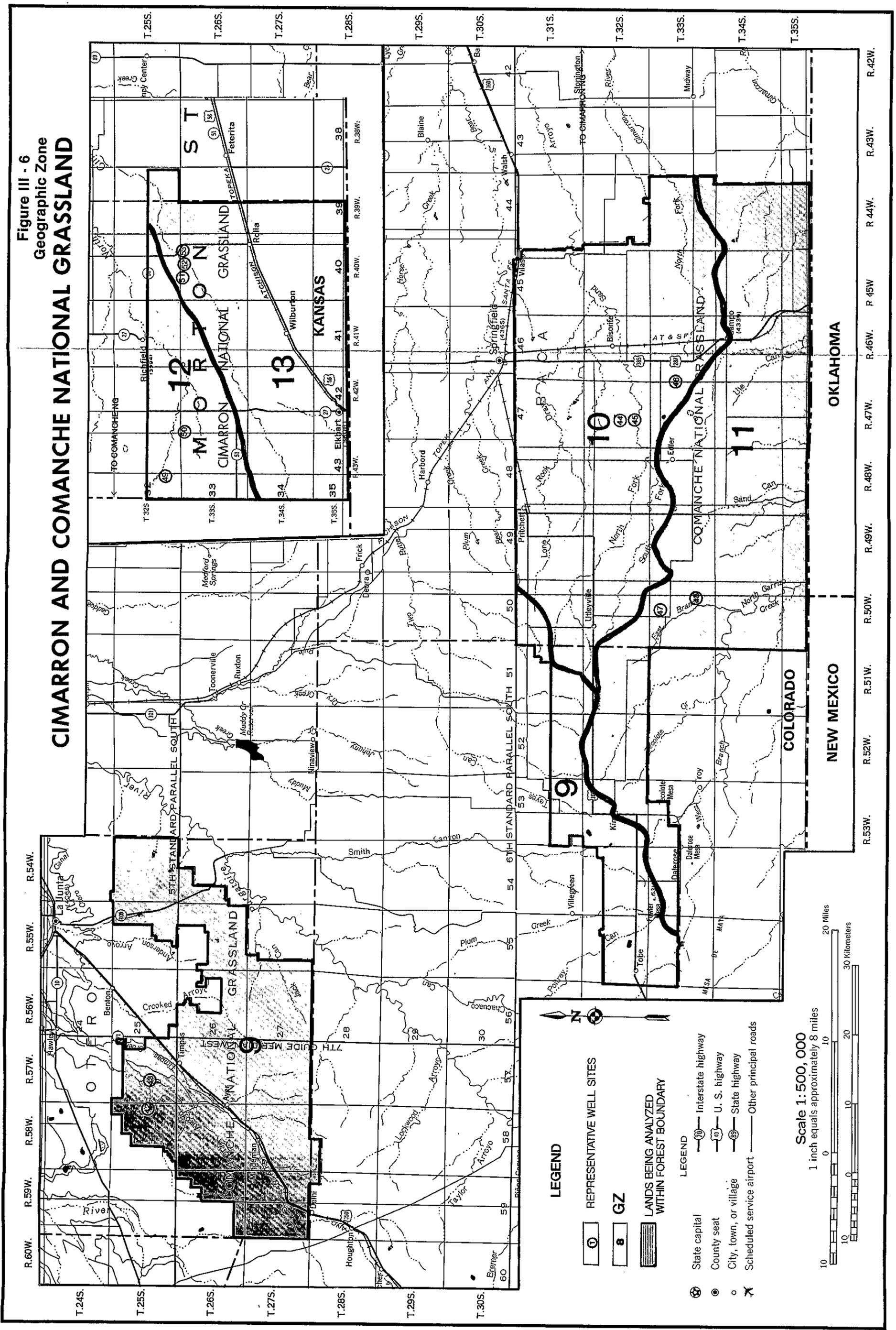


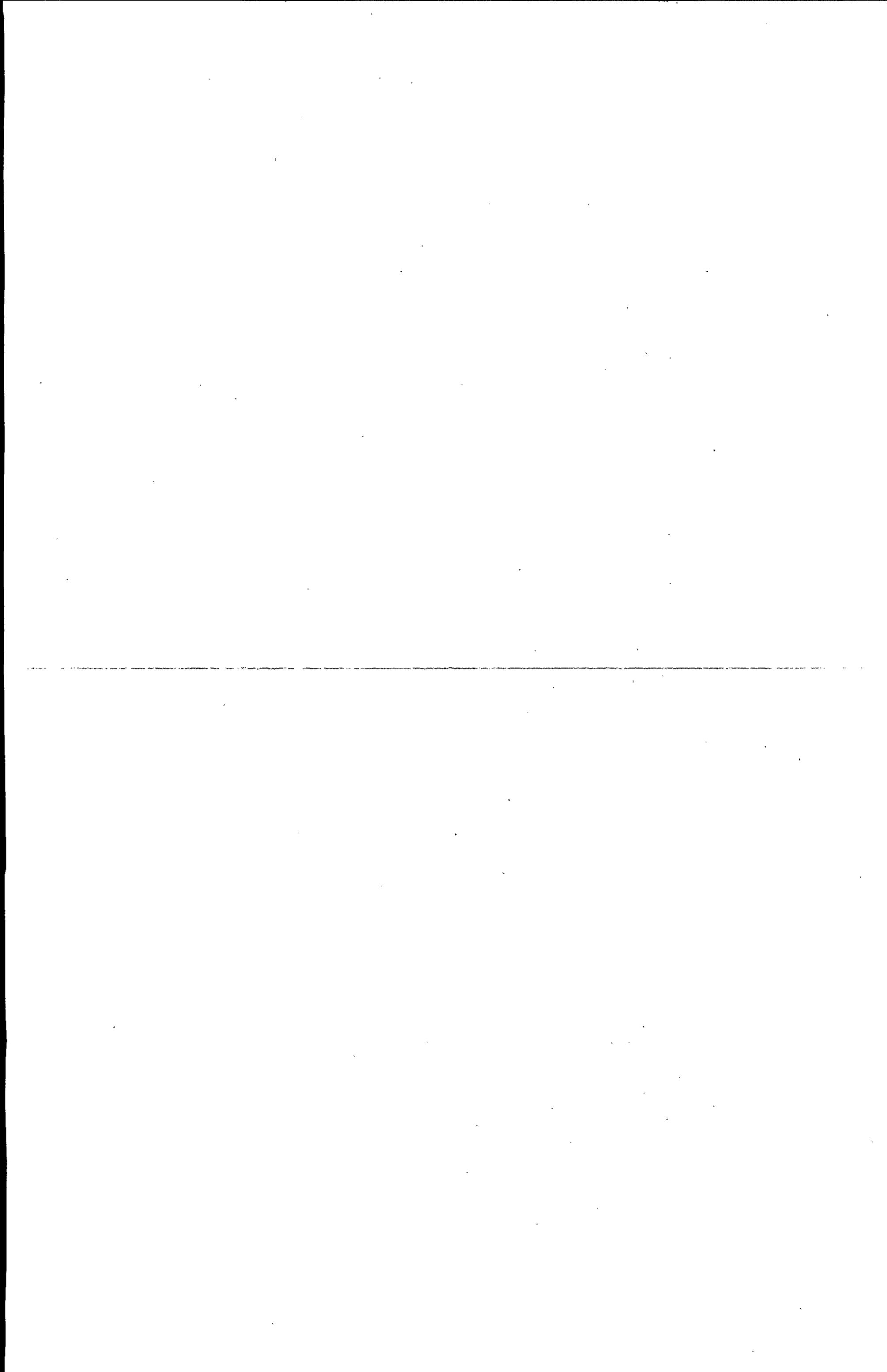
NORTH PORTION  
COLORADO

# PIKE AND SAN ISABEL NATIONAL FOREST



**Figure III - 6**  
**Geographic Zone**  
**CIMARRON AND COMANCHE NATIONAL GRASSLAND**





# The Mountain Environment

## GEOGRAPHIC ZONE 1

### Vegetation

At the north end of this zone, dominant vegetation is dense stands of lodgepole pine, with smaller quantities of spruce-fir near timberline. Aspen, willow and grassland areas are interspersed with the conifers. The south end is dominated by spruce-fir. Localized areas have experienced silvicultural treatments, typically shelterwood or selection methods, resulting in light to moderately dense canopy cover. Unmanaged areas typically have dense canopy cover. Aspen, mountain grassland areas and nonforested riparian types are interspersed with the conifers. A vegetation type summary follows as Exhibit III-17.

### Soils

Shallow soil depths occur on residual side slopes in complex patterns with rock outcrop, and deeper soils are associated with colluvial footslopes, glacial moraines, and alluvial terraces. Medium to coarse soils have primarily developed from metamorphic and igneous parent materials. Very gravelly sandy loams are typical on upland landforms, and finer textures such as loams, sandy clay loams, and clay loams are generally confined to the depositional landforms. Surface and internal rock fragments vary by amounts and sizes, but most soil profiles on upland landforms have greater than 35 percent rock by volume.

Critical soil management concerns are areas of high geologic hazard for mass failure, high surface erosion rates on steep slopes, and fragile alpine ecosystems.

### Water

The streams are all located in the upper Arkansas River watershed. The average annual runoff varies from 1 acre foot per acre to 1.5 acre feet per acre (AF/ac). The highest water producing areas are those draining Mt. Massive and Mt. Elbert. Most of the precipitation occurs as snow between October and May. The highest streamflows occur during the spring and early summer as a result of snowmelt runoff.

This zone has the greatest amount of transmountain diversions on the Forest. Eight diversions bring water from the west slope to the Arkansas basin. These include Wurtz Ditch, Columbine Ditch, Ewing Ditch, Homestake Tunnel, Bousted Tunnel, Busk-Ivanhoe Tunnel, Twin Lakes irrigation tunnel and Larkspur Ditch. They bring an average of 120,000 acre feet of additional water into the Arkansas Basin annually.

There are major water quality problems resulting from old mining activities.<sup>18</sup> St. Kevin Gulch, Iowa Gulch, the East Fork of the Arkansas River, Box Creek, Chalk Creek, Lake Creek and the South Arkansas River have heavy metal concentrations that exceed state standards. Some of the water quality problems in Lake Creek are a result of natural weathering of pyritized rocks in the vicinity of Red Mountain.

Many of the sediment problems in the streams are the result of damage caused by increased flows from transmountain diversions. Many of these streams are still actively eroding even though some of the diversions are from 50 to 100 years old. The Board of Water Works of Pueblo, CO, installed drop structures on the Wurtz Ditch and on the Ewing Ditch to safely convey water down steep eroded slopes. They also have ongoing stream improvement projects on Lake Creek below the Twin Lakes Tunnel.

Other streams that exhibit extensive bank erosion and sand bar formations include East Tennessee Creek, Chalk Creek, Silver Creek, Poncha Creek and the upper section of the South Arkansas River above Monarch Park. No studies have been done on any of these streams yet to determine what is causing the erosion problem. However, significant rilling and gullyng below Highway 50 is good indication that excess runoff from the highway is a major sediment contributor to the South Fork of the Arkansas River.

## **Wildlife and Fishery Resources**

Management Indicator Species (MIS) for this zone can be found in Exhibit III-3.

Over 48,735 acres of deer and elk winter range have been identified in this zone. Current winter range supports an estimated 3000 elk and 4500 deer. An estimated 450 bighorn sheep and an estimated 400 mountain goat occur within the Zone. Critical habitat for all species has been identified through the use of the Colorado Division of Wildlife (CDOW).

High elevation lakes and streams provide anglers with opportunities to catch brook trout and several different subspecies of cutthroat trout. Limited angling opportunities currently exist for the federally threatened greenback cutthroat trout in the Rock Creek and Lake Fork watersheds. Brown trout and rainbow trout are found in most stream systems below 8,500 feet. Lower elevation, larger order streams are generally more productive than smaller, higher ones due to increased habitat conditions and overall stream temperature. Turquoise Lake has been managed by supplementing a self-sustaining lake trout and brown trout with a variety of other salmonid fish. Over 140,000 trout were stocked in 1990 alone. Native fish currently existing in Turquoise Lake include western white suckers and longnose suckers. Twin Lakes is the most heavily used lake fishery. Over 180,000 salmonid fish were planted in 1990 alone. A trophy size lake trout fishery also exists in both lakes.

## **Riparian Resources**

Riparian resources are found in the foothills at 8,200 feet to the alpine beginning at approximately 11,500 feet. Most of the riparian areas are found in the montane zone. Riparian vegetation includes a variety of woody and herbaceous species, with the willow-sedge community dominating the vegetation. Cottonwoods and alders become more prevalent at lower elevations. Riparian areas are generally associated with stream corridors, wet meadow and standing water environments. See Exhibit III-4 for a summary of riparian area acres.

## **Alpine**

The Sawatch Range portion of the Continental Divide includes many of the "fourteeners" in Colorado. Almost half of the alpine on the Mountains is in this zone. Approximately 70 percent of the alpine is dominated by rock. See Exhibit III-18 for a summary of alpine acres.

## **Threatened and Endangered Species**

This zone is considered to be within the historical distribution range of the greenback cutthroat trout.<sup>19</sup> Endemic to the mountainous areas of the South Platte and Arkansas River drainages, this colorful trout has been eliminated throughout most of its original range as a result of competition and hybridization with non-native species, as well as physical habitat degradation of its habitat by man. Five populations of greenbacks are found in the Lake Fork drainage and Rock Creek drainage. A segment of the Lake Fork watershed is outside of the boundary on NFS lands.

The yellowfin trout was historically found in Twin Lakes.<sup>20</sup> This subspecies is currently considered to be extinct, unless isolated or currently unknown populations exist. Threatened and endangered species under consideration in this zone are listed in Exhibit III-5 for wildlife and Exhibit III-6 for plants.

### **Range Resource**

Several livestock grazing allotments occurring in this zone contain land that is accessible to livestock and capable of producing forage on a sustained yield basis. Many areas are not suitable for livestock grazing: i.e., rocky outcrops, steep slopes and dense timber. Suitable range acres and permitted grazing use for this zone is identified in Exhibit III-7.

### **Visual Resource**

This zone is visible from the Colorado and Continental Divide Trails, several Wilderness Areas, numerous 4WD roads and several picnic areas and campgrounds.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL RESOURCES**

Known significant historic properties include mining properties such as mines, mills, camps, landscapes, railroad history resources, and historic logging resources. Interlaken and the Twin Lakes Historic District are two National Register listed tourism-related properties in the Lake Creek drainage. Properties related to other historic themes, for example, ranching, and recreation are present, but in lesser densities. The potential for undiscovered significant resources relating to these other themes is low to moderate.

Prehistoric cultural properties have been identified in moderate densities. Prehistoric resource types identified and recorded in this zone include prehistoric camps, stone quarries, games drives and hunters' kill sites, and culturally scarred trees.

Significant resources related to the mining boom of the late 19th century, and resources on the surface are the ones which have the most potential to be affected by projected oil and gas development.

### **PALEONTOLOGICAL RESOURCES**

There are small exposures of the Dry Union Formation of Miocene Age in the extreme southern portion of the Sawatch Range, and of the Minturn Formation of Middle Pennsylvanian Age in the northern Mosquito Range. Whether these formations contain scientifically valuable fossils has not

been assessed. For the zone as a whole, the potential for oil and gas development to affect significant fossils is very low.

## **CAVE RESOURCES**

There are no known significant caves in Zone 1. Based on the characteristics of the local bedrock formations, the chances of discovering new significant caves is virtually nil.

## **Recreation**

The zone has a high capacity for recreation visitors due to accessibility, land diversity, seasonal recreational diversity, and public and commercial accommodations. Developed recreation sites concentrated in the north portion of the zone around Turquoise Lake and Twin Lakes include 450 camp sites, several picnic grounds, boating sites, trailheads, fisherman parking lots and group use sites. An additional 300 camp sites are located in the southern portion of the zone. All of the sites have high occupancy rates.

Automobile touring and viewing scenery are popular activities in this zone. All roads entering the zone except one cross scenic mountain passes and many go over the Continental Divide. Some of these passes are popular four-wheel drive routes. There is an extensive network of trails for hiking, horseback riding, cross country skiing and some motorized vehicle use. A 120 mile segment of the Colorado Trail and an 80 mile segment of the Continental Divide Trail cross the zone. Many trails provide access to or near the summits of the fourteen 14,000 foot peaks located in the zone.

The zone offers a variety of historical sites as evidence of the 19th century mining boom. Some of these sites are National Register properties.

The zone contains three Wilderness areas including the Holy Cross, Mt. Massive and Collegiate Peaks with a total of 120,000 acres.

A considerable amount of mountain based outfitting and guiding activity occurs in the zone. Populations of wildlife provide recreation opportunities for the hunter, viewer, or photographer.

## **Transportation**

The area is traversed by U.S. Highways 50, 285, 24, and Colorado Highways 82, 300, 91, 306, and 162. There are many miles of county and Forest roads; 1,160 miles of these roads are shown on the Forest's Transportation Inventory System (TIS). There are also noninventoried roads and "travel ways," most of which resulted from previous mining activity. The average road density of inventoried roads for the zone is 1.39 miles per square mile.

## **Special Use**

Special uses found in this area include recreation residences, ski areas, and communication sites. A complete list of special uses for this zone is found in Exhibit III-19.

## **GEOGRAPHIC ZONE 2**

### **Vegetation**

In the subalpine zone, vegetation is dominated by spruce-fir, interspersed with aspen and grassland areas of various sizes. At mid-elevation, Douglas-fir and aspen are the dominant vegetation types, mixed with smaller amounts of Gambel oak and grassland areas. The drier, lower slopes are typically covered by ponderosa pine and pinyon-juniper. Most vegetation is over 100 years old, due to low levels of silvicultural treatment and wildfire suppression. Refer to Exhibit III-17 for the vegetation summary for this zone.

### **Soils**

Shallow soil depths occur on residual side slopes in complex patterns with rock outcrop. Deeper soils are associated with colluvial footslopes, glacial moraines, and alluvial terraces. Medium to coarse textured soils have primarily developed from metamorphic and igneous parent materials, sedimentary rock layers, and transported glacial or fluvial materials. Typical soil texture for most igneous parent materials is very gravelly sandy loam. Finer textures such as loams, sandy clay loams, and clay loams have generally developed from volcanic, sedimentary, or alluvial materials. Soils generally have weak to moderate development and low to moderate fertility ratings. Surface and internal rock fragments vary by amounts and sizes; but most soil profiles have greater than 35 percent rock by volume, and rocky surfaces are most common on the steeper landforms.

These geologically young mountain ranges have moderate erosion hazard and geologic hazard ratings. Soils associated with severe erosion hazard are confined to areas with very steep slopes. Particular soil management concerns are controlling surface erosion by maintaining adequate ground cover, protecting alluvial bottom land from gully formations, and protecting fragile alpine ecosystems.

### **Water**

All the streams in this zone are tributary to the Arkansas River. Most of the streams flowing out of the Sangre de Cristo Range are perennial. The annual runoff is about 1.1 AF/ac.<sup>21</sup> The Spanish Peaks area has both perennial and intermittent channels. The annual runoff is around .5 AF/ac. The west side of the Wet Mountains is dry and most of the streams are intermittent. The annual water yield from this area only averages around .1 AF/ac.

Water quality in most streams of this zone is good enough to support a cold water fishery. Taylor Creek exhibits low severity effects from abandoned mining. Streams that have a significant amount of erosion include Cucharas Creek and White Creek in the Spanish Peaks area. Roads contribute to some of the sediment problem in Cucharas Creek. The cause of the sediment problem in White Creek isn't as clear; however, White Creek cuts through some fairly fine material that is easily eroded during high flows. There are several drainages in the Williams Creek/Wylie Gulch area on the west side of the Wet Mountains that are severely eroded. Overgrazing and poor road locations during the early development of the area caused erosion problems.

### **Wildlife and Fishery Resources**

Management Indicator Species (MIS) for this zone can be found in Exhibit III-3. Over 37,905 acres of deer and elk winter range have been identified in this zone. Current winter range supports an estimated 3000 elk and 5500 deer. An estimated 650 bighorn sheep occur

within the zone. Critical habitat for all species has been identified through the use of the Colorado Division of Wildlife Data Base.

This zone encompasses high elevation glacier formed lakes and gradient headwater streams in the Sangre de Cristo Mountains to intermittent gullies and arroyos in the Wet Mountain area. The most productive systems are located in the southern portion of the zone in the upper Purgatoire drainage, and along the eastern portions of the remaining Sangre de Cristo range. The Wet Mountains also contain self-sustaining as well as hatchery supplemented populations of rainbow, brook, brown and cutthroat trout which are accessible to the public.

A number of high elevation lakes throughout the Sangre de Cristo Range provide anglers with destination type fishing opportunities. The Colorado Division of Wildlife (CDOW) manages these lakes primarily by periodic stockings with cutthroat trout. Most of these lakes have inadequate inlets or outlets for spawning or rearing habitat. They have to be periodically planted to maintain fishable populations. Blue and Bear Lakes, located in the Cucharas Creek watershed receive more intensive management, due to their accessibility and high use.

The vast majority of permanent stream systems in the Sangre de Cristo range contain self-sustaining salmonid populations, with several supplemented with hatchery reared fish. Others, such as the North Fork of the Purgatoire River, Cuchara Creek and the Huerfano River have vehicle access along their length. Physical stream habitat conditions in these streams are currently limited in this zone.

## **Riparian Resources**

Riparian resources are found from the foothills to the alpine. Most of the riparian areas are found in the mountain zone. Riparian vegetation includes a variety of woody and herbaceous species, with the willow-sedge community dominating throughout most of the zone. Cottonwoods and alders are more prevalent at lower elevations. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Alpine**

Most of the alpine is in the Sangre de Cristo range, followed by the Spanish Peaks. The southern part of the Wet Mountains has a relatively small amount of alpine. See Exhibit III-18 for a summary of alpine acres.

## **Threatened and Endangered Species**

This zone is within the historical distribution of the greenback cutthroat trout.<sup>22</sup> Endemic to the mountainous areas of this zone, this colorful trout has been eliminated from most of its original range as a result of competition and hybridization with non-native salmonids, as well as physical habitat degradation by man. The only two native populations of greenbacks in this zone reside in Cascade Creek and South Apache Creek. A reintroduced population resides in Cottonwood Creek. Other threatened and endangered species under consideration are listed in Exhibit III-5 for wildlife and Exhibit III-6 for plants.

## **Range Resource**

Several livestock grazing allotments occur within this zone. These allotments contain land that is accessible to livestock and capable of producing forage on a sustained yield basis. Many areas

are not suitable for livestock grazing. Suitable range acres and permitted grazing use for this zone is identified in Exhibit III-7.

## **Visual Resource**

This zone is visible from the Colorado and Continental Divide Trails, several Wilderness Areas, numerous 4WD roads and several picnic areas and campgrounds.

This area can be viewed while driving along Highways 69, 50, 60 and 12. Because of the rugged country the area is a favorite for 4WD enthusiasts. Only two paved roads cross the range.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

According to the available information, prominent themes in Colorado mountain history or prehistory are not well represented in this zone, nor does there seem to be high potential for large quantities of significant cultural resources in areas that have not been examined for historic or archaeological sites. The known significant historic resources are associated with the mining and transportation themes. Several of the geographic landmarks in this zone may have traditional place value for American Indian groups. These are the Spanish Peaks ('Huajatollah' to American Indian peoples) and Mount Blanca which has traditional place significance for the Ute and Navajo tribes.

### **PALEONTOLOGICAL RESOURCES**

There are some substantial deposits of potentially fossiliferous bedrocks in Zone 2. Sangre de Cristos (including the southern portion west of the Spanish Peaks) contain large exposures of the Sangre de Cristo Formation, a known fossil-producing deposit dating to the Permian and Pennsylvanian Periods. Although this formation is known to contain large amounts of plant fossils (including the "crinoid" fossils near Marble Mountain), the scientific value of these deposits has not been assessed. Also known are less extensive exposures of other Pennsylvania Period Devonian and Ordovician Age sedimentary. The potential for significant fossils in the former is unknown, while the Ordovician deposits apparently do contain some plant fossils of scientific merit.

On the lower southwest and southeast slopes is a band of Cretaceous age sedimentary sandstones and shales. The fossiliferous content of this band of sedimentary bedrock has not been evaluated. The potential for oil and gas development affecting paleontological resources in this zone is rated as moderate to high for the Sangre de Cristos, and low for the southern Wet Mountain and Spanish Peaks.

### **CAVE RESOURCES**

The Marble Cave system in the Sangre de Cristo Range is a significant cave resource in this zone; the system includes Spanish Cave, White Marble Halls Cave, Bridal Cave, and other less prominent caves in this locality.

### **Recreation**

The Sangre de Cristo Range provides opportunities for recreation experiences involving a degree of adventure, challenge and risk. Visitors seeking these experiences are attracted to the area from all parts of Colorado and the United States.

The face of Crestone Peak has become a favorite among rock climbers. This face and the north face of Blanca Peak rank as two of the most challenging for technical climbing in Colorado. Approximately 50 small lakes are destination attractions for fishermen in particular and also for hikers and backpackers. Another unique high adventure recreation activity in the Sangres is cave exploration. Several limestone caves are located above timberline in the area around Marble Mountain.

The zone has limited vehicular access. Most of the roads that provide access in this zone are low standard and do not accommodate passenger cars. Access depends on a system of trails totalling approximately 225 miles. The most important is the 100 mile long Rainbow Trail. A series of trails diverge from the Rainbow Trail to the lakes and several continue over the crest. The Rainbow Trail is open to motorized trail use, but most of the side trails are closed to protect the wilderness character of the high country.

Four developed campgrounds located along the zone provide base campsites for pursuing dispersed recreation activities in the high country. Six trailheads provide access and disperse the users.

In the Spanish Peaks portion, the main recreational attraction is the scenic landscape. The Spanish Peaks are very scenic in all seasons and may be viewed from Colorado Highway 12, US 160 and I-25. This route has been designated a Scenic Byway by the Forest Service and the State of Colorado. Hiking and mountain climbing are also popular activities. The summits of the Spanish Peaks afford outstanding views of the plains to the east and mountain ranges to the north, west and south. The peaks are not technically difficult to climb but provide a challenge to many with rewarding views from the summits.

Three campgrounds and two picnic grounds are located in this zone. Use at these sites is near capacity during the summer months. Trout fishing is a popular activity for visitors to the zone. Blue and Bear Lakes and Cuchara Creek and the North Fork of the Purgatoire River receive the most use. Big game hunting for deer, elk, bear and turkey occur around the Peaks.

The other portion of the zone contains the south one-third of the Wet Mountains. Recreation activities consist mainly of hiking, hunting and viewing the scenery while driving the limited number of roads. The area is particularly known for turkey hunting along with bear, elk and deer.

The majority of the 22,300 acre Greenhorn Mountain WSA occurs in this zone. In addition, there are 61,657 acres in the Sangre de Cristo WSA. The Spanish Peaks portion of the zone contains a 19,570 acre WSA that was not recommended for Wilderness designation.

## **Special Interest Areas**

The Spanish Peaks National Natural Landmark is located in this zone.

## **Transportation**

The forest area is traversed only by Colorado 12. The zone is crossed by U.S. 160 and Colorado Highways 69, 165, and 96. There are many miles of county and Forest roads; approximately 315 miles of these roads are included in the Forest's Transportation Inventory System (TIS). There are noninventoried roads and "travel ways," most of which resulted from ranching and recreation activities. The average road density of inventoried roads for the Geographic Zone is 0.61 miles per square mile.

## Special Uses

Special uses in the area include recreation residences and two ski areas. Additional information on special uses is found in Exhibit III-19.

## GEOGRAPHIC ZONE 3

### Vegetation

Vegetation is characterized by mixed conifer stands dominated by Douglas-fir or ponderosa pine, frequently interspersed with aspen. Grassy parks and Gambel oak are interspersed with conifer at mid to lower elevations. Much of the mountain grassland is found within the alpine zone. Spruce-fir dominates the subalpine vegetation, although aspen and smaller grassland areas are scattered throughout this zone. Spruce-fir with relatively dense canopy cover typically occupies steeper slopes. On gentler upper slopes and ridgetops, past silvicultural treatments have created a pattern of young spruce-fir stands, interspersed with older spruce-fir stands. A vegetation summary can be found as Exhibit III-17.

### Soils

Shallow soil depths occur on residual side slopes in complex patterns with rock outcrop. Deeper soils are associated with colluvial footslopes, and transported glacial or alluvial materials. Soils formed in place from weathered granite typically have coarse sandy textures with weak development and low fertility. Medium textured soils have developed from sedimentary formations and depositional parent materials which are generally more productive. Surface and internal rock fragments vary by amounts and sizes; but most soil profiles have greater than 35 percent rock by volume, with rocky surfaces common over most landforms.

Soil management concerns for this geographic zone relate to controlling surface erosion and gullies on granitic soils and steep slopes. Gully formations on gently sloping alluvial bottom land can also be a problem if vegetative cover is not properly managed. Geologic hazard for mass failure is not a major concern for soils and landforms of this area.

### Water

All the streams in this zone are tributary to the Arkansas River. Most of the streams in the Arkansas Hills are intermittent. Precipitation is low and intense summer thunderstorms are commonplace. The highest peak flows result from summer thunderstorms. This area was severely eroded at the turn of the century from overgrazing, overcutting, and from fires. Watershed restoration work was undertaken in the early 1930's and continues today to correct some of these problems. Streams in this area are small and are usually located in the bottom of old gullies. The gullies are usually well vegetated on the bottom and sparsely vegetated on the sides. The streams that flow through them are fairly stable meandering channels. Badger Creek has been identified as an area of concern for erosion. The Forest Service is doing erosion control work in this watershed as funding becomes available. Runoff from this area is low, around 0.1 AF/ac.

The streams on the southeastern side of the Wet Mountains are perennial since they receive a lot of their precipitation from upslope storms during the winter and spring months. Most of the channels are fairly stable. Streams in the northern portion of the Wet Mountains are mostly intermittent due to low precipitation. These channels also appear to be stable with no significant

erosion problems evident. Some pollution in the St. Charles River has resulted from individual sewage disposal systems in the small community of San Isabel. Runoff from this area varies from 0.2 AF/ac in the northern portion to 0.5 AF/ac. in the southern part.

## **Wildlife and Fishery Resources**

MIS for this zone can be found in Exhibit III-3.

Over 73,102 acres of deer and elk winter range have been identified in this zone. Current winter range supports an estimated 3,000 elk and 5,500 deer. An estimated 650 bighorn sheep also occur within the Zone.

Most of the perennial streams contain self-sustaining populations of either brook, brown, rainbow or cutthroat trout, with brook trout being the dominant species. In 1990, the CDOW planted more than 15,000 rainbow, cutthroat and brook trout in the streams in this zone, with the majority being catchable size rainbow trout.

In 1990, 2,000 rainbow trout-cutthroat trout hybrids were planted in Lake Isabel to supplement a self-sustaining brook trout population. Browns Lake is also periodically stocked with cutthroat trout. Recently, a cooperative project between the Forest Service and the CDOW resulted in the construction of several fishing ponds in the Castle Rock Gulch area.

## **Riparian Resources**

Riparian resources are found exclusively in the montane and foothills zones. Riparian vegetation includes a variety of woody and herbaceous species, with willows and sedges dominating the community. Alders and cottonwoods become more prevalent at lower elevations, with blue spruce apparent below 9,000 feet. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Alpine**

This zone includes approximately 5% of the alpine on the Mountains. See Exhibit III-18 for a summary of alpine acres.

## **Threatened and Endangered Species**

Threatened and endangered species under consideration in this zone are listed in Exhibit III-5 for wildlife and Exhibit III-6 for plants.

Confirmed sightings of at least two pair of Mexican spotted owls have been made on the southern end of this zone. The bird is a candidate for Federal listing.

This zone is considered to be within the historical range of the greenback cutthroat trout.<sup>23</sup> The greenback has been eliminated from this zone, due to hybridization and competition with non-native salmonid fish, and habitat degradation. During the fall of 1990, 2,000 adult greenbacks were reintroduced into the headwaters of Greenhorn Creek.

## **Range Resource**

Several livestock grazing allotments occurring in this zone contain land that is accessible to livestock and capable of producing forage on a sustained yield basis. Many areas are not suitable for livestock grazing. Refer to Exhibit III-7 for suitable range acres and permitted grazing use.

## **Visual Resource**

This area is visible from I-25, the towns of Beulah, Westcliffe and Gardner. Several recreation developments including Lake Isabel are located within this zone.

Within this zone several viewing platforms are potentially affected. The Rampart Range Road, Interstate 25, the South Platte River, Lost Creek Wilderness, State Highway 24, numerous county and Forest Service roads, campgrounds and picnic areas are all within this zone.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

Zone 3 contains several known significant historic period resources, especially mining-related properties. There is a high potential in this zone for additional, currently unrecorded historic resources that are significant. The important historic themes and presently known significant historic resources within this zone include historic mines, mining camps and ghost settlements, railroad related properties, logging related properties, and other significant or potentially significant cultural properties.

The Arkansas Hills and the western portion of the zone in the area of Brown's Creek and Sand Creek are known to contain a substantial number of significant prehistoric archeological sites including quarries, camps, and scarred trees.

### **PALEONTOLOGICAL RESOURCES**

While most of the bedrocks of Zone 2 are metamorphic or igneous in origin, there also are some substantial deposits of potentially fossiliferous bedrocks. The Sangre de Cristos (including the southern portion west of the Spanish Peaks) contain large exposures of the Sangre de Cristo Formation, a known fossil-producing deposit dating to the Permian and Pennsylvanian Periods. While this formation is known to contain large amounts of plant fossils (including the "crinoid" fossils near Marble Mountain), the scientific value of these deposits has not been assessed. Also known are less extensive expanses of other Pennsylvania Period sedimentary formations.

### **CAVE RESOURCES**

There may be significant caves in the limestone outcrops of the canyons west of Beulah in the Wet Mountains. This area has not been scientifically mapped or assessed relative to the presence of caves or their significance.

### **Recreation**

The majority of the recreation in the Wet Mountains occurs in this area and is centered around the Lake Isabel recreation area. The lake is popular for fishing, motorless boating, camping, picnicking, hiking, winter play, snowmobiling and ice fishing. There are three campgrounds in the zone. Private

facilities include an RV Park, cabin rentals, restaurants, and three youth camps (Boy Scouts, Girl Scouts and YMCA).

Recreation consists primarily of dispersed activities with 170 miles of trails of which 130 are open to motorized users. There are 70 miles of groomed snowmobile trails for a variety of users. Driving the highways and forest roads to enjoy the scenery is a popular activity because of the zone's proximity to Pueblo.

Recreation activities in the Mosquito Range are dispersed with no developed sites in the zone. The primary activity is driving the forest roads to view the scenery. Few trails exist and very little live water is present. Some fishing does occur at some watershed improvement dams. Big game hunting for deer and elk is available. Mining in the late 1800's left remnants of that era for those interested in viewing old towns, mines and related structures.

### **Transportation**

The area is traversed by U.S. Highways 24/285, 50 and Colorado Highways 96 and 78. There are many miles of county and Forest roads; 1,005 miles of these roads are included in the Forest's TIS. Noninventoried roads and "travel ways" resulted from ranching, recreation, and mining activity. The average road density of inventoried roads for the Geographic Zone is 1.75 miles per square mile.

### **Special Uses**

Recreation uses include the Columbine Girl Scout Camp, a boat dock, two trail shelters and an isolated cabin. Special uses in this zone are outlined in Exhibit III-19.

## **GEOGRAPHIC ZONE 4**

### **Vegetation**

The majority of this zone is characterized by mixed conifer stands Dominated by Douglas-fir or ponderosa pine, interspersed with lesser amounts of aspen, grassy openings, Gambel oak and rocky outcrops. Spruce-fir occurs at higher elevations, notably below timberline on Pikes Peak, and on moister sites. Most bristlecone pine vegetation is interspersed with talus slopes and rocky outcrops near timberline, primarily in the vicinity of Pikes Peak. A summary of vegetation types for this zone can be found in Exhibit III-17.

### **Soils**

Pikes Peak granite weathers into large coarse-grained crystals with little binding material. Soils formed from this type of granite are coarse textured, weakly developed, and low in fertility. Although soil depth widely varies, shallow depths commonly occur on steeper side slopes in complex patterns with rock outcrop, and moderately deep to deep soils occur on colluvial footslopes and alluvial fans. Soils typically have coarse sandy textures with coarser surface textures as slope gradients increase. Loamy soil textures are generally confined to minor areas of sedimentary parent materials and in depositional areas. Surface and internal rock fragments are typically very gravelly, and rock content generally increases with soil depth.

Soil management concerns relate to the physical properties of fragile soils and their susceptibility to accelerated erosion and gully formations. Soils lack inherent fertility which makes it questionable whether natural recovery can keep pace with geologic erosion even under complete protection.

## Water

All streams in this zone are tributary to the Arkansas River. They flow through the Pikes Peak granite which are some of the most erodible soils on the forest. Gravel makes up a significant portion of the beds and banks of streams in this area. This fine material makes the streams extremely susceptible to erosion. These streams also carry high sediment loads during high flows because the material is small and easily moved.

Beaver Creek was identified in the Forest Plan<sup>24</sup> as a stream that has exceeded its sediment threshold due to the numerous roads and trails in the watershed. Roads and trails are the major influence on the water quality in this zone. Erosion and excess sediment can be found along any road or trail in this zone.

Runoff in this zone varies from 0.3 AF/ac to 0.6 AF/ac. Several reservoirs in this zone provide water to Colorado Springs and the surrounding areas.

## Wildlife and Fishery Resources

Management Indicator Species (MIS) for this zone and the reason for their selection as an indicator species can be found in Exhibit III-3.

Over 18,952 acres of deer and elk winter range have been identified in this zone. Current winter range supports an estimated 300 elk and 1500 deer. An estimated 150 bighorn sheep occur within the zone.

Self-sustaining populations of salmonid fish, predominately brook trout inhabit most perennial streams in the zone, with minor supplementation by the CDOW with hatchery-reared fish. Rampart and Nichols Reservoirs are probably the most intensively managed lake systems, in terms of fishery resource associated with the National Forest. A variety of salmonid fish inhabit Rampart Reservoir, with a self-sustaining lake trout fishery a unique quality. Rainbow smelt, native gamefish in the northern and eastern states, have been planted for several years as a food source for the lake trout, as well as a potential gamefish. Rainbow trout and brook trout are stocked annually in both reservoirs.

## Riparian Resources

Riparian resources are found primarily in the foothills and montane sections of the Pike National Forest. There is limited alpine riparian environment in the south central portion of this zone. Riparian vegetation includes a variety of woody and herbaceous species, with the willow-sedge community dominating the vegetation throughout most of the zone. Cottonwoods and alders become more prevalent in the lower elevations. See Exhibit III-4 for a summary of riparian area acres for this zone.

## Alpine

This zone includes approximately 5 percent of the alpine on the Mountains. Most alpine is dominated by rock and is found in the vicinity of Pikes Peak. See Exhibit III-18 for a summary of alpine acres.

## **Threatened and Endangered Species**

Threatened and endangered species under consideration in this zone are listed in Exhibit III-5 for wildlife and Exhibit III-6 for plants.

Although no recent Mexican spotted owl sightings have been made, there are historic records and one study skin at the Denver Museum of Natural History from this zone. The steep canyons dominated by mixed forests of Douglas fir, ponderosa pine and white fir are components of preferred Mexican spotted owl habitat.

This zone is considered to be within the historical distribution of the federally threatened greenback cutthroat trout.<sup>25</sup> However, through hybridization and competition with non-native fishes, there are currently no populations on Forest Service lands in this zone. One reintroduction has occurred in the City of Colorado Springs Water Supply Reservoir #2. There is also a population of greenback cutthroat trout located on the Fort Carson Military Reservation (Lyttle Pond) east of the Pike National Forest.

## **Range Resource**

Refer to Exhibit III-7 for suitable range acres and permitted grazing use for this zone. Several livestock grazing allotments occur within this zone. These allotments contain land that is accessible to livestock and capable of producing forage on a sustained yield basis. Many areas are not suitable for livestock grazing.

## **Visual Resource**

This zone is the backdrop for towns such as Woodland Park, Colorado Springs and Manitou Springs. Interstate 25, Pikes Peak Highway, Gold Camp Road, the old Stage Road and Rampart Range Road are major travel routes through the zone. The Barr Trail, Pikes Peak Summit, Cog Railroad, Rampart Reservoir and St. Peter's Dome are other important resources.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

There are known significant historic resources concentrated in the Pikes Peak area. Pikes Peak is listed as a National Historic Landmark; during the Colorado Gold Rush in 1859 and 1860, the first view of the Peak by fortune seekers from the east meant their journey was near an end. After the Gold Rush, the Peak was developed as a tourists' attraction; it commands a spectacular vista of the High Plains reaching nearly to the eastern border. The recognized historic themes and significant sites in this zone include recreation-related historic resources and Forest Service and forestry history.

Prehistoric resources appear to be of low density in this zone. No significant sites have been recorded, although some are known in the Manitou Experimental Forest. There is potential for future discoveries. Pikes Peak, in addition to its cultural significance as a symbol of the Gold Rush, also may contain traditional place values for some American Indian groups including the Ute and Comanche tribes.

## **PALEONTOLOGICAL RESOURCES**

Virtually of the bedrock in Zone 4 is metamorphic gneisses or igneous granites. Thus, the potential to affect significant fossil resources in this zone is virtually nil.

## **CAVE RESOURCES**

Cave of the Winds, a famous cave and visitors' attraction is within the Forest boundary on private land; limestone formations that produced this cave continue on Forest lands in the Waldo and Williams Canyon area. There is a potential for discovering new caves.

## **Recreation**

The recreation activities are centered primarily around the summit of Pikes Peak which has three routes leading to it: the Pikes Peak Highway, the Barr National Recreation Trail and the Pikes Peak Cog Railway. Another area for viewing scenery is the Gold Camp Road along the south side of Pikes Peak.

Recreation to the north of Pikes Peak is centered around Rampart Reservoir. The reservoir is popular for fishing, camping, picnicking, hiking and mountain biking. The Waldo Canyon Trail, located off U.S. 24, receives a high amount of use, year around, as this trail provides panoramic views of Colorado Springs and the plains to the east. The Rampart Range Road from Garden of the Gods to Rampart Reservoir is another route used to enjoy the scenery of the area. Dispersed activities of big game hunting for deer and elk is the primary activity associated with off road users.

## **Special Interest and Research Natural Areas**

The Queen's Canyon Geologic area established in 1963 is located in this zone. This area contains 1,130 acres, and features scenic geologic features and canyon areas.

The Hurricane Canyon Research Natural Area (RNA) established on 520 acres in 1931 is located in this zone. It is characterized by steep slopes and either boulder-filled canyons or narrow bottoms of colluvial soil. There are two primary canyons, cut by the North and South Forks of French Creek, and several secondary canyons.

## **Transportation**

The area is cut in two by U.S. Highway 24 from Colorado Springs to Woodland Park. Other major roads include Colorado Highway 67, the Rampart Range Road, the Gold Camp Road and the Old Stage road. There are many miles of county, city and Forest roads; approximately 515 miles of these roads are included in the Forest's Transportation Information System (TIS). In addition, there are noninventoried roads and "travel ways," most of which resulted primarily from homesteading, recreation, and mining activity. The average road density of inventoried roads for the Geographic Zone is 1.60 miles per square mile.

## **Special Uses**

Special uses in this area include recreation uses and communication sites. The special uses are outlined in Exhibit III-19.

## **GEOGRAPHIC ZONE 5**

### **Vegetation**

Front Range vegetation typically consists of mixed conifer stands dominated by Douglas-fir or ponderosa pine, frequently interrupted by grassy openings or Gambel oak. Open ponderosa pine stands on southerly aspects project a park-like appearance. Stands on northerly aspects are more dense and are usually dominated by Douglas-fir. Past and current silvicultural treatments have reduced canopy cover in localized areas. Most treated acres still have mature overstories. A vegetation summary for this zone can be found in Exhibit III-17.

### **Soils**

Soils formed from Pikes Peak granite are coarse textured, weakly developed, and low in fertility. Although soil depth varies widely, shallow depths commonly occur on steeper side slopes in complex patterns with rock outcrop, and moderately deep to deep soils occur on colluvial foot-slopes and alluvial fans. Soils typically have coarse sandy textures with increasingly coarser surface textures as slope gradients increase. Finer soil textures generally develop from some of the metamorphic and sedimentary parent materials. Loamy textures also occur in alluvial bottoms and areas of deposition. Surface and internal rock fragments are typically very gravelly, and rock content generally increases with soil depth.

Particular soil management concerns for this area are the physical properties of fragile granitic soils and their susceptibility to accelerated erosion and gully formations. Soils lack inherent fertility which makes it questionable whether natural recovery can keep pace with geologic erosion even under complete protection.

### **Water**

All of the streams in this zone are tributary to the South Platte River. This zone is also located mostly in granitic soils. The streams are sensitive and carry high sediment loads like the streams in Zone 4. Streams found to be over their sediment thresholds during the Forest planning effort include Trail Creek, Jackson Creek and a tributary to Plum Creek. There are numerous roads and trails in the watersheds that contribute sediment to the streams. This zone is a favorite area for off-road vehicle recreation.

Runoff is greatest in the late spring and early summer during snowmelt. Intense thunderstorms do occur in the spring and summer. Some of the largest floods in this zone result from thunderstorms that occur early in the summer when the streams are flowing high with snowmelt runoff. Runoff varies from 0.2 AF/ac to 0.5 AF/ac in this zone.

### **Wildlife and Fishery Resources**

Management Indicator Species (MIS) for this zone and the reason for their selection as an indicator species can be found in Exhibit III-3.

Over 10,830 acres of deer and elk winter range have been identified in this zone. Current winter range supports an estimated 1000 elk and 3000 deer. An estimated 150 bighorn sheep occur within the Zone.

This zone includes a wide variety of fishery resources, including one of the most intensively managed cold water river systems in the state, the South Platte River. There are a number of smaller order streams that sustain a cold water fishery. Creel census information collected in 1979 and 1980 revealed that over 11,000 fishermen used a relatively small (less than 3 miles) section of the South Platte River between May and October, with over 34,000 trout caught.<sup>26</sup> Sampling information collected by the CDOW indicates that rainbow and brown trout dominate the salmonid population in the South Platte River in this zone. Estimates range from 744 kg/ha in the Cheesman Canyon area downstream of Cheesman Reservoir to 46 kg/ha near Scraggy View.<sup>27</sup>

The river from Beaver Creek to Cheesman Reservoir is categorized as Wild Trout Water by the CDOW. This designation is given to streams which are self-sustaining and are not supplemented with hatchery reared fish. The section of river downstream of Cheesman Reservoir to the Forest Service boundary is classified as Gold Medal by the CDOW. These streams or lakes are of the highest quality in the state and must consistently have a standing crop of 40 lbs/acre with at least 12 fish per acre 14 inches or larger. This section of river also contains self-sustaining populations of rainbow and brown trout, with biomass values consistently greater than 400 lbs/acre. The section of river, from the Forest Service boundary upstream of Deckers to the confluence with the North Fork of the South Platte River, is also Gold Medal. Trout populations are greatest in the section of stream between the Forest Service boundary and the Scraggy View Campground. Trout in this section are protected with special regulations on harvest, and there is no stocking. Populations downstream of the Scraggy View Campground are considerably lower than upstream, the result of more liberal creel limits, reduced physical habitat and/or loss of the reduced influence of the tailwater effects produced by Cheesman Reservoir. The trout population downstream of Strontia Springs Reservoir to the Forest Service boundary is dominated by brown trout, although a self-sustaining rainbow trout population also exists. This section was closed from 1978-1980, while Strontia Springs dam was being constructed. This section of river is supplemented by stocking with hatchery reared rainbow trout and is accessible only by foot from the lower portion of Waterton Canyon.

Physical habitat measurements of the South Platte River reveal that adult brown and rainbow trout habitat is greatest in the section between Cheesman Reservoir and the Forest Service - Wigwam Club boundary downstream. Minimum adult habitat for rainbow trout was located downstream of Strontia Springs Reservoir. Adult brown trout habitat exhibits minimum values downstream of Elevenmile Reservoir. Discharge-habitat relationships indicate that adult and juvenile trout habitat is at a minimum during the snowmelt runoff period in the late spring and summer months. This is because of excessive stream velocities.

Most tributaries of the South Platte River in the zone have been documented in terms of trout populations as a result of the Denver Water Board's Environmental Report Analyses. Fish populations vary, but rainbow, brook and brown trout dominate. Maximum size of the trout is generally smaller than the mainstream populations, probably due to the limited habitat.

## **Riparian Resources**

This zone is located entirely in the montane and foothills sections of the Pike National Forest. Riparian vegetation along the South Platte River has been restricted to a small area along most of its length, due to its development in a confined valley. Riparian vegetation includes a variety of woody and herbaceous plants. The most riparian environments in this area are associated with wet meadow environments and cottonwood-willow-sedge communities. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Alpine**

The north end of the Rampart Range and the eastern foothills of the Tarryall mountains include a negligible amount of alpine outside wilderness. See Exhibit III-18 for a summary of alpine acres.

### **Threatened and Endangered Species**

Threatened and endangered species under consideration in this zone are listed in Exhibit III-5 for wildlife and Exhibit III-6 for plants.

The Pawnee Montane Skipper is a recent addition to the federal threatened species list. The habitat of this species is located in the upper portion of the South Platte River drainage. The species is associated with a vegetative community of open ponderosa pine woodlands with a dominance of mountain mahogany in the understory. The ground cover consists of blue grama grass and prairie gayfeather plant, an important nectar source for adult Pawnee Montane Skippers.

Historical records exist of the Mexican spotted owl in this zone. No recent sightings have been made.

This zone is within the historical distribution range of the federally threatened greenback cutthroat trout.<sup>28</sup> There is one population of greenback cutthroats, located in the headwaters of Jackson Creek. This native salmonid most likely inhabited most of the perennial stream systems in this zone, from the smaller systems to the South Platte River.

### **Range Resource**

Refer to Exhibit III-7 for suitable range acres and permitted grazing use for this zone. Several livestock grazing allotments occur within this zone. These allotments contain land that is accessible to livestock and capable of producing forage on a sustained yield basis. Many areas are not suitable for livestock grazing: i.e., rocky outcrops, steep slopes and dense timber.

### **Visual Resource**

This zone is visible from areas that include Highways 24, 9, 285, 165 and 96, Boreas Pass (proposed scenic byway), Guanella Pass Scenic Byway, Mount Evans and Lost Creek Wildernesses, Continental Divide Trail Corridor, Colorado Trail and other lessor roads, trails and recreation facilities. This zone is also the background for several mountain communities such as Rye, McKenzie Junction, Lake George, Hartsell Beulah and San Isabel.

Within this zone several viewing platforms are potentially affected. The Rampart Range Road, Interstate 25, the South Platte River, Lost Creek Wilderness, State Highway 24, numerous county and Forest Service roads, campgrounds and picnic areas are all within this zone.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

A fair amount of pertinent information has been gathered from results of compliance investigations completed in the recent past. Several of the important historic themes pertinent to this area and associated significant or potentially significant known cultural properties are railroads, recreation and tourism, logging, prohibition era, and Forest Service administration. The North Fork Historic

District is centered on the North Fork of the South Platte River above (west) of the confluence. This resource includes the South Platte Hotel and numerous other turn of the century buildings between the hotel and the modern town of Pine. Other significant recreation and tourism history-related cultural properties in this zone include the Estabrook Historic District (listed on the National Register), Deckers Resort (Daffodil), the Wigwam Club, and Glen Isle. All of these historically-significant sites are on private lands within the boundary of the Pike National Forest.

There is a fair quantity of information regarding prehistoric resources within this zone. The relatively open valley of the South Fork between the Wigwam Club and South Platte apparently was a preferred area, and many large campsites have been recorded in this section of the river corridor. Culturally-scarred trees also have been recorded in Zone 5; notable among this class of resources is the Webster Park Grove northwest of Cheesman Reservoir. There are several resources and areas within this zone that may contain significance in terms of their traditional place values for American Indians. These resources include Tahana and Kataka Peaks, the vicinity of the Meadows Campground on Buffalo Creek, and the Webster Park Scarred Tree Grove.

### **PALEONTOLOGICAL RESOURCES**

Virtually all of the bedrock strata in Zone 5 are metamorphic gneisses or igneous granites representing the Pikes Peak Batholith. There are small exposures of the Fountain Formation (sandstones and conglomerates of the Pennsylvanian Period), and of Manitou limestone of the Ordovician Period in the vicinity of Ute Pass and Manitou Park-West Creek. The fossil content of these sedimentary formations is unknown.

### **CAVE RESOURCES**

The Lost Creek Caves system is a significant cave resource in this zone.

### **Recreation**

This zone provides an expansive combination of developed site and dispersed area recreation opportunities. Day use activities predominate. The most prevalent activities are the motorized travel for scenic enjoyment, viewing wildlife, picnicking and hiking. An extensive area for motorized activity is the Rampart Range Motorcycle Area with 115 miles of system trails especially designed and designated for all classes of motorcycle riders. Campgrounds, picnic grounds and trailheads are located along the Rampart Range Road to accommodate motorcycle enthusiasts. In addition to the 115 miles of system trails, there are 30 miles of non-system trails. Also there are 75 miles of non-system motorcycle trails that have been closed but to date have not been revegetated.

Waterton Canyon provides opportunities for fishing, hiking, jogging, bicycling, and viewing wildlife, particularly bighorn sheep. The northern terminus of the Colorado Trail begins here and winds its way for 40 miles across the zone providing opportunities for hiking, bicycling and horseback riding.

The South Platte River Corridor includes 20 miles of the North and South Forks of the South Platte River. The river is directly accessible from a paralleling road. The dispersed recreation activities that occur along the river include fishing, swimming, tubing, rafting, hiking and rock climbing. Camping and picnicking occur in the developed sites scattered along the river. The South Fork of the river is one of the most productive and popular fisheries in Colorado.

Developed recreation is centered in the Manitou Park area with several large campgrounds, picnic areas, and group areas. Manitou Lake is a popular year round area for picnicking and fishing with one campground open year round to accommodate the demand. The Buffalo Creek recreation

area is another area with a concentration of developed sites for day use, overnight use and group use. It is also a popular fishery.

Other popular activities scattered throughout the zone include mountain bicycling, horseback riding, big game hunting for deer, elk and turkey, winter sports of snowmobiling and cross country skiing.

The Lost Creek and Mt. Evans Wilderness are located in the western part of the zone. They contain 139,217 acres and reported 75,000 Recreation Visitor Days (RVDs) of use in 1990.

## **Transportation**

The area is traversed by Colorado Highway 96 and Douglas County Roads 67 and 126. There are many miles of county and Forest roads; approximately 1,170 miles of these roads are included in the Forest's Transportation Information System (TIS). In addition, there are noninventoried roads and "travel ways," most of which resulted from homesteading, recreation, and mining activity. The average road density of inventoried roads for the zone is 1.39 miles per square mile.

## **Special Uses**

Special uses in the area include recreation residences and communication sites. Additional information on special uses is found in Exhibit III-19.

# **GEOGRAPHIC ZONE 6**

## **Vegetation**

Near Thirtynine Mile Mountain, ponderosa pine savannah is interrupted by large, grassy openings at lower elevations. At mid to upper elevations, spruce usually forms mixed conifer stands with Douglas-fir, or mixed conifer-aspen stands. Aspen stands tend to occur on steeper slopes. Bristlecone pine occurs on the upper slopes of Thirtynine Mile Mountain and in semi-open stands with ponderosa pine and brush. Near Black Mountain, mixed conifer-aspen stands tend to form "islands" within large, grassy openings. Grassy parks are found throughout the elevational range. A vegetation summary follows as Exhibit III-17.

## **Soils**

Soils have formed from extrusive-igneous parent materials with medium textures and deep, well developed profiles. Inherent fertility is considered moderate to high. Surface horizons of mountain grassland soils are high in organic matter with high forage production potential. Surface and internal rock fragments vary by amounts and sizes. Most soil profiles have greater than 35 percent rock by volume, and rocky surfaces are most common on the steeper landforms.

Soils in this zone have moderate water erosion and geologic hazard ratings. Although inherent soil properties are considered relatively resistant to sheet and rill erosion, existing gully formations are indicative of past abuse. Management implications for this area relate to controlling surface runoff and concentrated flows by maintaining adequate ground cover protection.

## **Water**

This zone lies in both the South Platte River watershed and in the Arkansas River watershed. The streams on the north slope of Thirtynine Mile mountain flow into the South Platte River and the streams on the south side of Thirtynine Mile Mountain and Black Mountain flow into the Arkansas River. Streams in this zone are all similar. They have cobble and gravel bottoms with a few boulders present, and are in fairly stable condition, although some bank erosion is evident.

There are numerous, unconstructed two-track roads in this zone and many of them occur right along the streams. Sediment from the roads can flow directly into the streams during rainfall and snowmelt runoff. Part of the Thirtynine Mile watershed was identified in the Forest Plan as being over sediment threshold due. Runoff in this area is around 0.4 AF/ac.

## **Wildlife and Fishery Resources**

MIS for this zone can be found in Exhibit III-3.

Over 13,537 acres of deer and elk winter range have been identified in this zone. Current winter range supports an estimated 300 elk and 400 deer.

Perennial streams probably contain self-sustaining populations of salmonid fish, although sampling records are limited. According to existing information, stocking by the Colorado Department of Wildlife (CDOW) is limited to Simms Creek. There does not appear to be a substantial fishery resource in this zone.

## **Riparian Resources**

Riparian resources in this zone are found primarily in the montane zone and are generally associated with headwater streams. Riparian areas associated with alpine environments are restricted in the vicinity of Black Mountain and Thirtynine Mile Mountain. Riparian vegetation in this zone includes a variety of woody and herbaceous species, with the willow-sedge community dominating the vegetation throughout most of the zone. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Alpine**

This zone encompasses the Thirtynine Mile Mountain area in South Park. No alpine is found in this vicinity. See Exhibit III-18 for a summary of alpine acres.

## **Threatened and Endangered Species**

Threatened and endangered species under consideration in this zone are listed in Exhibit III-5 for wildlife and Exhibit III-6 for plants.

## **Range Resource**

Refer to Exhibit III-7 for suitable range acres and permitted grazing use for this zone. Several livestock grazing allotments occur within this zone. These allotments contain land that is accessible to livestock and capable of producing forage on a sustained yield basis. Many areas are not suitable for livestock grazing: i.e., rocky outcrops, steep slopes and dense timber.

## **Visual Resource**

This zone is visible from areas that include Highways 24, 9, 285, 165 and 96, Boreas Pass (proposed scenic byway), Guanella Pass Scenic Byway, Mount Evans and Lost Creek Wildernesses, Continental Divide Trail Corridor, Colorado Trail and other lesser roads, trails and recreation facilities. This zone is also the background for several mountain communities such as Rye, McKenzie Junction, Lake George, Hartsell Beulah and San Isabel.

Within this zone several viewing platforms are potentially affected. The Rampart Range Road, Interstate 25, the South Platte River, Lost Creek Wilderness, State Highway 24, numerous county and Forest Service roads, campgrounds and picnic areas are all within this zone.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

Although a systematic cultural resources inventory of the entire area has not been completed, large portions of the Thirtynine Mile Mountain vicinity are known in this regard. The historic themes especially pertinent to this zone and individual contributing cultural properties are historic logging and early prehistoric montane occupations.

### **PALEONTOLOGICAL RESOURCES**

All of the exposed bedrock strata in this zone are geologically recent ash flows and andesitic lavas from volcanic activity. Hence, the potential for significant fossils in this area is virtually nil.

### **CAVE RESOURCES**

No known significant caves exist in Zone 6. The potential for discovering new significant cave systems is virtually nil, based on the bedrock geology.

### **Recreation**

The entire zone may be referred to as the "Thirtynine Mile Mountain" with Black Mountain at 11,654 feet being the high point in the zone. Several roads provide access for a variety of dispersed recreation activities. Hunting for deer and elk is the primary activity associated with dispersed camping. Use is approximately 7500 RVD's.

### **Research Natural Areas**

The Saddle Mountain RNA, approximately 480 acres, established in 1951, is located in this zone. The fertile soil, derived from basaltic rocks, supports a variety of plant communities. Wide meadows are covered by an unusual climax stand of oat-grass. A large stand of bristlecone pine covers portions of the RNA.

### **Transportation**

The area is bisected by Colorado Highway 9 for approximately two miles. The remaining roads are forest access roads including approximately 50 miles of roads shown on the Forest's TIS. In addition, there are noninventoried roads and "travel ways" open to use, most of which resulted from

recreation and mining activity. The average road density of inventoried roads for the zone is 2.51 miles per square mile.

## **Special Uses**

The special uses in this zone are outlined in Exhibit III-19.

## **GEOGRAPHIC ZONE 7**

### **Vegetation**

Near Kenosha Pass at the north end of this zone, spruce composes mixed conifer stands with lodgepole pine or bristlecone pine. South of the Kenosha Pass area, aspen and mixed conifer stands dominated by spruce or Douglas-fir are interspersed with numerous, large openings. The Tarryall Mountains are a prominent feature with generally steep slopes occupied by spruce or spruce/Douglas-fir stands interspersed with rock.

In the south part of the zone, the lower elevation vegetation is characterized by mixed conifer stands dominated by ponderosa pine or Douglas-fir, interspersed with large, grassy parks at lower elevations. Douglas-fir and aspen are characteristic on northerly aspects, while ponderosa pine savannah is common on drier sites. Mountain mahogany is a common understory species in the ponderosa pine type.

Mixed conifer-aspen stands comprised of Douglas-fir, spruce, lodgepole pine and aspen are typical at higher elevations. A vegetation summary for this zone is in Exhibit III-17.

### **Soils**

An area of Pikes Peak granite occurs west of Lake George in the vicinity of Elevenmile Canyon, and there are alluvial deposits in valley bottoms. Slope gradients range from 10 to 50 percent over most landforms. Steep slopes of 40 to 70 percent occur around mountain summits and rocky escarpments. Nearly level to gently sloping landforms with 0 to 15 percent slopes include ridges, plateaus, and valley bottom land.

Shallow soils occur on residual side slopes in complex patterns with rock outcrop, and deeper soils are associated with colluvial footslopes and transported alluvial materials. Medium to coarse textured soils have developed from parent materials derived from igneous and metamorphic sources. Typical textures consist of sandy loams on residual landforms, and loams or clay loams are common in deeper soil profiles. Soils generally have weak to moderate development and low to moderate fertility ratings. Surface horizons of the mountain grassland soils are high in organic matter with high forage production potential. Surface and internal rock fragments vary by amounts and sizes; but most soil profiles have greater than 35 percent rock by volume, and rocky surfaces are most common on the steeper landforms.

Soils in this zone generally have moderate to severe erosion hazard and low to moderate geologic hazard ratings. Soil management concerns are mainly confined to protecting areas of Pikes Peak granite with severe erosion hazard, controlling surface erosion on steeper slopes, and protecting alluvial bottom land from gully formations by maintaining adequate ground cover.

## Water

The streams in this zone are all tributary to the South Platte River. Streams are mostly intermittent in this zone although perennial streams occur at the higher elevations. The intermittent streams are mostly small stable streams that are inside larger, old drainages or gullies. Most of these streams were severely eroded early in the century. Overgrazing was most likely the main cause of the erosion. As the vegetation improved, the gully bottoms started to stabilize. Runoff was not as flashy since vegetation tends to hold more of the precipitation on site and lets it infiltrate the soil rather than run off.

Runoff occurs during snowmelt and after summer thunderstorms. Runoff in this area averages about 0.2 AF/ac in the lower, drier part of the zone and 0.8 AF/ac in the higher elevations.

## Wildlife and Fishery Resources

Management Indicator Species (MIS) for this zone can be found in Exhibit III-3. Over 27,075 acres of deer and elk winter range have been identified in this zone. Current winter range supports an estimated 1,000 elk and 2,000 deer. An estimated 650 bighorn sheep occur within the Zone.

This zone encompasses a wide variety of fishery resources, from small headwater streams to the South Platte River. Elevenmile Reservoir located on the South Platte River is a heavily used recreational fishery resource.

Stocking of Elevenmile Reservoir included a variety of gamefish, including rainbow, lake, and cutthroat trout, kokanee salmon and walleye. Northern pike were planted to control sucker populations. Fish grow relatively fast in this reservoir due to its high productivity. Tarryall Reservoir is also an important reservoir fishery, although it does not receive as intensive use as Elevenmile Reservoir. Spinney Mountain Reservoir is a high quality fishery located upstream of Elevenmile Reservoir. This reservoir should not be affected by oil and gas leasing on Forest Service lands and will not be included in this analysis.

Tarryall Creek is located primarily on private land, with approximately 6 miles on NFS lands. Streambank erosion, caused primarily by agricultural practices, has led to this stream being classified as a non-point source upstream of Tarryall Reservoir.<sup>29</sup> Although Tarryall Reservoir acts as a catchment for most of the upstream suspended sediment, similar conditions exist along much of the privately owned stretches downstream of the reservoir. A total of 16,500 brown and rainbow trout were planted in Tarryall Creek, both upstream and downstream of the reservoir. A section of Tarryall Creek (approximately 3 miles in length) upstream of the confluence with the South Platte River is managed as a self-sustaining fishery.

Access to fishing sites is good throughout most of its length. The two most abundant trout on the South Platte River are brown and rainbow trout, with the highest biomass occurring downstream of Cheesman Reservoir. Populations in the Elevenmile Canyon area are varied, with both brown and rainbow trout stocked yearly. White and longnose suckers dominate the fish biomass in the upper, lower gradient portion of the canyon, while trout dominate in the steeper canyon areas. Northern pike and kokanee salmon are also periodically found in the canyon area as a result of swimming or being swept over the Elevenmile Reservoir spillway.

## **Riparian Resources**

Riparian resources in this zone are found in the alpine, montane and foothills areas of the Pike National Forest. Riparian vegetation in this zone includes a variety of woody and herbaceous species relative to elevations in this area. The willow-sedge community is dominant, with relatively large willow complexes growing in the Craig, Lost and Tarryall Creek drainages. Cottonwoods and alders are more abundant in the lower elevations of this zone; mostly cottonwoods grow along the South Platte River. ERO Consultants (1986) discovered that the willow-sedge and wet meadow communities dominated the riparian areas in the Hacket Mountain and Cheesman Lake area. They also found that willow and willow-alder stands comprised a relatively high proportion of the total riparian.

This zone contains some relatively large riparian areas in stream valleys, comprising a small percentage of all the public land. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Alpine**

This zone encompasses portions of the Kenosha Mountains, Tarryall Mountains and the Eleven-mile Canyon area. Less than 1 percent of the alpine on the Mountains occurs in this zone. See Exhibit III-18 for a summary of alpine acres.

## **Threatened and Endangered Species**

This zone is considered to be within the historical distribution range of the Federally threatened greenback cutthroat trout.<sup>30</sup> Currently, no populations exist in this zone.

Two plants are of concern in this zone. These are the Weber monkey flower found in the Tarryall Mountains and Porter's Feathergrass found in the Lost Park area. Both plants are under review for formal Federal listing.

Threatened and endangered species under consideration in this zone are listed in Exhibit III-5 for wildlife and Exhibit III-6 for plants.

## **Range Resource**

Refer to Exhibit III-7 for suitable range acres and permitted grazing use for this zone. Several livestock grazing allotments occur within this zone. These allotments contain land that is accessible to livestock and capable of producing forage on a sustained yield basis. Many areas are not suitable for livestock grazing: i.e. rocky outcrops, steep slopes and dense timber.

## **Visual Resource**

This zone is visible from areas that include Highways 24, 9, 285, 165 and 96, Boreas Pass (proposed scenic byway), Guanella Pass Scenic Byway, Mount Evans and Lost Creek Wildernesses, Continental Divide Trail Corridor, Colorado Trail and other lesser roads, trails and recreation facilities. This zone is also the background for several mountain communities such as Rye, McKenzie Junction, Lake George, Hartsell Beulah and San Isabel.

Within this zone several viewing platforms are potentially affected. The Rampart Range Road, Interstate 25, the South Platte River, Lost Creek Wilderness, State Highway 24, numerous county and Forest Service roads, campgrounds and picnic areas are all within this zone.

# Cultural, Paleontological, and Cave Resources

## CULTURAL

This area is not well-known in terms of either prehistoric or historic resources. Probably the greatest potential for significant resources is the vicinity of the eastern and southern slopes of the Puma Hills where historic mining activity was pervasive. The especially pertinent historic themes for this zone and associated significant resources are historic mining activity and railroading. Elevenmile Canyon, in the southern portion of this zone, is the historic route for the Midland Railroad, the first standard gauge line to penetrate the central Colorado mountains.

## PALEONTOLOGICAL RESOURCES

Near Lake George are exposures of Oligocene age sedimentary shales and tuffs associated with the Florissant Lakes Beds; these are proven sources of significant fossils. For the zone as a whole, the potential for oil and gas development to affect significant paleontological resources is low, but for the Lake George locality it is moderate to high.

## CAVE RESOURCES

No known significant caves exist in Zone 7. The potential for discovering new significant cave systems is virtually nil, based on the characteristics of the local bedrock geology.

## Recreation

The prominent developed recreation area in this zone is Elevenmile Canyon recreation area which is a series of campgrounds and picnic grounds along the South Platte River from Lake George to Elevenmile Canyon Dam. A parallel road affords easy river access for a variety of activities including fishing, tubing, rafting, wading, sunbathing and technical rock climbing. During summer weekends, Elevenmile Canyon takes on the character of an intensively used urban river parkway. The six campgrounds and four picnic grounds are usually filled to capacity on weekends. Many users simply drive the road that parallels the river to view the scenery and people enjoying the outdoors. The road follows the bed of the abandoned Colorado Midland Railroad and proceeds through tunnels. The road and related historic features are significant cultural resources and of interest to many visitors to the canyon. This segment of the river has been determined to be eligible for addition to the National Wild and Scenic Rivers System. The determination found that this segment meets the "recreation river" eligibility criteria under the Wild and Scenic Rivers Act.

West of Lake George on U.S. 24, Wilkerson Pass has a Forest Service administered visitor information center that is potentially one of the most important in Colorado. The site is an outstanding scenic overlook, as well as an opportune rest stop. It is favorably located for providing visitor information pertaining to every National Forest, Park and Monument in Colorado as well as most State Parks. The site's location and service capabilities are suitable for introducing every highway traveler to the purpose and mission of the Forest Service.

The Tarryall Creek from Lake George to Jefferson is popular for fishing and various forms of water play. Destination users find the Spruce Grove Campground an ideal site from which to go fishing or hiking into the Lost Creek Wilderness. There are trailheads and DOW facilities for providing additional creek and Wilderness access. The Tarryall Road is also popular for scenery and wildlife viewing. Much of the remaining zone is used for big game hunting and associated dispersed camping.

## **Transportation**

The area is traversed by Park County Road 77 (Tarryall Rd.) and U.S. Highway 24. There are many miles of county and Forest roads; approximately 245 miles of these roads are shown on the Forest's TIS. In addition there are noninventoried roads and "travel ways," most of which resulted from recreation and ranching activity. The average road density of inventoried roads for this zone is 0.960 miles per square mile.

## **Special Use**

Special uses for this zone include the Sleeping Tom Summer Home Group and the Badger Mountain Communication Site. Additional information on special uses is found in Exhibit III-19.

## **GEOGRAPHIC ZONE 8**

### **Vegetation**

The north part of this zone is characterized by lodgepole pine, spruce and aspen stands, interspersed with grassy areas. Grassy parks become larger and more frequent from Hoosier Pass, south to Trout Creek Pass.

The south part of this zone has a more diverse mixture of conifer and aspen. Common coniferous species include lodgepole pine, spruce, Douglas-fir, ponderosa pine and bristlecone pine. Sagebrush grows in natural openings. A vegetation summary for this zone is in Exhibit III-17.

### **Soils**

Shallow soil depths occur on residual side slopes and benches in complex patterns with rock outcrop, and deeper soils are associated with colluvial footslopes, glacial moraines, and alluvial terraces. Medium to coarse textured soils have developed from igneous and metamorphic rocks, sedimentary rock layers, and transported glacial or fluvial materials. Typical soil texture for most igneous parent materials is very gravelly sandy loam. Finer textures such as loams, sandy clay loams, and clay loams have generally developed from volcanic, sedimentary, or alluvial materials. Surface and internal rock fragments vary by amounts and sizes, but most soil profiles on upland landforms have greater than 35 percent rock by volume.

Most of this geographic zone has moderate erosion hazard and geologic hazard ratings. Soil management concerns relate to controlling surface erosion on the steeper slopes and gullies on alluvial bottom land by maintaining adequate ground cover protection.

### **Water**

The streams in this zone are the headwaters of the South Platte River, and for the most part are stable. Some of the streams that exhibit erosion problems are those in the Buffalo Peaks area such as Pony Creek, Buffalo Creek and Salt Creek. This area was severely eroded during the early part of the century when most of the main drainages were gullied. Most of the streams have stabilized within these gullied drainage ways. These drainages have good vegetation in the bottom with small, stable, meandering stream channels in them. The banks of the gullies are not completely healed and are still sensitive to impacts. Rough and Tumbling Creek has some eroded banks that were probably caused by livestock.

Old mining activities have left their impacts on some streams in this zone. They include the South Fork of the South Platte River, Twelvemile Creek and Mosquito Creek. The North Fork of the South Platte River carries elevated levels of heavy metals. The metals originate in Hall Valley from Handcart Gulch and from Geneva Creek. The metals in Geneva Creek are from old mining activity and from naturally occurring iron bogs and iron springs.

Runoff in this zone occurs mostly from snowmelt. Runoff varies considerably in this zone from around 0.4 AF/ac in the Buffalo Peaks area to 1.0 AF/ac in the northern portion of the zone.

## **Wildlife and Fishery Resources**

MIS for this zone can be found in Exhibit III-3.

Over 40,612 acres of deer and elk winter range have been identified in this zone. Current winter range supports an estimated 4,000 elk and 6,500 deer. An estimated 450 bighorn sheep occur within the Zone.

The North Fork of the South Platte River extends through this zone. Brown trout are the dominant trout species in the North Fork, although brook and rainbow trout are also present. Rainbow trout are planted yearly in public stretches of the North Fork, and cutthroat were planted as well in 1990. Elevational segregation and competition may have a large influence on the distribution of different salmonid fish species in this zone, with brook trout being the dominant species in the higher elevation small order streams.

Physical habitat conditions for this zone are limited primarily to the North Fork of the South Platte River. Habitat measurements in the North Fork indicate that physical habitat for rainbow and brown trout is most limiting during the summer months during the snowmelt runoff period. Spawning habitat appears to be especially limiting for this stream. High stream velocity during the runoff period is the primary factor resulting in the decreased habitat during the summer months.

Historical mining activities in this zone have resulted in poor water quality conditions in several watersheds (Water Quality Control Commission, 1988). Specific streams systems identified include: Twelvemile Creek, South Fork Mosquito Creek, Handcart Gulch, Geneva Creek, and the North Fork of the South Platte River. Results from benthic macroinvertebrate samples indicate that the majority of toxic metal concentrations in the North Fork are found upstream of the confluence with Geneva Creek.

Jefferson Lake is probably the most intensively managed lake system in this zone. In 1990, a total of 75,000 kokanee salmon and 36,000 rainbow trout were planted in this reservoir. Also, a self-sustaining lake trout population exists in this lake. Several other smaller lake systems in this zone are periodically planted with hatchery reared trout, including Wheeler Lake and Shelf Lake.

## **Riparian Resources**

Riparian resources in this zone are found entirely in the alpine and montane areas of Pike National Forest. Riparian vegetation includes a variety of woody and herbaceous species, with the willow-sedge community dominating throughout the zone. Blue spruce grows in the riparian at lower elevations. Narrow bands of riparian are found along all permanent streams, and most temporary streams with numerous isolated areas that are periodically saturated with water and contain emergent or willow complexes. Riparian tracts are extensive in some Forest areas, especially on the South Park valley floor. Most, however, are outside National Forest boundaries.

Although this zone contains some of the larger riparian areas on the Forest, they still comprise a relatively small proportion of total Forest land. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Alpine**

The Mosquito Range portion of the Continental Divide includes approximately 30 percent of the alpine on the Mountains. Approximately two thirds of the alpine in this zone is dominated by vegetation. See Exhibit III-18 for a summary of alpine acres.

### **Threatened and Endangered Species**

This zone is considered to be within the historical distributional range of the federally threatened greenback cutthroat trout. Currently, there is one drainage that contains this native salmonid, Bruno Gulch.

Fifteen T&E plants are found in this zone. None of the plants have been federally listed. The Forest Service intends to protect their habitats from deterioration pending completion of review by the U.S. Fish and Wildlife Service. Refer to Exhibits III-5 and III-6 for a listing of threatened and endangered wildlife and plants for this zone.

### **Range Resource**

Refer to Exhibit III-7 for suitable range acres and permitted grazing use for this zone. Several livestock grazing allotments occur within this zone. These allotments contain land that is accessible to livestock and capable of producing forage on a sustained yield basis. Many areas are not suitable for livestock grazing: i.e. rocky outcrops, steep slopes and dense timber.

### **Visual Resource**

This zone is visible from areas that include Highways 24, 9, 285, 165 and 96, Boreas Pass (proposed scenic byway), Guanella Pass Scenic Byway, Mount Evans and Lost Creek Wilderness, Continental Divide Trail Corridor, Colorado Trail and other lessor roads, trails and recreation facilities. This zone is also the background for several mountain communities such as Rye, McKenzie Junction, Lake George, Hartsell Beulah and San Isabel.

The Buffalo Peaks WSA is in this area. The proposed Boreas Pass Scenic Byway, Highways 285 and 9 are the major roads in the zone. In addition to numerous smaller trails the Continental Divide Trail and Colorado Trail traverse the zone.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

Cultural resources knowledge of this zone is fairly extensive although there are large gaps in the systematic coverage of the area. It has a relatively high density of significant cultural resources, notably mining related historic period properties and prehistoric sites. The historic themes that are particularly applicable to this zone and known historic properties are mines and mining-related sites, railroad history, the timber and charcoal industry, and transportation routes. There are several identified prehistoric sites in the Mosquito Range area; these are camps probably dating

to the 18th and 19th century use of the area by historically-known tribes. There also are scarred ponderosa tree groves and stone quarry sites that are significant or potentially significant.

## **PALEONTOLOGICAL RESOURCES**

The eastern slopes of the Mosquito Range and the northern Arkansas Hills have large scale exposures of sedimentary rock including sandstones and conglomerates of the Middle Pennsylvanian age and limestones of the Upper Cambrian and Devonian Periods. These deposits have not been investigated for their possible fossil content. Based on this summary, the potential to affect significant paleontological resources in the northern part of Zone 8 is very low, while for the middle and southern portions, it is rated as moderate.

## **CAVE RESOURCES**

Cave Creek Cavern southwest of Fairplay in the Mosquito Range is a potentially significant cave resource in this zone. There is low potential for discovering new significant cave resources in this zone.

## **Recreation**

This zone has two highly developed recreation complexes, Jefferson Creek and Geneva Creek. The Jefferson Creek enclave features scenic 190 acre Jefferson Lake, three campgrounds, three picnic grounds, fishing and boating access, trailheads and fisherman parking lots. The area is so popular with the Denver urban area that the demand for campsites exceeds the capacity throughout the summer season. High fishing use occurs both at the lake and creeks during the summer.

Geneva Creek from Grant to Guanella Pass is also a complex of developed sites with three campgrounds, two picnic grounds and two trailheads. Geneva Creek is paralleled by the Guanella Pass road, a designated Scenic Byway. This Scenic Byway between Georgetown and Grant is a popular loop trip from the Denver metropolitan area. The road also parallels a portion of the Mt. Evans Wilderness with several trails leaving the road and providing access to the Wilderness.

U.S. 285 over Kenosha Pass travels through the zone and parallels the North Fork of the South Platte River. This highway provides extensive viewing opportunities of National Forest scenery between Bailey, Fairplay and Antero Junction. Other roads that provide scenic views of the National Forest are Hoosier Pass (Colorado 9), Boreas Pass, Georgia Pass and Webster Pass. Driving for scenic pleasure is a popular activity in this zone.

A 13 mile segment of the Colorado Trail traverses the zone as does a 35 mile segment of the proposed Continental Divide National Scenic Trail. Additional trails scattered throughout the zone provide dispersed recreation activities. Developed campgrounds are also scattered throughout to provide base camps to accommodate a variety of dispersed activities including hiking, horseback riding, mountain biking, big game hunting, viewing and photographing historical sites and fishing. The zone also provides many opportunities for winter activities of snowmobiling, snowshoeing and cross country skiing. Snow conditions and terrain in this zone lend themselves to these activities.

## **Special Interest and Research Natural Areas**

The Windy Ridge Bristlecone Pine Scenic Area, designated in 1966, features a wind swept ridge with old growth bristlecone pine over 1,000 years old. The area has unique biological values as well as outstanding scenery.

Mt. Cross, West Hoosier and Iron Mountain Botanical Areas, are proposed Special Interest Area candidates for designation because of the presence of populations of the Federally Endangered Alpine braya plant. This is a small herbaceous perennial that occurs in the alpine tundra and is a rare plant separated from its nearest relative in Canada. Colorado Natural Areas Program has been working with the Forest to determine the proper boundaries and extent of the population.

The Lost Park Botanical Area proposed for Special Interest designation contains the largest known occurrence of Porter Needlegrass, a U.S. Fish and Wildlife Service (USFWS) Category 2 species (candidate species for listing pending further data). This rare species grows on large, springy floating mats capable of supporting a person. The genus has one representative in North America and a total of three representatives worldwide.

A 695 acre area, the Hoosier Ridge RNA, is proposed for this zone. The area is above timberline where the Continental Divide runs east and west. Moist bogs with mossy ground cover provide the necessary habitat for *Eutremia penlandii*, a plant now under consideration by the US Fish and Wildlife Service as a threatened species. The area also provides habitat for *Sausseria weberi* and *A. maritima sibirica*, species that are distinct from other arctic and high alpine areas; that is, they occur in the far north and in a few Colorado sites and nowhere in between. The nearest occurrence of *A. maritima sibirica*, a plant characteristic of arctic seashores, is found in Labrador. One theory is that these plants are relict species from the Great Ice Age which covered much of North America during the Pleistocene.

## Transportation

The zone is accessed from U.S. Highway 285 with Colorado Highway 9 bisecting the area north of Fairplay. Other major roads in the area are the Boreas Pass Road, the Weston Pass Road and U.S. Highway 24/285. There are many miles of county and Forest roads; approximately 685 miles of these roads are shown on the Forest's TIS. In addition, there are noninventoried roads and "travel ways," most of which resulted from recreation and ranching activity. The average road density of inventoried roads for this zone is 1.2 miles per square mile.

## Special Uses

Special uses includes recreation, summer homes, and communication sites. The special uses in this zone are outlined in Exhibit III-19.

# The Grassland Environment

## GEOGRAPHIC ZONE 9

### Vegetation

Shortgrass prairie is the dominant type, but this zone also includes about one percent pinyon-juniper. The pinyon-juniper type appears as an open forest with small, rounded trees. Rocky Mountain juniper is the dominant species. Common understory species include several grama grasses and buffalo grass, with some oak brush and mountain mahogany in the shrub layer. The pinyon-juniper type provides year-round range for mule deer. Its darker color and rougher texture also offers good visual relief from the prairie landscape.

## **Soils**

Soils of the upland plain are shallow to moderately deep over limestone geology. Loam surface textures and silty clay loam subsoils typically contain high amounts of lime. These "hard land" soils are well drained and have water-holding capacities that are somewhat limited due to soil depth. The canyon escarpments and steeper terrain have shallow soils on rocky bluffs and deeper soils on colluvial footslopes. Soils on these landscapes have typically developed from sandstone parent materials, although some are associated with basalt breaks. Soil textures consist of stony sandy loams and limy loams; slightly heavier textures are derived from basalt materials.

This geographic area has moderate erosion hazard. Most soil management concerns relate to controlling water erosion on steeper slopes and alluvial bottom land by maintaining adequate ground cover protection.

## **Water**

The drainages at the north end of this zone drain into Timpas Creek. The drainages at the south end of the zone drain into the Purgatoire River and into Mustang Creek. All of the drainages in this zone are intermittent except for Timpas Creek. Runoff occurs as a result of rainfall. Runoff from snowmelt is rare. The average runoff for this zone is only about 0.03 AF/ac.

The water is high in salts due to the saline soils that are present in the area. Any ground disturbing activities can contribute more salts to the streams. Suspended sediments appear to be high, although we haven't done any sediment measurements on the streams in the Grasslands. The murky color of the water after a rainstorm give some indication of the high suspended sediment loads being transported.

Many of the drainages have small stock dams and erosion control dams constructed on them for the purpose of slowing the runoff and allowing water to percolate into the soils. The dams also provide much needed water for the wildlife and livestock that use the area. Wells provide a more reliable source of water. Some of the larger wells have electric pumps and a series of pipelines that provide water to stock tanks over a large area.

## **Wildlife and Fishery Resources**

MIS for this zone and the reason for their selection as an indicator species can be found in Exhibit III-3.

Timpas Creek is the largest permanent stream system on the Comanche National Grassland. Results from the Colorado Division of Wildlife (CDOW) indicate that there are at least eleven species of fish inhabiting this watershed. The only non-native fish sampled during the three year sampling period was carp. Gamefish sampled included black bullheads and green sunfish. Sampling conducted in Purgatoire River, the watershed adjacent to Timpas Creek River revealed similar results, with the addition of channel catfish. Channel catfish may also be present in the Timpas Creek system, as a result of migrations from the Arkansas River. The fish species found in these watersheds are typical of the Arkansas River plains environment.

## **Riparian Resources**

This zone contains the largest stream riparian zone on the Grassland, Timpas Creek. Riparian areas are limited primarily to depressions in the land and narrow stream channels. Numerous

temporarily moist depressions exist that contain vegetation that is characteristic of riparian conditions (e.g., sedges) but are only periodically saturated as a result of rains and/or snowmelt. Streams are mostly temporary or intermittent and exhibit restricted or narrow riparian areas. Woody riparian vegetation includes primarily cottonwoods, willows, and salt cedar. Herbaceous plants in the area include those species that have evolved to withstand periodic droughts and desiccation in the semiarid conditions, as well as those that are restricted to the few permanent aquatic habitats available. The salt cedar, was introduced from Asia and has been spreading in the Arkansas valley since the early 1890's. This hardy riparian species appears to have spread rapidly and displaced native vegetation throughout this geographic zone. Diversity of herbaceous plants was less in the presence of native salt cedar stands with only those species tolerant of soluble salts able to survive. The relatively small percentage of riparian areas in this zone is primarily the result of the semiarid conditions. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Threatened and Endangered Species**

Threatened and endangered wildlife and plant species under consideration in this zone are listed in Exhibits III-5 and III-6 respectively.

Two species of fish found in this zone are Colorado listed as threatened: the Arkansas darter and the southern red-bellied dace. The Arkansas darter is also a Federal candidate for listing.

## **Range Resource**

This zone is a typical area on the Grasslands, suitable for very intensive livestock operations. There are very few areas that cannot be used by livestock; in most cases use is precluded only by range fences and the availability of water. Grazing within this zone is carried out under agreement with the Timpas and Kim Grazing Associations.

## **Visual Resource**

This zone is visible from the town of LaJunta, Highways 350, 109 and 71, the Santa Fe National Historic Trail and the Vogel Canyon Trail.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

Cultural resources knowledge of this zone is fairly extensive although there are large gaps in the systematic coverage of the area. There are several very significant prehistoric and historic resources in this area, notably preserved rock art and several resources associated with the Mountain Branch of the Santa Fe Trail. The historic themes that are particularly applicable to this zone and known significant cultural properties are prehistoric resources, the Santa Fe Trail, Hispanic settlements, and homesteads and the Depression Era. Vogel Canyon contains numerous prehistoric campsites and associated intact archaeological deposits and rock art. This resource also may contain traditional place significance for American Indian groups. It is a proposed National Historic District. There are other known significant rock art sites and playa-associated archaeological sites.

### **PALEONTOLOGICAL RESOURCES**

The Purgatoire River Dinosaur Trackway, a paleontological resource with international significance is located in the Comanche National Grasslands. The potential for discovering new significant

paleontological resources in this zone is high, especially in the Morrison and Dakota sandstone formations along the Purgatoire River.

## **CAVE RESOURCES**

No significant cave resources are known in Zone 9. The potential for discovering such resources in the future is low, based on the characteristics of the local bedrock formations.

## **Recreation**

This zone consists of recreation activities closely associated with the wildlife, history and archaeology of the zone. Two drainages, Timpas Creek and Purgatoire River influence the habitat and abundance of wildlife in the zone. Hunting for upland birds, waterfowl, big game and small mammals is one of the predominant activities as well as bird watching with over 250 species of birds in the zone.

The route of the Santa Fe Trail, a National Historic Trail, travels through the zone. Ruts from the wagon trains are still visible and of interest to many visitors each year. Other history buffs enjoy viewing and photographing the old homesteads in the area, particularly those made of native stones. Still others enjoy visiting the prehistoric Indian sites of rock wall, caves and overhangs many of which contain rock art left by the Indian inhabitants. Vogel Canyon contains prehistoric rock art and is managed to further the public's understanding and appreciation of this resource.

## **Transportation**

The area is traversed by U.S. Highway 350 and Colorado Highways 71 and 109. There are many miles of county roads; Grassland roads generally are those needed for direct access into fields and activity locations. Most roads in the area result from agricultural and land management activities.

## **Special Uses**

The special uses in this zone are outlined in Exhibit III-19. The La Junta Communication Site is located in this zone.

# **GEOGRAPHIC ZONE 10**

## **Vegetation**

Shortgrass prairie is the dominant type, with midgrass prairie occurring on less than half of the zone. Visual variety is generally limited to seasonal color changes in grasses and riparian vegetation.

## **Soils**

The landscape is characterized as nearly level to gently undulating uplands, and composition is split between loamy "hard lands" and sandy plains. Slope gradients range from 0 to 10 percent, but slightly steeper slopes may occur in narrow drainageways. Relatively fertile soils support native mid and short grass prairies. The loamy uplands consist of deep soils developed from loess deposits, and they are well drained with high water holding capacity. Typical soil textures consist

of loam and clay loam on the surface, and subsoil textures include silt loam, silty clay loam, and clay. The undulating sandy plains consist of deep soils developed from wind-deposited eolian sands, and soil profiles typically have sandy loam and loamy sand textures.

Land types sustain both wind and water erosion, but accelerated wind erosion is the greatest hazard on the sandy plains and alluvial flood plains. Soil management objectives are to maintain vegetative ground cover protection for erosion control.

## **Water**

This zone includes Sand Arroyo, Lone Rock Draw and the headwaters of the North Fork of the Cimarron River. The main drainage is Sand Arroyo which is intermittent, as are all other drainages in this zone. They flow only during floods. Runoff averages about 0.03 AF/ac.

Sediment movement is high during runoff due to the predominance of sand in the watershed. Stock dams and erosion control dams have been built in the drainages in the western end of this zone where the soils aren't as sandy. Wells are an important source of water in this zone.

## **Wildlife and Fishery Resources**

Management Indicator Species (MIS) for this zone and the reason for their selection as an indicator species can be found in Exhibit III-3.

There are a number of fish in this portion of the Grassland that are adapted to the harsh environment. As a result of poor sampling information and the intermittent nature of the streams, fish populations have not been fully quantified.

## **Riparian Resources**

Riparian areas are limited primarily to depressions in the land and narrow stream channels. The relatively small percentage of riparian areas is primarily the result of the semiarid conditions in this zone. Although there are numerous arroyos and intermittent streams in this zone, there are no permanent streams or lakes to enhance riparian conditions. Temporarily moist depressions contain vegetation that is characteristic of riparian conditions (e.g., sedges) but are only periodically saturated as a result of rains and/or snowmelt. Many of these depressions contain species (e.g., *Distichlis spicata*) which are tolerant of saline conditions, typical of these environments. Streams are mostly intermittent and exhibit narrow riparian areas. Woody riparian vegetation includes primarily cottonwoods, willows and salt cedar. Herbaceous plants that inhabit the area include those species that have evolved to withstand periodic droughts and desiccation in the semiarid conditions, as well as those that are restricted to the few permanent aquatic habitats available. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Threatened and Endangered Species**

Threatened and endangered wildlife and plant species under consideration in this zone are listed in Exhibits III-5 and III-6 respectively.

Two species of fish found in this zone are Colorado listed as threatened: the Arkansas darter and the southern red-bellied dace. The Arkansas darter is also a Federal candidate for listing.

## **Range Resource**

Grazing on NFS land is carried out under agreement with the Pritchett Grazing Associations. This zone is suitable for very intensive livestock operations.

## **Visual Resource**

Visitors can view this analysis zone while on the Santa Fe Historic Trail, Highways 56, 51 and 27, 287, 385 and 160 or while recreating at Point of Rocks, Cimarron Recreation Area, Middle Spring, Picture and Carrizo Canyons, all of which provide recreation facilities.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

Cultural resources survey coverage for this zone is spotty; several significant sites are known and there is high potential for discovery of additional significant sites based on extrapolation from the known data. The most prominent historic themes in this zone and known significant properties are prehistoric resources, the Santa Fe Trail, the cattle ranch era and the homestead and depression era. Prehistoric resources in this zone include seasonal camping sites near playas and other water sources.

### **PALEONTOLOGICAL RESOURCES**

There are no known significant paleontological resources in this zone; based on the characteristics of the local bedrock geology, the potential for undiscovered resources is very low.

### **CAVE RESOURCES**

There are no known significant cave resources in Zone 10 and the potential to discover resources of this type in this area is virtually nil.

### **Recreation**

Most of the recreation activity is associated with bird watching, with over 250 species available, and hunting of big game (deer and antelope), small game and upland birds. The viewing and photographing of stone homesteads also occurs.

### **Special Interest Areas**

Part of the Carrizo Botanical Area occurs within this zone. The Botanical Area has two populations of the Colorado green gentian, which is designated as a sensitive species in Colorado, and is being considered for formal federal listing.

### **Transportation**

The area is traversed by U.S. Highways 160, 287/385, and Colorado Highway 100. There are many miles of county roads; Grassland roads generally are those needed for direct access to fields and activity locations. Most roads in the area resulted from agricultural and land management activities.

## Special Uses

Special uses include the SE Colorado Experiment Station which occupies 3,908 acres and the Springfield Communication Site. The special uses in this zone are outlined in Exhibit III-19.

## GEOGRAPHIC ZONE 11

### Vegetation

Shortgrass prairie and midgrass prairie occur in roughly equal proportions, but are complemented by about one percent of pinyon-juniper. The pinyon-juniper type is similar to that found in this zone 9. Sand sage and yucca areas in the eastern part of this zone provide year-round habitat for the lesser prairie chicken.

### Soils

The landscape is characterized as nearly level to gently undulating uplands which are dissected by drainageways with strongly sloping to moderately steep canyon escarpments and rocky bluffs. Composition of the upland plains is split between loamy "hard lands" and sandy plains with slope gradients of 0 to 10 percent. The canyon lands generally comprise the southwestern corner of the Carrizo Unit and slopes commonly range from 10 to 30 percent. Steeper slopes are often associated with sandstone outcroppings.

The loamy uplands consist of deep soils developed from loess deposits which generally have loam, silty clay loam, and clay loam textures. The undulating sandy plains consist of deep soils developed from eolian sands. These soils typically have sandy loam and loamy sand textures. The canyon lands and steeper landforms have shallow soils on rocky bluffs and deeper soils on colluvial footslopes. Most of these soils have come from sandstone parent materials, but certain areas south of Campo, Colorado consist of shallow-gravelly loams that overlie caliche.

Soil erosion problems are complex and moderate to severe ratings exist throughout this geographic zone. Accelerated wind erosion on the undulating sandy plains is by far the greatest soil management concern, but potential for serious water erosion exists on the shallow soils and steeper slopes.

### Water

This zone includes Carrizo Creek and all its tributaries. Carrizo Creek is the only other perennial stream besides Timpas Creek on the Comanche National Grasslands. Most of the tributaries to Carrizo Creek are intermittent. The average runoff is 0.03 AF/ac. There is only a milelong stretch of Carrizo Creek on the Grasslands. Most of the stream is on private land.

This zone has many canyon lands along the Colorado-New Mexico and Colorado-Oklahoma borders. Springs are located in many of these canyons. They provide a more reliable source of water for the wildlife in the area.

Stock dams and erosion control dams are located in the intermittent drainages. They also provide water for livestock and wildlife, but they are not as reliable as the springs and wells.

## **Wildlife and Fishery Resources**

Management Indicator Species (MIS) for this zone and the reason for their selection as an indicator species can be found in Exhibit III-3.

This zone encompasses a relatively wide range of aquatic environments, including dry arroyos, as well as permanent and semipermanent stream systems. Although surface flows may not be apparent year round, many of these streams contain deep water pools that are permanent and contain fish. Sampling of the Carrizo Creek watershed in 1982 revealed that at least nine different species of fish inhabit this system. Smallmouth bass and white crappie were the only non-native species collected. Sampling conducted south of the Grassland on Chacuaco Creek showed similar results in terms of species composition. Other perennial streams probably contain similar fish fauna as the Carrizo Creek watershed.

Permanent deep water pools located within the Carrizo Creek watershed are also periodically stocked by the CDOW. In 1990, 200 channel catfish of catchable size were planted in these ponds. In addition, the USFS and CDOW manage man-made ponds in the Picture Canyon area. Although they were not stocked in 1990, these ponds are periodically planted with gamefish.

### **Riparian Resources**

Riparian areas are limited primarily to depressions in the land and narrow stream channels. Temporarily moist depressions exist that contain vegetation that is characteristic of riparian conditions (e.g., sedges) but are only periodically saturated as a result of rains and/or snowmelt. Many of these depressions contain species which are tolerant of saline conditions. Streams are mostly temporary or intermittent and exhibit restricted or narrow riparian areas. Wood riparian vegetation includes primarily cottonwood, willow and salt cedar. Herbaceous plants that inhabit the area include those species that have evolved to withstand periodic droughts and desiccation in the semiarid conditions, as well as those that are restricted to the few permanent aquatic habitats available.

The relatively small percentage of riparian areas is primarily the result of the semiarid conditions. Although there are numerous arroyos and perennial streams in this zone, there are no permanent streams or lakes to enhance riparian conditions. See Exhibit III-4 for a summary of riparian area acres for this zone.

### **Threatened and Endangered Species**

Threatened and endangered wildlife and plant species under consideration in this zone are listed in Exhibits III-5 and III-6 respectively.

Two species of fish found in this zone are Colorado listed as threatened: the Arkansas darter and the southern red-bellied dace. The Arkansas darter is also a Federal candidate for listing.

### **Range Resource**

The Pritchett Grazing Association is responsible for livestock grazing in this zone. It is very suitable for intensive livestock operations. Fences and the availability of water are the main hindrances to livestock grazing. The rough canyons of this zone also provide some natural, physical barriers to grazing animals.

## **Visual Resource**

This analysis zone is visible from the Santa Fe National Historic Trail, Vogel Canyon and Highways 350, 71, 109, 287, 160 and 385.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

Zone 11 has not been systematically explored for cultural resources. There are several known significant cultural properties and the potential to discover additional significant sites is high, based on our current knowledge. The most prominent historic themes represented in this zone, the exploration era, the cattle ranch era, and the homestead and depression eras. The Picture Canyon area has a high density of significant prehistoric resources including campsites, sites with stone architecture, rock shelters, and rock art. The canyon is a proposed National Historic District because of its heritage values. Also, Holt Canyon, Carrizo Creek, and Sand Canyon near the Oklahoma border contain significant prehistoric resources. Some of these resources may be significant in terms of their traditional place values for American Indians; Picture Canyon and Carrizo Creek and their rock art are notable in this regard.

### **PALEONTOLOGICAL RESOURCES**

There are no known significant paleontological resources in this zone. However, the potential of discovering such resources in the future is high, especially in exposures of the Morrison Formation in the vicinity of Carrizo Creek and in the Dakota sandstone outcrops in many of the main canyons. Some dinosaur tracks are known in the vicinity of Holt Canyon, but this site has not been evaluated.

### **CAVE RESOURCES**

There are no known significant caves in this zone. There are some small sandstone caves (for example, the Crack Cave in Picture Canyon); these are thought to be not significant as they do not contain any cave formations or cave-adapted plant or animal life.

### **Recreation**

This area is home and habitat to a varied and abundant population of wildlife and approximately 250 species of birds that attract bird watchers to the zone. Hunting for big and small game and upland birds occurs in the zone.

Visiting archaeological and historical sites and learning about the past appeals to a wide spectrum of users to the zone. They enjoy viewing and photographing the old homesteads, particularly those made of native stones, and Indian rock art that is found in the caves and overhangs. Carrizo Picnic Ground, the only developed site in the zone, is in a scenic canyon that rock art visitors can enjoy while hiking. Picture Canyon is being developed to interpret the rock art and to construct a network of hiking and horseback riding trails.

### **Research Natural Areas**

The Campo RNA, established in 1987, is 35 acres. It is a prime representative of shortgrass plains, with grama-buffalo grass in an undisturbed condition. The area has been established for a research and study bench mark.

## Special Interest Areas

The Carrizo Botanical Area, proposed as a special interest area, is 400 acres encompassing four different sites (two sites in Zone 10). Sites include the Colorado green gentian, which is designated as a sensitive species on the Colorado State List and is being considered for formal Federal listing. This species is endemic to Las Animas, Baca and Prowers Counties. The ecological community in which this species exists is unusual and interests ecologists. There are two sites in zone 11 where this plant grows. Plant populations found to date appear to be vigorous and healthy. Reproduction is apparently very successful, with no predation and threats to habitat, health or numbers.

The Comanche Lesser Prairie Chicken Zoological Area containing 9212 acres, was established in 1987 to preserve the concentration of booming areas (leks) and nesting sites for the lesser prairie chicken. This area is also discussed under Threatened and Endangered Species.

## Transportation

The area is traversed by U.S. Highway 287/385. There are fewer miles of county roads than in some other parts of the Grasslands and Forest areas; Grassland roads generally are those needed for direct access into fields and activity locations. Most roads in the area resulted from agricultural and land management activities.

## Special Uses

The special uses in this zone are outlined in Exhibit III-19.

## GEOGRAPHIC ZONE 12

### Vegetation

This zone is essentially all shortgrass prairie. Visual variety is generally limited to color changes in grasses and riparian vegetation.

### Soils

The northern portion of the Cimarron National Grassland has undulating topography along the North Fork of the Cimarron River, and a relatively flat upland plain extends to the northern boundary of the grassland. The nearly level to gently sloping upland landscape is comparatively featureless with slope gradients generally under 5 percent. Some dissection exists from drainageways, and gully formations are common.

Moderately deep to deep soils have primarily developed from loess deposits and are often referred to as the "hard lands." Soils are well drained and have high water holding capacity. Surface soil textures consist of loam, fine sandy loam, and silt loam; and finer subsoil textures include clay loam, sandy clay loam, and silty clay loam. Although these loamy soils are subject to both wind and water erosion, most of this area has moderate erosion hazard.

Soil management concerns are generally confined to sandy areas associated with the rolling topography along the North Fork of the Cimarron River where soils are more susceptible to wind erosion.

## **Water**

Only 10 percent of the Cimarron National Grassland is in this zone. The zone includes a portion of the North Fork of the Cimarron River and its tributaries. All of the drainages are intermittent. The average runoff is very low, only 0.01 AF/ac. Many of the drainages are gullied and woody draws provide crucial habitat. Some stock ponds exist on the side drainages of the North Fork of the Cimarron River. Other water that is available to wildlife and livestock is provided by wells.

## **Wildlife Resource**

Management Indicator Species (MIS) for this zone can be found in Exhibit III-3. This zone contains habitat that is suitable for year-round use by deer. A recent transplant of Rocky Mountain elk to the Cimarron River may also use a part of this zone. Most of this zone is also grazed by livestock. There is a good population of upland game birds within the zone, as well as other non-game species.

## **Riparian Resources**

Riparian resources in this geographic zone are restricted to the semiarid plains of the Cimarron National Grassland. They are limited primarily to isolated, temporary depressions with emergent vegetation. Some riparian environment exists along the North Fork of the Cimarron River which extends through most of the zone. Woody vegetation is limited primarily to the North Fork corridor. The relatively low percentage of riparian areas in this geographic zone is primarily a result of few permanent or temporary stream systems. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Threatened and Endangered Species**

Wildlife species which the State of Kansas (Kansas Department of Wildlife and Parks, 1989) has listed as State Category 2 candidate T&E species known or likely to occur on the Cimarron National Grassland are:

- Eastern Spotted Skunk - Riparian
- Checkered Garter Snake - Riparian
- Kansas Glossy Snake - Dry plains
- New Mexico Blind Snake - Riparian
- Texas Longnose Snake - Prairie
- Western Green Toad - Arid Prairie-Historic

Other threatened and endangered wildlife species under consideration in this zone are listed in Exhibit III-5.

Two species of fish found in this zone are Colorado listed as threatened: the Arkansas darter and the southern red-bellied dace. The Arkansas darter is also a Federal candidate for listing.

## **Range Resource**

The zone is typical of most areas on the National Grasslands, being very suitable for intensive livestock operations. Livestock can reach most areas unless prevented by fences or lack of water. Forty percent of the land in Federal ownership in Morton County is controlled by the Morton County Grazing Association within this zone.

## **Visual Resource**

Visitors can view this analysis zone while on the Santa Fe National Historic Trail, Highways 56, 51 and 27, 287, 385 and 160 or while recreating at Point of Rocks, Cimarron Recreation Area, Middle Spring, Picture and Carrizo Canyons, all of which provide recreation facilities.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL**

This zone has been examined systematically for prehistoric resources, but not for historic resources. Several prehistoric campsites have been recorded on the Cimarron Grassland, two of which are potentially eligible to the National Register. No significant historic properties have been recorded in this zone and the probability of discovering significant sites in the future is very low, based on our current knowledge.

### **PALEONTOLOGICAL RESOURCES**

There are no known significant paleontological resources in this zone. The probability of discovering such resources in the future is very low, based on the characteristics of the bedrock geology.

### **CAVE RESOURCES**

There are no significant caves in this zone and the possibility of discovering significant cave systems in the future is virtually nil.

### **Recreation**

Recreation use is principally upland bird hunting. A variety of nature study activities also occurs in the zone.

### **Transportation**

The area is traversed by Kansas Highways 27 and 51. There are fewer miles of county roads than in other parts of the Grasslands and Forest areas; Grassland roads generally are those needed for direct access into fields and activity locations. Most roads in the area resulted from agricultural activities, land management activities, and Oil and Gas development.

### **Special Uses**

The special uses in this zone are outlined in Exhibit III-19.

## **GEOGRAPHIC ZONE 13**

### **Vegetation**

This zone is about 70 percent midgrass prairie and 30 percent shortgrass prairie. Visual variety is generally limited to small contrast between the two prairie types, and seasonal color changes in grasses and riparian vegetation. Sand sage and yucca areas provide year-round habitat for the lesser prairie chicken.

## Soils

The southern portion of the Cimarron National Grassland is characterized by the flood plain and river escarpments on both sides of the Cimarron River channel, comparatively minor areas of loamy "hard lands," and extensive areas of rolling to hilly sandy uplands. Relief is nearly level to undulating with slope gradients ranging from 0 to 15 percent, but hummocky sand hills with dune-like relief can have slope inclinations up to 30 percent. Moisture is readily absorbed so there is not much runoff to develop pronounced drainage patterns.

Deep, coarse soils have developed from wind-deposited eolian sands and sandy sediments. Both surface and subsoil textures typically consist of fine sand, loamy fine sand, and fine sandy loam. Soils are susceptible to both water and wind erosion, but accelerated wind erosion is the greatest hazard. The loamy "hard land" soils have moderate erosion hazard.

Soil management concerns for the entire zone focus on maintaining adequate vegetative ground cover protection. Severe wind erosion of coarse textured soils produces movement of sand particles on the surface which causes considerable damage to vegetation and makes management difficult.

## Water

The Cimarron River is a wide, shallow, sandy river. Flows are intermittent. This was not always the case. At the turn of the century, the Cimarron River in Kansas was a narrow, deep, stable stream with perennial flows of clear water.<sup>31</sup> The average river width was 50 feet in 1874. Beginning in 1914 and continuing intermittently until 1942, the channel widened until almost all of the floodplain was destroyed. The channel widening began during the major flood of May 1914. This flood is the greatest of record. The period 1943-54 consisted of channel narrowing and floodplain construction. The period of 1955-60 showed relatively minor changes from the previous period. Measured channel widths in Morton County in 1960 varied from 150 feet to 1650 feet with an average width of 900 feet.

The narrow reaches of the Cimarron River seem to maintain a surface flow for most of the year. The flow is sufficient to support some aquatic life. The wider reaches of the river very seldom have a surface flow, but water remains close to the surface. The subsurface water supports an extensive riparian area. Most of the tributary drainages to the Cimarron River are on the north side of the river where the soils are less sandy. These drainages are fairly well gullied and many of them support a woody draw habitat.

Some stockwater dams exist on these drainages and provide water for livestock and wildlife use whenever they have water. Water wells are more prevalent and they provide a more reliable source of water. Ground water has been called the most important natural resource in southwest Kansas.

Another major water resource in this zone is Middle Springs. This spring keeps a couple of ponds full year-around. The springs are fenced off to livestock but provide water for wildlife. A picnic ground is also located at the spring.

Numerous oil and gas wells are located on the Cimarron National Grassland. They have had impacts on the water quality and, in some instances, benefits for the water resource. Some of the water wells drilled in conjunction with the oil and gas wells have been left in production to provide water for wildlife. Some water quality problems have been detected that may be due to oil and gas fields.

The Southwest Kansas Ground Water Management District No. 3 has a ground water monitoring network. Several of their test wells are on or near the Cimarron National Grasslands. Some of these wells have high specific conductance. As the mineral content increases, the value for the specific conductance (numerical expression of the ability of water to conduct electricity) increases. These wells are located along the Cimarron River in the areas of old oil and gas fields.

## **Wildlife and Fishery Resources**

Management Indicator Species (MIS) for this zone and the reason for their selection as an indicator species can be found in Exhibit III-3.

This zone contains habitat that is suitable for year-round use by deer. A recent transplant of Rocky Mountain elk to the Cimarron River use a part of this zone. Most of this Zone is also grazed by livestock. There is also a good population of upland game birds within the zone, as well as other non-game species.

There are at least twelve species of fish inhabiting the Cimarron River in Kansas, with the majority of fish species being of the minnow family. The river exhibits surface flows only during short periods during the year. During these short durations, fish migrate upstream from more permanent pools interspersed in the stream channel. During most of the year, fish survival is limited to selectively small refuges provided by beaver dams and other permanent pools.

The Kansas Department of Game and Parks in cooperation with the U.S. Forest Service constructed several fishing ponds on the Grassland. These ponds are maintained by the Department of Game and Parks, which plants a variety of gamefish annually. Stocked fish include channel catfish, redear sunfish, bluegill and rainbow trout. In addition, white amur are planted for aquatic vegetation control.

## **Riparian Resources**

Riparian resources in this zone include the largest continuous riparian area in either the Comanche or Cimarron Grassland, the Cimarron River. The Cimarron riparian area is dominated by areas of temporarily flooded scrub/shrub-emergent wetlands, intermittent streambeds and mature cottonwood stands. The Cimarron River flows overground only periodically, with limited permanent stands of water occurring in small pools and marshes. The dominant woody vegetation in the Cimarron Riparian area are cottonwoods and willows. Willows appear to be more restricted to the main river channels, where soil moisture conditions are high, while cottonwoods grow throughout the area, dominating the drier areas. Herbaceous plants include cattails. Sedges grow where soils are saturated at least part of the year. Based on available NWI maps, it appears that the composition and distribution of riparian conditions along the Cimarron River are constantly changing, as the river channel moves. These dynamic conditions in the river proper are due primarily to dewatering upstream from irrigation. The riparian areas in the remainder of this geographic zone are limited to a relatively few temporary depressions and "flatwater" environments with characteristic emergent vegetation. There are also a few narrow, temporary stream riparian conditions that comprise a relatively small percentage of the total riparian area for this geographic zone.

Riparian areas comprise a considerably higher percentage of the total Grassland area than the other zone on the Cimarron Grassland. However, riparian area still comprises a relatively low percentage of the entire zone. See Exhibit III-4 for a summary of riparian area acres for this zone.

## **Threatened and Endangered Species**

Threatened and endangered wildlife species under consideration in this zone are listed in Exhibit III-5.

Two minnow species, the Arkansas River shiner and the flathead chub are listed as State category 2 candidate threatened and Endangered species and have historically been found in the Cimarron River.<sup>32</sup> The Cimarron Grassland is also within the historical range of the Arkansas darter. Cross et al. concluded that historical dewatering of the Cimarron River resulted in considerable change, notably a reduction of the fish fauna in the upper Cimarron River. A species similar to the Arkansas River shiner, the Red River shiner is apparently replacing the Arkansas River shiner in much of its historical range in the Cimarron River. Although habitat appears to be much reduced from historical records, the Cimarron River should be closely monitored, because it is within the range of several rare fish.

Two other species of fish found in this zone are Colorado listed as threatened: the Arkansas darter and the southern red-bellied dace. The Arkansas darter is also a Federal candidate for listing.

## **Range Resource**

Grazing in this zone is carried out under agreement with the Morton County Grazing Association. The zone is very suitable for intensive livestock operations. Fences and the availability of water are probably the only hindrances to livestock grazing throughout most of the zone. Sixty percent of the land in Federal ownership in Morton County is controlled by the Grazing Association within this zone.

## **Visual Resource**

Visitors can view this analysis zone while on the Santa Fe National Historic Trail, Highways 56, 51 and 27, 287, 385 and 160 or while recreating at Point of Rocks, Cimarron Recreation Area, Middle Spring, Picture and Carrizo Canyons, all of which provide recreation facilities.

## **Cultural, Paleontological, and Cave Resources**

### **CULTURAL RESOURCES**

This zone has been examined systematically for prehistoric resources but not for historic resources. The zone is rich in cultural resources associated with use of the Cimarron Cutoff Branch of the Santa Fe Trail and contains several significant resources related to other themes. Prominent historic themes for this zone and known significant cultural properties are prehistoric resources, the exploration era, the Santa Fe Trail, the cattle ranch era, and the homestead and depression eras. Among the significant resources are the Point of Rocks and Middle Spring sites associated with use of the Santa Fe Trail, and the former headquarters location of the 1881 Ranch. Middle Spring also may contain traditional place value for American Indian groups.

### **PALEONTOLOGICAL RESOURCES**

There are no known paleontological resources in Zone 13 and the characteristics of the local soil and bedrock geology suggest that the probability of discovering significant fossils in this zone is very low. It is common to discover fragmented and disarticulated buffalo bones in erosional contexts in Zone 13. These are not considered significant, but the discovery of an articulated

skeleton or a bone bed with several individuals might be significant. These bones are not fossilized, but this phenomenon probably should be considered a potential paleontological resource.

## **CAVE RESOURCES**

No significant caves are present in this zone and the probability of discovering such resources in the future is very low, based on the characteristics of the local bedrock geology.

## **Recreation**

This is a significant area for a variety of recreation activities. The National Historic Santa Fe Trail parallels the Cimarron River and is visited by many who want to see the route and the ruts from the wagon trains, as well as other historical sites from the homesteading era. Hunting for big game (deer, antelope and elk), upland game birds and waterfowl is popular in this zone. A wide variety of habitats attracts the game as well as over 250 species of non-game birds. This unusually large number of birds attracts many bird watchers during the various seasons to see the birds that migrate through the area, as well as those that are there year-round.

Fishing in the zone is a somewhat limited but popular activity for many residents in the area, because it is their only opportunity to fish. There are several stockwater dugouts developed by the Department of Wildlife and Parks along the Cimarron River and regularly stocked with bass, catfish, bullheads, and bluegills.

Abundant nongame wildlife in the zone, with numerous species of mammals, amphibians and reptiles, provides many opportunities for observation.

Despite limited developed facilities, many users camp and picnic in the shade along the river while participating in hiking, horseback riding and motorized vehicle use.

## **Research Natural Areas**

There is one proposed Research Natural Area for this zone. This is the Cimarron RNA and is representative of the Kuchler K-70 Sandsage-Bluestem Prairie Potential Natural Community. The area is located four miles northwest of Elkhart, Kansas and is approximately 310 acres. Management emphasis will be on research, study, observations, monitoring and educational activities that retain the area in an unmodified condition.

## **Transportation**

The area is traversed by U.S. Highway 56 and Kansas Highways 27 and 51. There are fewer miles of county roads than in other parts of the Grasslands and Forest areas; Grassland roads generally are those needed for direct access into fields and activity locations. Most roads in the area result from agricultural activities, land management activities, and oil and gas development.

## Special Uses

The special uses in this zone are outlined in Exhibit III-19.

# RFD WELLS AND REPRESENTATIVE WELLS AFFECTED ENVIRONMENT (LEVEL 4)

## Introduction

This part of the chapter describes the environment affected by the "reasonable foreseeable post-leasing activity". The remainder of this chapter describes the affected environment for the RFD well locations. The disclosure of the environment affected by the "reasonable foreseeable post-leasing activity" (RFD) is a requirement of the Oil and Gas Regulations (228.102(c)(4)). The disclosure of the environment affected by the management alternatives (RFD) is also a requirement of the National Environmental Policy Act (NEPA).

In the RFD, wells were specifically located on the mountains. The grasslands wells were distributed based on major soil types (Ecosystem) as described in Appendix B. Those are: Hard lands, Sandy lands, Canyon lands, and Riparian. This information is tiered to the affected environments discussed earlier, as it continues to refine specificity. Additional information can be found in the individual resource Specialist Reports.

The individual well information on the Mountains will be more specific than the environment described on the Grasslands. This is because the variety of environments and effects (road distances, slopes, etc.) is so much greater on the mountains. Statistical analysis of the existing Oil and Gas program on the Grasslands indicated a high level of consistency in the site disturbance related to exploration and development across all soil/land types. Based on that information, the disclosure of effects in Chapter IV will be at the soil/land type level.

Effects on the Mountains, for both BLM RFD and Concentrated RFD, will be discussed at the "Mountain" (Sub-Unit) level, but developed from the site-specific well analysis. Individual wells may be discussed but they will be in the context of the Forest-wide (Unit) program.

There are two "Concentrated RFD" affected environments because of the four different alternative management scenarios. Alternatives I and III restrict the placement of wells in environmentally sensitive areas based on stipulations developed by the Interdisciplinary Team (IDT) [see Appendix A]. Alternatives II and IV allow well sites in these areas. Thus, the site-specific affected environments are slightly different between these alternatives.

The geographic zone concept was used to locate additional hypothetical oil and gas drill sites referred to as "representative wells." Representative wells were located on representative environments in each of the 13 geographic zones on the Unit. These wells were used to justify supplemental stipulations and to assess site-specific effects of oil and gas development across the various environments on the Unit. The environment for the representative wells on the Mountains include alpine, riparian, and land types with slope ranges of 0-15%, 16-40% and greater than 40%. Representative well locations are mapped in Figure III-4, 5, and 6. Legal descriptions are shown

in Figure IV-1 of Chapter IV. The environments for the Grasslands include riparian, canyon lands, hard lands and sandy lands. The site-specific affected environments for the representative wells were combined with the effects disclosure in the Representative Wells Analysis in Chapter IV.

## The Mountain Environment

### BLM RFD

**Table III-8**  
**BLM RFD Well Descriptions - All Alternatives**

Well#	Vegetation Type	Aspect	% Slope	Suitable (Timber)	% Vegetative Cover	Conflicting Special Uses
1	Ponderosa	E	16	No	50	Electric distribution line
2	Ponderosa Mtn. grass	ESE	20	No	80-100	None
3	Douglas-fir	S	6	Yes	80-100	None
4	Ponderosa	E	6	No	50-60	None

**Well 1** (Geographic Zone 3, Wet Mountains, T.20S., R.70W., NW1/4 SW1/4 Sec. 4)

The site has a vegetation cover of primarily Ponderosa Pine. It is on an east aspect, and is not suitable for timber production.

The drill pad and access road occur on moderate slopes surrounded by steep terrain, and moderately deep residual soils in this area have properties with moderate management limitations. A typical undisturbed site on a 16 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.4 tons/acre/year.

There are no critical winter ranges, Big Game production areas, Threatened and Endangered (T&E) species habitat areas or critical Management Indicator Species (MIS) habitat in the area.

It is located in the drainages of an Unnamed Tributary and Oak Creek. No known T&E fish species exist in these drainages at this time. These drainages are below their sediment threshold limits.

The area around the well site is generally used for dispersed recreational activities (i.e., hiking, hunting, sightseeing, etc.). The site is adjacent to the Oak Creek Road, and is visible from the Stultz Creek trail. The site is also adjacent to an electric distribution line.

There are no known cultural, paleontological, or cave resources at this location at the present time.

**Well 2** (Geographic Zone 7, Tarryall Mountains, T.9S., R.74W., SW1/4 NE1/4 Sec. 6)

The site is covered with a dense cover on Ponderosa Pine. The access road crosses through sparse vegetation and openings of mountain grass. It has a east by southeast aspect and is not suitable for timber production.

The drill pad and access road occur on gentle to moderate slopes, and the shallow residual soils in this area have properties with moderate management limitations. A typical undisturbed site on a 20 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.1 tons/acre/year.

There are no critical winter ranges, Big Game production areas, Threatened and Endangered (T&E) species habitat areas or critical Management Indicator Species (MIS) habitat in the area.

It is located in the drainages of Hall Gulch and Tarryall Creek. No known T&E fish species exist in these drainages at this time. These drainages are below their sediment threshold limits.

The area around the well site is generally used for dispersed recreational activities (i.e., hiking, hunting, sightseeing, etc.). The site is visible from the Rock Creek Hills road and as middleground from the Lost Creek Wilderness.

There are no known cultural, paleontological, or cave resources at this location at the present time.

**Well 3** (Geographic Zone 4, Rampart Range, T.13S., R.67W., NE1/4 SE1/4 Sec. 6)

The site has relatively dense vegetation cover of Douglas-fir. It is on a southern exposure, and is suitable for timber production.

The drill pad and access road occur on gentle to moderately steep slopes with shallow, granitic soils of the Pikes Peak formation. Although soils in this area are considered highly erodible, moderate slopes reduce the risk for significant impacts and increase the effectiveness of erosion-control measures. Surrounding areas have steeper slopes associated with rock outcrop, and soils are considered fragile with severe management implications. A typical undisturbed site on a 6 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.04 tons/acre/year.

The site is located within a Mule Deer Winter Range.

It is located in the drainage of Monument Creek, which drains into Monument Lake. The drainage is within 10% of exceeding its sediment threshold limits at the present time.

The area around the well site is generally used for dispersed recreational activities (i.e., hiking, hunting, sightseeing, etc.). The site is visible from the Rampart Range Road.

There are no known cultural, paleontological, or cave resources at this location at the present time.

**Well 4** (Geographic Zone 4, Rampart Range, T.11S., R.67W., SW1/4 NE1/4 Sec. 21)

The site has a vegetative cover of primarily Ponderosa Pine. It has an east aspect, and is not suitable for timber production.

The drill pad and access road occur on a deep, non-fragile soil on gentle slopes of an alluvial fan. Soil properties on this landform have slight limitations for management activities even though surrounding areas have steeper slopes associated with rock outcrop, and soils are considered fragile with severe management implications. A typical undisturbed site on a 6 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.04 tons/acre/year.

There are no critical winter ranges, Big Game production areas, Threatened and Endangered (T&E) species habitat areas or critical Management Indicator Species (MIS) habitat in the area.

It is located in the drainages of an Unnamed Tributary and Oak Creek. No known T&E fish species exist in these drainages at this time. These drainages are within 10% of, or exceeding, its sediment threshold limits.

The area around the well site is generally used for dispersed recreational activities (i.e., hiking, hunting, sightseeing, etc.). The site is visible from County Road 105, the Mount Herman Road, and possibly I-25. It is a relatively flat site with natural openings nearby.

The location is in the vicinity of the Monument Nursery, a significant cultural resource containing multiple values, and also potential recreational and interpretive values. There are no known cultural, paleontological, or cave resources at the specific well site at this time.

## CONCENTRATED RFD (FOR ALTERNATIVES I AND III)

**Table III-9  
Concentrated RFD Well Descriptions - Alternatives I & III**

Well#	Vegetation Type	Aspect	% Slope	Suitable (Timber)	% Vegetative Cover	Conflicting Special Uses
1R	Douglas-fir	SW	35	No	80-100	None
2R	Ponderosa	SSW	16	No	60-100	None
3R	Douglas-fir	NNE	25	No	80-100	None
4R	Lodgepole	E	8	Yes	40-100	None

**Well 1R** (Geographic Zone 5, T.9S., R.69W., SW1/4, SE1/4, Sec. 21)

The site has a dense vegetation cover of Douglas-fir. It is on a southwest aspect, and is not suitable for timber production.

The drill pad and access road occur on moderate slopes, and the shallow residual soils in this area have properties with moderate management limitations. A typical undisturbed site on a 35 percent slope with 80 percent ground cover has a soil loss rate of approximately 1.5 tons/acre/year. Potential soil loss after disturbance would increase to about 17 tons/acre/year which exceeds the soil loss tolerance rate.

The site is located within a Winter Turkey Concentration Area (Meriam Turkeys).

It is located in the drainage of Jackson Creek. There is a self-sustaining population of brook and rainbow trout in Jackson Creek. It has also been identified as exceeding its sediment threshold limit.

The site is located in the proximity of recreation developments that include Jackson Creek Campground, Devils Head Campground, Topaz Point Picnic Ground, Devils Head Lookout, and the Devils Head National Recreation Trail. The area around the well site is generally used for dispersed activities (i.e., hunting, hiking, sightseeing, etc.). The well site is adjacent to a natural opening, and visibility of the site is limited. The access road travels through dense vegetative cover.

There are no known cultural, paleontological, or cave resources at this location at the present time.

**Well 2R** (Geographic Zone 5, T.9S., R.69W., NE1/4, SW1/4, Sec. 22)

The site has a relatively dense vegetation cover of Ponderosa Pine. It is on a south by southwest aspect, and is not suitable for timber production.

The drill pad and access road occur on gentle to moderately steep slopes, and the shallow residual soils in this area have properties with moderate management limitations. A typical undisturbed site

on a 16 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.5 tons/acre/year.

The site is located within a Winter Turkey Concentration Area (Meriam Turkeys).

It is located in the drainages of Jackson Creek and North Jackson Creek. There is a self-sustaining population of brook and rainbow trout in Jackson Creek. It has also been identified as exceeding its sediment threshold limit. North Jackson creek has been managed as a greenback cutthroat trout fishery for the last several years. The greenback cutthroat trout is a federally listed "Threatened" species and is protected under the Endangered Species Act.

The site is located in the proximity of recreation developments that include Jackson Creek Campground, Devils Head Campground, Topaz Point Picnic Ground, Devils Head Lookout, and the Devils Head National Recreation Trail. The area around the well site is generally used for dispersed activities (i.e., hunting, hiking, sightseeing, etc.). The well site is not visible from the Rampart Range or Jackson Creek Roads. The access road travels through dense vegetative cover.

There are no known cultural, paleontological, or cave resources at this location at the present time.

**Well 3R** (Geographic Zone 5, T.9S., R.69W., SW1/4,SE1/4, Sec. 14)

The site is located in relatively dense vegetative cover of Douglas-fir. It is on a north by northeast aspect, and is not suitable for timber production.

The drill pad and access road occur on moderate slopes, and the shallow residual soils in this area have properties with moderate management limitations. A typical undisturbed site on a 25 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.9 tons/acre/year. Potential soil loss after disturbance would increase to about 5 tons/acre/year which exceeds the soil loss tolerance rate.

The site is located within a Winter Turkey Concentration Area (Meriam Turkeys).

It is located in the drainages of Jackson Creek and Watson Park Creek. There is a self-sustaining population of brook and rainbow trout in Jackson Creek. Jackson Creek has also been identified as exceeding its sediment threshold limit.

The site is located in the proximity of recreation developments that include Jackson Creek Campground, Devils Head Campground, Topaz Point Picnic Ground, Devils Head Lookout, and the Devils Head National Recreation Trail. The area around the well site is generally used for dispersed activities (i.e., hunting, hiking, sightseeing, etc.). The well site is not visible from the Devils Head Lookout.

There are no known cultural, paleontological, or cave resources at this location at the present time.

**Well 4R** (Geographic Zone 5, T.9S., R.69W., SW1/4,SE1/4, Sec. 26)

The site is located in Lodgepole Pine vegetation which has pockets of dense areas and scattered (less dense) areas. It is on an east aspect, and it is suitable for timber production.

The drill pad and access road occur on gentle slopes, and the shallow residual soils in this area have properties with moderate management limitations. A typical undisturbed site on a 8 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.2 tons/acre/year.

Potential soil loss after disturbance would increase to about 3 tons/acre/year which exceeds the soil loss tolerance rate.

The site is located within a Winter Turkey Concentration Area (Meriam Turkeys).

It is located in the drainage of Jackson Creek. There is a self-sustaining population of brook and rainbow trout in Jackson Creek. It has also been identified as exceeding its sediment threshold limit.

The site is located in the proximity of recreation developments that include Jackson Creek Campground, Devils Head Campground, Topaz Point Picnic Ground, Devils Head Lookout, and the Devils Head National Recreation Trail. The area around the well site is generally used for dispersed activities (i.e., hunting, hiking, sightseeing, etc.). The well site is not visible from the Devils Head Lookout.

There are no known cultural, paleontological, or cave resources at this location at the present time.

## CONCENTRATED RFD (FOR ALTERNATIVES II AND IV)

Table III-10  
Concentrated RFD Well Descriptions - Alternatives II & IV

Well#	Vegetation Type	Aspect	% Slope	Suitable (Timber)	% Vegetative Cover	Conflicting Special Uses
1C	Rock Douglas-fir	S	50	No	80-100	None
2C	Douglas-fir	SW	50	No	80-100	None
3C	Douglas-fir	W	40	No	80-100	Jackson Creek Summer Home Group
4C	Douglas-fir	NW	40	No	80-100	Jackson Creek Summer Home Group

**Well 1C** (Geographic Zone 5, T.9S., R.69W., NW1/4 NW1/4 Sec. 22)

The site has dense areas of Douglas-fir with areas of rock. It is on a south aspect, and is not suitable for timber production.

The drill pad and access road occur on shallow, granitic soils of the Pikes Peak formation that are associated with steep slopes and rock outcrop. Soil properties are considered fragile and management implications reflect severe limitations. A typical undisturbed site on a 50 percent slope with 80 percent ground cover has a soil loss rate of approximately 2.2 tons/acre/year which indicates natural erosion on steep slopes is already exceeding soil loss tolerance values.

The site is located within a Winter Turkey Concentration Area (Meriam Turkeys).

It is located within the drainages of Jackson Creek and North Jackson Creek. There is a self-sustaining population of brook and rainbow trout in Jackson Creek. It has also been identified as exceeding its sediment threshold limit. North Jackson creek has been managed as a greenback cutthroat trout fishery for the last several years. The greenback cutthroat trout is a federally listed "Threatened" species and is protected under the Endangered Species Act.

The site is located in the proximity of recreation developments that include Jackson Creek Campground, Devils Head Campground, Topaz Point Picnic Ground, Devils Head Lookout, and the Devils Head National Recreation Trail. The area around the well site is generally used for dispersed activities (i.e., hunting, hiking, sightseeing, etc.). The site and access road maybe visible from the Rampart Range and Jackson Creek roads. The access road is near a campground and crosses the National Recreation Trail twice.

The well location and access road is in the vicinity of Devils Head Lookout, a significant cultural resource with multiple significance values. There are no known cultural, paleontological, or cave resources at the specific site location at the present time.

**Well 2C** (Geographic Zone 5, T.9S., R.69W., SW1/4 NE1/4 Sec. 22)

The site has a dense vegetation cover of Douglas-fir. It is on a southwest aspect, and is not suitable for timber production.

The drill pad and access road occur on shallow, granitic soils of the Pikes Peak formation that are associated with steep slopes and rock outcrop. Soil properties are considered fragile and management implications reflect severe limitations. A typical undisturbed site on a 50 percent slope with 80 percent ground cover has a soil loss rate of approximately 2.2 tons/acre/year which indicates natural erosion on steep slopes is already exceeding soil loss tolerance values.

The site is located within a Winter Turkey Concentration Area (Meriam Turkeys).

It is located within the drainages of Jackson Creek and North Jackson Creek. There is a self-sustaining population of brook and rainbow trout in Jackson Creek. It has also been identified as exceeding its sediment threshold limit. North Jackson creek has been managed as a greenback cutthroat trout fishery for the last several years. The greenback cutthroat trout is a federally listed "Threatened" species and is protected under the Endangered Species Act.

The site is located in the proximity of recreation developments that include Jackson Creek Campground, Devils Head Campground, Topaz Point Picnic Ground, Devils Head Lookout, and the Devils Head National Recreation Trail. The area around the well site is generally used for dispersed activities (i.e., hunting, hiking, sightseeing, etc.). The site and access road maybe visible from the Rampart Range and Jackson Creek roads. The access road is near a campground and crosses the National Recreation Trail twice.

There are no known cultural, paleontological, or cave resources at this location at the present time.

**Well 3C** (Geographic Zone 5, T.9S., R.69W., NW1/4 SE1/4 Sec. 23)

The site has a dense vegetative cover of Douglas-fir. It is on a west aspect, and is not suitable for timber production.

The drill pad and access road occur on shallow, granitic soils of the Pikes Peak formation that are associated with steep slopes and rock outcrop. Soil properties are considered fragile and management implications reflect severe limitations. A typical undisturbed site on a 40 percent slope with 80 percent ground cover has a soil loss rate of approximately 1.6 tons/acre/year which indicates natural erosion on steep slopes is already exceeding soil loss tolerance values.

The site is located within a Winter Turkey Concentration Area (Meriam Turkeys).

It is located in the drainage of Jackson Creek. There is a self-sustaining population of brook and rainbow trout in Jackson Creek. It has also been identified as exceeding its sediment threshold limit.

The site is located in the proximity of recreation developments that include Jackson Creek Campground, Devils Head Campground, Topaz Point Picnic Ground, Devils Head Lookout, and the Devils Head National Recreation Trail. The area around the well site is generally used for dispersed activities (i.e., hunting, hiking, sightseeing, etc.). The first 1/4 mile of the access road would be visible from Devils Head Lookout and Jackson Creek road (it passes through a solid canopy). The rest of the road and well site would not be seen. The well site is within 1/2 mile of the Jackson Creek Summer Home Group, and the access road goes through the area.

There are no known cultural, paleontological, or cave resources at this location at the present time.

**Well 4C** (Geographic Zone 5, T.9S., R.69W., NW1/4 SW1/4 Sec. 26)

The site has a dense vegetative cover of Douglas-fir. It is on a northwest aspect, and is not suitable for timber production.

The drill pad and access road occur on shallow, granitic soils of the Pikes Peak formation that are associated with steep slopes and rock outcrop. Soil properties are considered fragile and management implications reflect severe limitations. A typical undisturbed site on a 40 percent slope with 80 percent ground cover has a soil loss rate of approximately 1.6 tons/acre/year which indicates natural erosion on steep slopes is already exceeding soil loss tolerance values.

There are no critical Big Game production areas, T&E species habitat, or MIS in this area.

It is located in the drainage of Jackson Creek. There is a self-sustaining population of brook and rainbow trout in Jackson Creek. It has also been identified as exceeding its sediment threshold limit.

The site is located in the proximity of recreation developments that include Jackson Creek Campground, Devils Head Campground, Topaz Point Picnic Ground, Devils Head Lookout, and the Devils Head National Recreation Trail. The area around the well site is generally used for dispersed activities (i.e., hunting, hiking, sightseeing, etc.). The site is not visible from the Jackson Creek road, but possible from the Rampart Range Road. The well site and access road are in solid canopies. The well site is within 1/2 mile of the Jackson Creek Summer Home Group, and the access road goes through the area.

There are no known cultural, paleontological, or cave resources at this location at the present time.

## **The Grassland Environment**

The grasslands were divided up into 5 different geographic zones (discussed earlier in this chapter). Within each zone, there are different major soil/land types. These types are: Hard lands, Sandy lands, Canyon lands, and Riparian. RFD wells were distributed in these major soil/land types for analysis. The following briefly describes the affected environment of these major soil/land types:

### **HARD LANDS**

These areas are characterized as nearly level to gently undulating upland plains comprised of loamy soil types. Soils have typically developed from sedimentary or igneous geology which has been overlain with loess deposits, and soil depth varies from shallow to deep. Loam surface textures and silty clay loam subsoils commonly contain high amounts of lime. These "hard land" soils are well drained and generally have moderate water-holding capacities. Short-grass prairie is the dominant vegetation types on these soils.

### **SANDY LANDS**

These areas are characterized as rolling to hilly uplands comprised of sandy soil types. Deep, excessively drained soils have developed from wind deposited eolian sands. Typical soil textures consist of sandy loam and loamy sand. Potential impacts from any surface-disturbing activity which removes protective ground cover on a typical sandy land soil have severe implications without effective mitigation. Mid-grass and tall-grass prairies are the dominant vegetation types on sandy soils.

### **CANYON LANDS**

These areas consist of canyon escarpments and steep terrain with shallow soils on rocky bluffs and deeper soils on colluvial footslopes. Soils on these landscapes have typically developed from sandstone parent materials, although some are associated with basalt breaks. Soil textures consist of stony sandy loams and limy loams; slightly heavier textures are derived from basalt materials. Shallow soils on scarp slopes are somewhat excessively drained and have properties with severe revegetation limitations. Once disturbed, these sites would have low reclamation potential due to difficulty in establishing vegetation and controlling accelerated erosion. The dominant vegetation on these soils is short grasses and Pinyon-Juniper.

### **RIPARIAN**

Riparian areas are limited primarily to depressions in the landscape and narrow stream channels. Riparian soils are typically deep, young and weakly developed from alluvial deposits. The relatively small percentage of riparian areas is primarily the result of the semiarid conditions of the grasslands. Potential impacts to sensitive soils in these areas include severe wind erosion, streambank degradation, and gully formations from altered stream flows. Soil erosion from disturbance on these landscape positions indirectly affects other resources. Woody riparian vegetation includes primarily cottonwood, willow and salt cedar. Herbaceous plants that inhabit the area include those

species that have evolved to withstand periodic droughts and desiccation in the semiarid conditions, as well as those that are restricted to the few permanent aquatic habitats available.

**Exhibit III-1  
Major Vegetation Types  
Forests and Grasslands**

The Forest Plan grouped and classified all Forest and Grassland vegetation into 13 vegetation types (Forest Plan, Chapter II, pages 15 to 25):

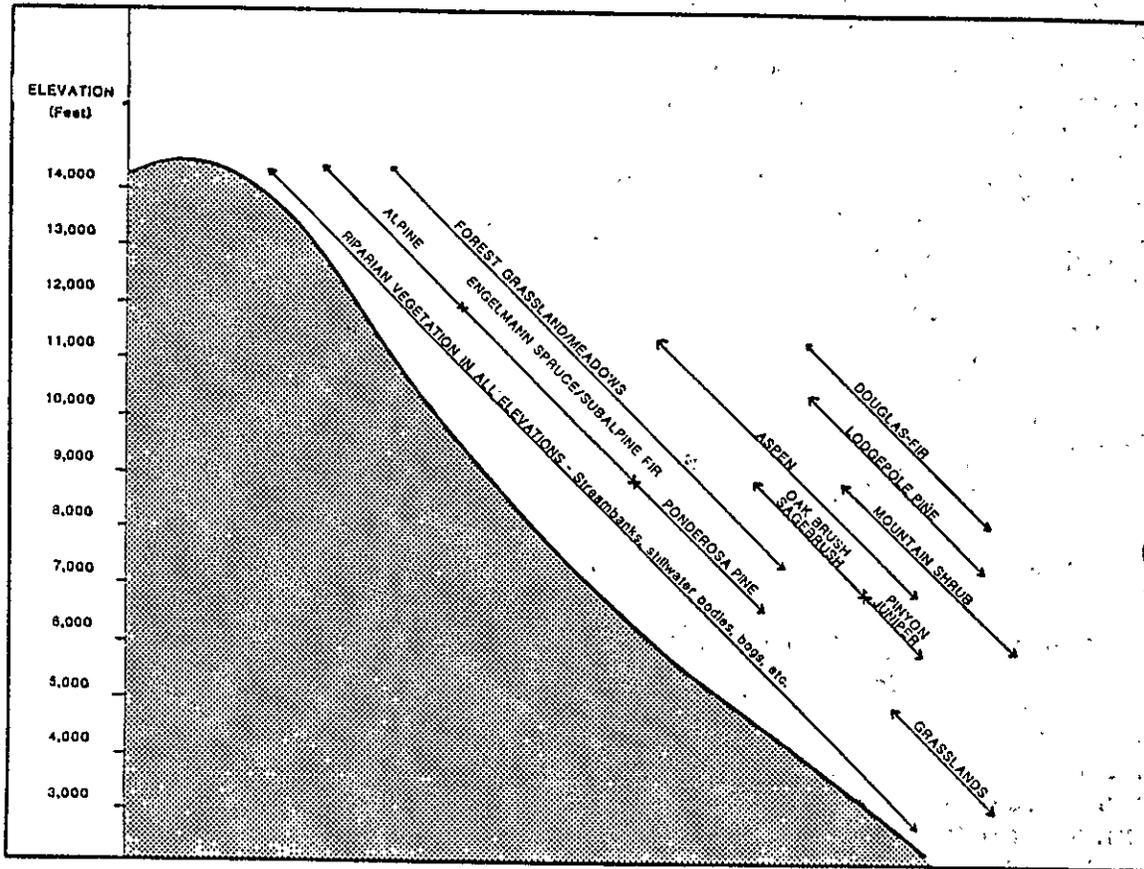
**Forest Types:** aspen, lodgepole pine, Douglas-fir, Engelmann spruce-subalpine fir (spruce-fir), ponderosa pine, pinyon-juniper. Bristlecone pine will be added to the forest types, as it is well-represented on the Forest.

**Non-forest Types:** sagebrush, mountain shrub, Gambel oak, Mountain grasslands and meadows, grasslands (Comanche and Cimarron National Grasslands). Mountain mahogany is usually the dominant mountain shrub on the Forest and provides valuable big game winter range. Therefore, mountain mahogany will be described in this section.

**Special Ecosystems:** Alpine (nonforest: on Forest only), Riparian (forest or nonforest: on Forest and Grasslands).

Figure III-3 below from Chapter II of the Forest Plan depicts the general elevational ranges of Forest and Grassland vegetation.

**Figure III-3  
Elevational Ranges of Vegetation**



## Exhibit III-2 Mountain Vegetation Types

The 11 vegetation types were redescribed for the purpose of this analysis as follows:

### ***Aspen***

The aspen vegetation type ranges from moderately tall to tall deciduous forest, often with well developed shrub layers and/or very well-developed tall grasses, short grasses, tall forbs and short forbs. Aspen is the predominant tree species but there may be a component of numerous other species of trees. Most often, the other tree species are replacing aspen through natural plant succession. On warmer sites, representative understory plants may include: beaked hazel, saskatoon serviceberry, thurber fescue, and elk sedge. On cooler sites representative understory plants may include: spreading golden-banner, silvertop sedge, Barbey larkspur, aspen peavine, Kentucky bluegrass, blue wildrye, dwarf blueberry, whortleberry, silvery lupine, honeysuckle, gooseberry currant, and common juniper. Aspen is an early seral species which normally sprouts prolifically after overstory removal, except in localized areas which have experienced soil compaction and/or aspen root damage.<sup>33</sup> This vegetation type is adaptable to a very wide range of climatic conditions and extends from timberline near Leadville to the warm, dry valleys of the Front Range.

### ***Lodgepole Pine***

The lodgepole pine vegetation type is typically composed of small to moderately large trees with rounded to pointed crowns. Growth is often slow. Undergrowth is usually sparse or absent under closed canopies and grassy under open canopies. Dense canopies are more common. Lodgepole pine is typically the dominant tree species, but there may also be varying degrees of dominance of limber pine and bristlecone pine. Representative understory plants include common juniper, twinflower, grouse whortleberry, elk sedge, Fremont geranium, silvery lupine, and *Lichen spp.* Lodgepole is an aggressive pioneer after disturbance such as fire or clearcutting. This vegetation type is found in a wide variety of climatic regimes.

### ***Douglas-fir***

The Douglas-fir vegetation type is typically a moderately tall, to tall, coniferous forest with rounded to pointed crowns. Undergrowth can be highly layered and diverse with shrubs in one or more layers. Douglas-fir is the dominant tree species. Other tree species found in lesser amounts include blue spruce and white fir. Understory plants include jamesia, purple virgins-bower, mountain ninebark, bitterbrush, Gambel oak, mountain snowberry, Idaho fescue, elk sedge and Ross sedge. This type is found in a wide variety of climatic regimes, ranging from cool and moist to warm and dry. It is generally absent on harsh southerly aspects or extremely cold northerly aspects.

### ***Engelmann Spruce/Subalpine Fir (spruce-fir)***

The spruce-fir vegetation type is typically composed of tall to moderately tall trees with pointed crowns, often with codominant species. Spruce tends to dominate the more mesic conditions, while fir tends to dominate the drier and wetter microsites. Growth is often slow as is recovery from disturbance. Other tree species which occur in lesser amounts include lodgepole pine and Douglas-fir. The understory is usually sparse, but sometimes a medium and/or low shrub layer is present. Common understory plants include arrowleaf groundsel, moss and twinflower. This vegetation type is found at higher elevations and colder conditions than other forested vegetation types on the Forests. The environment is typically wet or moist.

### ***Ponderosa Pine***

The ponderosa pine vegetation type is widely represented throughout the Forest, at lower to mid elevations. At lower elevations and on ridge tops the canopy is generally open. The understory in this environment is typically composed of a sparse shrub layer with a high composition of grasses that are characteristic of high plains. At mid elevations, the canopy tends to be more closed. The understory in this environment is typically more diverse, often with several layers of shrubs, grasses and forbs. Ponderosa pine is the dominant tree species but there may be varying degrees of abundance of Douglas-fir and minor amounts of lodgepole pine, bristlecone pine, and other species. Representative understory plants in the foothills and ridgetop environments include mountain mahogany, Rocky Mountain juniper, bluegrasses, low northern sedge, yucca and sideoats gramma. Understory plants in the montane environments typically include jamesia, purple virgins-bower, mountain ninebark, bitterbrush, Gambel oak, mountain snowberry, Idaho fescue, elk sedge and Ross sedge. This type is found in a wide variety of climatic regimes. In general this type will occur in slightly warmer climates than the lodgepole pine type and slightly drier climates than the Douglas-fir type.

### ***Pinyon-Juniper***

The pinyon-juniper vegetation type is principally represented in the southerly portions of the Pike NF and the southerly and easterly portions of the San Isabel NF, occurring predominantly on the San Carlos, Salida and South Park Ranger Districts. This type appears as an open forest with small rounded trees. Sometimes an open layer of medium to light shrubs is present, otherwise only a sparse herbaceous layer.

Pinyon pine, Utah juniper, Rocky Mountain juniper and one-seed juniper are the dominating species of this vegetation type. On the poorest sites of rocky or shale exposed soils, Rocky Mountain juniper replaces pinyon and the other junipers. On more productive sites pinyon tends to be more prevalent. Common understory plants on the rockiest sites include mountain mahogany, western wheatgrass, littleseed ricegrass, bitterbrush, mosses and lichens. On less rocky sites understory plants are represented by mountain mahogany, Utah serviceberry, sagebrush species, sideoats gramma, prickly pear and yucca.

This type is found in harsh, semidesert climates that can have very wide temperature extremes.

### ***Bristlecone Pine***

The bristlecone pine vegetation type ranges from small to moderately large trees with rounded to pointed crowns. Canopy cover is often sparse, creating a park-like appearance. However, bristlecone pine tends to occur as a denser forest on sandy soils near timberline. Undergrowth is usually grassy under open canopies. Common understory species range from Arizona fescue and currant in the lower subalpine zone, to common juniper, whiprooot clover and silvertop sedge just below timberline. Bristlecone pine generally occurs within an elevational range of 9,500 to 12,000 feet. Growth is slow to very slow. Trees can survive to very old ages and often have a twisted or gnarled appearance.

### ***Mountain Mahogany***

The mountain mahogany vegetation type generally occurs as a mixed species, medium-size shrubland, with mountain mahogany as the dominant species. Associated shrub species include currant, Gambel oak, rabbitbrush, snowberry and wild rose. Common understory species include Parry oatgrass, mountain muhly, Arizona fescue, blue grama, Carex spp., pussytoes and vetch. Understories tend to be more productive at the upper end of the elevation range, on moister sites.

Mountain mahogany is probably the most important big game winter range browse species for big game animals on the Forest. It also occurs as an understory species in the ponderosa pine type; usually on dry, rocky, hillsides below 8,000 feet. Mountain mahogany normally regenerates by sprouting after disturbance, provided the root stocks are relatively undamaged by the disturbance. Mountain mahogany can be found at elevations ranging from 6,000 feet to 10,000 feet.

### ***Gambel Oak***

Gambel oak is a common tall shrub which often occurs with medium-sized shrubs such as mountain mahogany, currant, snowberry and wild rose. Canopy cover ranges from semiopen to fairly dense. Understory species are similar to those described in the mountain mahogany type. The Gambel oak type tends to have more productive understories, since it usually occupies moister sites than the mountain mahogany type. Gambel oak sprouts prolifically following cutting or wildfire. Sprouts are produced from latent buds located near the root collar and from underground stems called rhizomes. Gambel oak generally occurs at elevations ranging from 6,000 feet to 9,000 feet.

### ***Sagebrush***

The sagebrush type generally occurs as low to medium-sized shrubland with semiopen canopy cover. Big sage often forms a mixed shrubland with rabbitbrush and some snowberry. Dominant grasses include Idaho fescue, mountain muhly, mat muhly, ring muhly and prairie junegrass. Common forbs are Colorado rubberplant, potentilla, eriogonum, antennaria, and aster. The understory is interspersed with patches of bare soil.

Sagebrush occurs at approximately 7,500 to 10,000 feet, primarily on the western portion of the Forests. Sagebrush can be found on flats or slopes, usually on southerly or westerly aspects at higher elevations, but on cooler aspects at lower elevations.

### ***Mountain Grasslands***

Mountain grasslands occur as large parks or openings interspersed within ponderosa pine, Douglas-fir, aspen or spruce-fir forests. Grasslands commonly occur in association with ponderosa pine at elevations of 6,500 to 9,500 feet. Vegetation is dominated by Arizona fescue, mountain muhly and Parry oatgrass. Blue grama, needle and thread, prairie junegrass, Kentucky bluegrass, *Carex* spp., potentilla, aster, geranium, yarrow, and antennaria are often present in smaller quantities.

Grasslands occur in association with aspen and spruce-fir at elevations from 8500 feet to timberline. Vegetation can be dominated by bunchgrasses with relatively few shrub and forb species. Dominant grasses are Thurber fescue, Arizona fescue, Parry oatgrass, wheatgrasses, and bromes. Yarrow, fleabane, aster, pussytoes and geranium occur in lesser amounts.

**Exhibit III-3  
Management Indicator Species (MIS)**

Species	Selection Criteria	Geographic Zones							Selection Criteria	Geographic Zones				
		1	2	3	4	5	6	7		8	9	10	11	12
Beaver	2,3	x	x	x	x	x	x	x	2,3	x	x	x	x	
Bighorn Sheep	1,2,3	x	x	x	x	x	x	x	3,5	x	x	x	x	
Mule Deer	2	x	x	x	x	x	x	x	2,3	x	x	x	x	
Elk	2	x	x	x	x	x	x	x		x	x	x	x	
Pine Marten	2	x	x	x	x	x	x	x		x	x	x	x	
Abert's Squirrel	1,2,5	x	x	x	x	x	x	x	2,3,5	x	x	x	x	
Mountain Bluebird	1,5	x	x	x	x	x	x	x		x	x	x	x	
Peregrine Falcon	1,2,5	x	x	x	x	x	x	x	3	x	x	x	x	
Mallard	2,5	x	x	x	x	x	x	x		x	x	x	x	
Water Pipit	2,5	x	x	x	x	x	x	x	3,5	x	x	x	x	
Yellow-bellied Sapsucker	1,2,5	x	x	x	x	x	x	x	1,2	x	x	x	x	
Green-tailed Towhee	5	x	x	x	x	x	x	x	5	x	x	x	x	
Turkey	1,2,3	x	x	x	x	x	x	x	1,2,3,5	x	x	x	x	
Lewis' Woodpecker	1,2,5	x	x	x	x	x	x	x	1,5	x	x	x	x	
Norther Three-toed Woodpecker	1,2,5	x	x	x	x	x	x	x	2,3,5	x	x	x	x	
Black-throated Gray Warbler	5	x	x	x	x	x	x	x	2,3,4,5	x	x	x	x	
Virginia's Warbler	5	x	x	x	x	x	x	x	3,5	x	x	x	x	
Wilson's Warbler	5	x	x	x	x	x	x	x	5	x	x	x	x	
Pronghorn														
Bobcat														
Mule Deer														
White-tailed Deer														
Black-tailed Prairie Dog														
Black-tailed Jackrabbit														
Bobwhite Quail														
Long-billed Curlew														
Ferruginous Hawk														
Northern Oriole														
Turkey														
Burrowing Owl														
Great Horned Owl														
Lesser Prairie Scaled Quail														
Cassin's Sparrow														
Lewis' Woodpecker														
Mourning Dove														
Bewick's Wren														
Cliff Swallow														
Mississippi Kite														
McCown's Longspur														
Red-headed Woodpecker														

**Criteria Selection Symbols**

1. Has a special habitat need during some phase of the life cycle.
2. High public concern for the species or its habitat.
3. High public interest for hunting or viewing.
4. Threatened or Endangered Species.
5. Species presence indicates particular, very specific biological community.

**Criteria Selection Symbols**

1. Has a special habitat need during some phase of the life cycle.
2. High public concern for the species or its habitat.
3. High public interest for hunting or viewing.
4. Threatened or Endangered Species.
5. Species presence indicates particular, very specific biological community.

**Exhibit III-4  
Summary of Riparian Area Acres  
Mountain and Grassland Environments**

Geographic Zone	Riparian Acres	Total NFS Acres	% Riparian
1	16922	322584	5
2	9049	206251	4
3	10737	277693	4
4	7792	127866	6
5	18422	316407	6
6	1983	40788	5
7	22148	166356	13
8	21063	218660	10
9	3216	103181	3
10	4242	145801	3
11	4484	133597	3
12	140	8763	1
13	8340	89559	9
<b>TOTAL</b>	<b>128538</b>	<b>2157506</b>	

**Exhibit III-5  
Threatened and Endangered Wildlife Species**

Species	Status-Comments	Geographic Zones								Status-Comments	9	10	11	12	13
		1	2	3	4	5	6	7	8						
<b>Black-footed</b>	<b>EF-Unconfirmed Sightings</b>														
Ferret	EF-Uncommon														
Peregrine Falcon	EF-Uncommon														
Bald Eagle	EF-Common, Winter	x	x	x	x	x	x	x	x						
Fernsee Montane Skipper	TF-So. Platte Drainage														
White-faced Ibis	TF2, TC-Rare Spring/Fall	x	x	x	x	x	x	x	x						
Long-billed Curlew	TF2, TC-Rare Spring/Fall	x	x	x	x	x	x	x	x						
Ferruginous Hawk	TF2-Uncommon														
Yellow-bellied Sapsucker	TF2, TC-Alpine	x	x	x	x	x	x	x	x						
Marmot	TF2, TC-Riparian	x	x	x	x	x	x	x	x						
Colorado Hog-nosed Skunk	TF2, TC-Riparian	x	x	x	x	x	x	x	x						
Preble's Jumping Mouse	TF2, TC-Riparian	x	x	x	x	x	x	x	x						
North American Lynx	TF2, EC-Leadville Area	x													
North American Wolverine	TF2, EC-Unconfirmed Reports														
Gray Wolf	TC-Functionally Extinct														
River Otter	EC-So. Platte River														
White Pelican	TC-Antero Reservoir area														
Mexican Spotted Owl	EF2 or TF2 - Isolated Locations														
	8.														
<b>Status and Comments</b>															
	EF or TF - Endangered or Threatened - Federally Listed Species														
	EF2 or TF2 - Endangered or Threatened - Federal Candidate Species as of 1/6/89 and 1/01/91														
	EC or TC - Endangered or Threatened Colorado														

Species	Status-Comments	Geographic Zones								Status-Comments	9	10	11	12	13
		1	2	3	4	5	6	7	8						
<b>Black-footed</b>	<b>EF-Unconfirmed Sightings</b>														
Ferret	EF-Uncommon Migrant														
Peregrine Falcon	EF-Uncommon Migrant														
Bald Eagle	EF-Common, Winter														
Least Tern	EF-Spring/Fall, May Nest														
Piping Plover	TF, EK-Migrant														
Lesser Prairie Chicken	TC-Sand Sage Areas														
Greater Sandhill Crane	EC-Rare, Migrant														
Texas Horned Lizard	TF2, TC-Dry Plains														
White-faced Ibis	TF2, TC, TK-Rare Migrant														
Western Snowy Plover	TF2, TK-Rare, Spring														
Mountain Plover	TF2, TC-Uncommon Breeder														
Long-billed Curlew	TF2, TC-Breeder, Summer														
Ferruginous Hawk	TF2, TC-Breeds														
Swift Fox	TF2, TC-Resident														
Colorado Hog-nosed Skunk	TF2, TC-Riparian Areas														
Kansas Glossy Snake	TK-Uncommon Resident														
New Mexico Blind Snake	TK-Uncommon Resident														
Texas Longnose Snake	TK-Uncommon Resident														
Western Green Toad	TK-Uncommon Resident														
Arkansas River Shiner	TF2														
Migrant Loggerhead Shrike	TF2														
Spotted Skunk	TF2														
<b>Status and Comments</b>															
	EF or TF - Endangered or Threatened - Federally Listed Species														
	EF2 or TF2 - Endangered or Threatened - Federal Candidate Species as of 1/6/89 and 1/01/91														
	EC or TC - Endangered or Threatened Colorado														
	EK or EC - Endangered or Threatened-Kansas														

**Exhibit III-6  
Threatened and Endangered Plant Species**

Species	Status-Comments	Geographic Zones							8	Species	Status-Comments	Geographic Zones				13
		1	2	3	4	5	6	7				9	10	11	12	
Alpine Braya	RE-EC-Various sites	x							x	Colorado Green	RF-Comanche NG		x			
Brandegei Wild Buckwheat	RE-Dronev Gulch			x						Gentian				x		
Weber Monkey Flower	RE-Tarryall Mtns.								x	Wing-leaved Soapberry	SC-Comanche NG					x
Degener Penstemon	RE-Oak Creek Area									Purple Cliff Brake	SC-Comanche NG		x			
Porter's Feathergrass	RE-Various Sites			x					x							
Tundra Buttercup	RE-Mt. Lincoln															
Sea Pink	SC-Hoosier Ridge								x							
Dwarf Alpine Hawkbeard	SC-Mt. Cross								x							
Penland Eutrema	SC-Various Sites															
Globe Gilia	SC-Various Sites															
Ice Grass	SC-Various Sites	x														
Lanate Willow	SC-Peerless Mtn.															
Weber Saussera	SC-Various Sites	x														
Little Bulrush	SC-Four Mile															
Prairie Goldenrod	SC-Manitou Lake															
Rocky Mountain Cinquefoil	FP, Category 2	x														
Diluvium Lady's Truss	FP, Category 2															

**Status and Comments**

RF - Under status review for formal Federal Listing.  
SC - Colorado plants designated special concern plants.

**Status and Comments**

RF - Under status review for formal Federal Listing.  
SC - Colorado plants designated special concern plants.  
FP - Appear to be rare potentialis-conclusive information lacking.

**Exhibit III-7  
Suitable Acres for Range and Permitted Use  
Mountain Environment**

<b>Geographic Zone</b>	<b>Suitable Acres</b>	<b>Permitted Numbers</b>	<b>Permitted AUM's</b>
GZ 1	41682	1157	2042
GZ 2	51378	2278	8960
GZ 3	53218	1565	7110
GZ 4	4665	343	1176
GZ 5	29735	553	2534
GZ 6	17935	1114	4719
GZ 7	62619	1637	8798
GZ 8	44169	2044	10147
<b>Totals</b>	<b>305401</b>	<b>10691</b>	<b>45486</b>

**Exhibit III-8  
Visual Quality Objectives  
and Evaluation Criteria**

**Visual Quality Objectives**

Visual quality objectives are assigned to all NFS lands based on viewing distance, sensitivity level and variety class. The concept of variety class is based on Physiographic Provinces. The analysis area lies within the southern Rocky Mountains and Great Plains provinces. The provinces have been subdivided into landscape character subtypes. Subtypes are divisions of the major character types (provinces) which are significantly different in visual characteristics from each other.

Variety class describes the physical attributes of the land based on landform, vegetation, water-form and climate. The landscape features of each subtype are assigned a variety class rating of A, B or C. The A landscapes have the most variety and are usually the most scenic and C the least.

Visitor sensitivity (concern for scenic quality) is rated from 1 to 3; level 1 is highest, level 2 is average, and level 3 is lowest.

Primary and secondary travel routes (i.e., Hwy 285, Hwy 9, etc.); use areas, and water bodies are assigned sensitivity levels with each distance zone also indicated. The distance zones are foreground (Fg), middle ground (Mg), and background (Bg).

Visual quality objectives are then based on the combinations of variety class and sensitivity/distance levels. The five visual quality objectives are: preservation (P), retention (R), partial retention (PR), modification (M), and maximum modification (MM). [Refer to Glossary for definitions.]

The following table shows what visual quality objectives result from the various combinations.

**Table III-11  
Visual Quality Objectives<sup>34</sup>**

VARIETY CLASS	SENSITIVITY LEVEL						
	Fg1	Mg1	Bg1	Fg2	Mg2	Bg2	3
CLASS A	R	R	R	PR	PR	PR	PR
CLASS B	R	PR	PR	PR	M	M	M,MM
CLASS C	PR	PR	M	M	M	MM	MM

Example: Fg1, Class A, R indicates that the area is located in a foreground zone which has the highest level of visitor sensitivity in a landscape which has high variety and is usually very scenic. The visual quality objective for the area is retention of existing landscape character.

The current Visual Quality Inventory for the Forests is represented in the following table.

**Table III-12  
Inventoried Visual Quality Objectives  
(Acres)**

DISTRICT	Preservation	Retention	Part. Ret.	Modification	Max. Mod.
Leadville	98,129	132,986	34,213	9,876	
Salida	20,138	103,516	265,720	70,317	
San Carlos		164,390	169,156	49,794	
South Park	44,801	145,578	277,516	7,539	
Pikes Peak		103,571	124,865	3,535	
South Platte	97,032	89,801	197,377	14,215	
Comanche NG		7,880	156,248		255,367
Cimarron NG			12,650	95,526	

NOTE: Figures based on inventory for 1984 Forest LMP.

***Evaluation Criteria***

At the time of an APD, each well site or associated development will be evaluated utilizing the following criteria to determine the level of impacts: distance zone, sensitivity level, variety class, slope, magnitude, user activity, viewer position, existing visual condition, visual absorption capability, duration and climatic conditions.

**Exhibit III-9  
Cultural Properties  
Listed on Historic National Registers**

***National Historic Landmarks***

PIKES PEAK, El Paso County, 15 miles west of Colorado Springs in the Pike National Forest; listed October 15, 1966.

***National Register of Historic Places***

ST. ELMO HISTORIC DISTRICT, Chaffee County, vicinity of St. Elmo in San Isabel National Forest; listed September 17, 1979.

NORTH FORK HISTORIC DISTRICT, Jefferson County, vicinity of Deckers; listed September 17, 1979. This property encompasses mostly private holdings with a minimum of Forest lands. It incorporates some individual properties originally listed in 1974 including the BLUE JAY INN, LA HACIENDA, the GREEN MERCHANTILE STORE, and the GREEN MOUNTAIN RANCH.

ESTABROOK HISTORIC DISTRICT, Park County, vicinity of Bailey; listed October 20, 1980. On private lands within boundary of Pike National Forest.

TWIN LAKES HISTORIC DISTRICT, Lake County, vicinity of Twin Lakes in San Isabel National Forest; listed July 30, 1974.

INTERLAKEN RESORT DISTRICT, Lake County, south of Twin Lakes in San Isabel National Forest; listed August 7, 1974.

VICKSBURG MINING CAMP, Chaffee county, 15 miles north of Buena Vista in the San Isabel National Forest; listed March 8, 1977.

LITTLEJOHN MINING COMPLEX, Chaffee County, southwest of Granite in San Isabel National Forest; listed December 27, 1978.

WINFIELD MINING CAMP, Chaffee County, 15 miles northwest of Buena Vista, in San Isabel National Forest; listed March 10, 1980.

MINGUS HOMESTEAD, Custer County, 16 miles northwest of Rye, in San Isabel National Forest; listed December 4, 1990.

***National Historic Trails***

SANTA FE TRAIL, portions in Morton County, Kansas, Cimarron National Grassland, and Otero and Baca Counties, Colorado, Comanche National Grasslands.

**Exhibit III-10**  
**Significant Cultural, Paleontological, and Cave Resources**  
**With Educational and Recreational Values**

The following cultural properties would be protected by the No Surface Occupancy (NSO) stipulation or Discretionary No Lease (DNL) under Alternative III.

**CULTURAL PROPERTIES**

***Cimarron National Grassland***

1. Santa Fe National Historic Trail, Cimarron Cutoff Route (several townships and ranges). 300 foot No Surface Occupancy (NSO) on either side of ruts, swales, or vegetation changes reflecting the Trail.
2. Point of Rocks site on Santa Fe Trail and Beaty Brothers Ranch in same vicinity (T34S, R43W). Discretionary No Lease (DNL), 240 acres.
3. Middle Spring site on Santa Fe Trail, also potential American Indian traditional property (T34S, R43W). DNL, 200 acres

***Comanche National Grassland***

1. Mountain Branch of Santa Fe National Historic Trail (several townships and ranges). 300 foot NSO on both sides of Trail for ruts and immediate vicinity.
2. Vogel Canyon Historic District (proposed), including Vogel Canyon Stage Stop, also potential American Indian religious site (T26S, R54W and 55W). DNL, 680 acres.
3. Granada - Ft. Union Wagon Road (branch of the Santa Fe National Historic Trail, various townships and ranges). 300 foot NSO in vicinity of ruts, on either side.
4. Aubrey Cutoff of Santa Fe Trail (various townships and ranges). 300 foot NSO in vicinity of ruts, on either side.
5. Picture Canyon Historic District (proposed), also potential American Indian traditional site (T35S, R74W). DNL, 1840 acres.

***Pike National Forest***

1. DSP&P Railroad grade, Boreas Pass, including Boreas Pass Station, and the Peabody's area (T7S, R77W; T8S, R76 and 77W), DNL, 540 acres.
2. Devil's Head Fire Lookout (T9S, R69W). DNL, 80 acres.
3. Webster Park Scarred Tree Grove, also a potential American Indian religious site (T9S, R71W). DNL, 320 acres.

***San Isabel National Forest***

1. Midland Railroad grade, the Hagerman Tunnel Route, including the Hagerman Tunnel, the Carlton Tunnel and the Highline Trestle (T9S, R81W). DNL, 560 acres.
2. Clear Creek Historic District, including the Swiss Boy Mine, the Fortune Mine, and the Banker Mine, the Clear Creek Flume and Ditch, and the townsites of Beaver City, Vicksburg, and Winfield (T12S, R80 and 81W). DNL, 3920 acres.
3. Trout Creek Jasper Quarry (proposed National Register of Historic Places) (T14, R77W). DNL, 160 acres.
4. Chalk Creek Historic District (proposed), including the Mary Murphy, Iron Chest, Flora Belle, and Allie Bell Mines, the Denver, South Park and Pacific Railroad Grade, the Alpine Tunnel

and Atlantic Camp, the Ghost House, the townsites of Hancock, Romley, and St. Elmo, the Iron City Stage Station, and the DSP&P Railroad Grade (T15S, R80W; T51N, R5 and 6E). DNL, 5840 acres.

5. Suckerville Spring prehistoric site (T51N, R10E). DNL, 80 acres.
6. Monarch Game Drive (T49N, R6E). DNL, 320 acres.
7. Mingus Ranch (T22S, R69W). DNL, 80 acres.

### **SIGNIFICANT CAVES**

#### ***Pike National Forest***

1. Cave Creek Caverns (T10S, R78W). DNL, 160 acres (pending evaluation of significance).

#### ***San Isabel National Forest***

1. Marble Mountain Caves (T24S, R73W). DNL, 480 acres.

**Exhibit III-11**  
**Summary of Total Recreation Use**  
**Pike and San Isabel National Forests**

Activity Grouping	RVD's	% of Total
Camping, Picnicking, Swimming	1,335,600	28%
Mechanized Travel and Viewing Scenery	1,806,800	38%
Hiking, Horseback Riding and Water Travel	552,600	11%
Winter Sports	181,300	4%
Resorts, Cabins and Organization Camps	202,700	4%
Hunting	118,400	2%
Fishing	385,600	8%
Nonconsumptive Fish and Wildlife Use	34,700	1%
Recreation Activities	192,300	4%
Grand Total	4,810,000	100%
Wilderness Total Use (Included Above)	225,700	5%

Source: Recreation Information Management (RIM) source documents (1990).

**Exhibit III-12  
ROS Activity Characterization**

<b>Primitive</b>	<b>Semiprimitive Nonmotorized</b>	<b>Semiprimitive Motorized</b>	<b>Roaded Natural</b>	<b>Rural</b>	<b>Urban</b>
<b>Land Based</b> Viewing Scenery Hiking and Walking Tent Camping Hunting Nature Study Mountain Climbing Horseback Riding	<b>Land Based</b> Viewing Scenery Hiking and Walking Mountain Biking Tent Camping Hunting Nature Study Mountain Climbing Non-motor Aircraft Horseback Riding	<b>Land Based</b> Viewing Scenery Auto (off-road) Motorcycle Special Landcraft Non-motor Aircraft Hiking and Walking Horseback Riding Camping Hunting Nature Study Mountain Biking	<b>Land Based</b> Viewing Scenery Auto (off-road) Viewing Activities Special Landcraft View Works of Man Motorcycle Auto Driving Aircraft Aerial Lifts Hiking and Walking Bicycling Mountain Biking Horseback Riding Camping Picnicking Resort Lodging Cabin Use Hunting Nature Study Forest Products Interp Services	<b>Land Based</b> Viewing Scenery Auto Driving Viewing Activities View Works of Man Motorcycle Bus Touring Aerial Lifts Hiking and Walking Bicycling Horseback Riding Mountain Biking Camping Picnicking Commercial Service Resort Lodging Cabin Use Hunting Nature Study Forest Products Interp Service Team Sports Games & Play	<b>Land Based</b> Viewing Scenery Auto Driving Viewing Activities View Works of Man Motorcycle Bus Touring Aerial Lifts Hiking and Walking Bicycling Horseback Riding Mountain Biking Camping Picnicking Commercial Service Resort Lodging Cabin Use Hunting Nature Study Forest Product Interp Service Team Sports Games & Play
<b>Water Based</b> Canoeing Other Watercraft Fishing	<b>Water Based</b> Canoeing Other Watercraft Fishing	<b>Water Based</b> Boating Other Watercraft Diving Fishing	<b>Water Based</b> Boating Other Watercraft Diving Fishing	<b>Water Based</b> Boating Other Watercraft Diving Fishing Waterplay	<b>Water Based</b> Boating Other Watercraft Diving Fishing Waterplay
<b>Snow/Ice Based</b> Snowplay X-Country Skiing Snowshoeing	<b>Snow/Ice Based</b> Snowplay X-Country Skiing Snowshoeing	<b>Snow/Ice Based</b> Ice and Snowcraft Downhill Skiing Snowplay X-Country Skiing Snowshoeing	<b>Snow/Ice Based</b> Ice and Snowcraft Downhill Skiing Snowplay X-Country Skiing Snowshoeing Ice Skating	<b>Snow/Ice Based</b> Ice and Snowcraft Snowplay Downhill Skiing Snowshoeing Ice Skating	<b>Snow/Ice Based</b> Ice and Snowcraft Snowplay Downhill Skiing Snowshoeing Ice Skating

Source: Recreation Opportunity Spectrum (ROS) book (1986)

Exhibit III-13

Recreation Opportunity Spectrum Class  
Composition and Use

ROS Class	% of Forest	% Use on Forest
Urban (U)	1%	1%
Rural (R)	1%	8%
Roaded Natural (RN)	53%	75%
Semiprimitive Motorized (SPM)	20%	6%
Semiprimitive Nonmotorized (SPN)	22%	9%
Primitive	3%	1%

Source: Table II-2, Forest Plan, 1984

Percent Use  
By ROS Class and Type of Use

Type of Use	ROS Class						Total
	P	SPN	SPM	RN	R	U	
Developed	-	-	1%	23%	6%	-	30%
Dispersed (excluding Wilderness)	-	5%	5%	52%	2%	1%	65%
Wilderness	1%	4%	-	-	-	-	5%

Source: Table II-3, Forest Plan, 1984

**Exhibit III-14**  
**Long-Term Special Use Authorizations**  
**Mountain Environment**

**Recreation Special Uses** - Boat docks, organization camps, trail shelters, recreation cabins, resorts, parks, playgrounds, target ranges and ski areas are the types of recreation special use permits. There are a total of 252 permits totaling 3,253 acres. The four ski areas have a capacity of 12,150 skiers-at-one-time (SAOT) and occupy an area totaling 2,065 acres. The other 248 developments have a capacity of 1,714 people-at-one-time (PAOT) and occupy a total area of 1,188 acres.

**Agricultural Special Uses** - Sheds, barns, corrals, fences and livestock pastures are included in these types of uses. There are 35 permits totaling 3,847 acres. The majority of these uses are livestock pasture permits.

**Community or Public Information Special Uses** - Waste disposal sites, signs, cemeteries and service areas are included in this category of uses. There are 21 permits covering 23 acres.

**Research and Historical Special Uses** - There are four special use permits in this category for a total of five acres. One permit is for historic buildings in Vicksburg and Winfield on the Leadville District. The others are for weather stations.

**Industrial Special Uses** - Storage sites, processing plants, (oil and gas related), and mineral materials (common variety) are the types of special uses in this category. Currently there are 15 permits occupying 118 acres. This includes one mile of access roads.

**Energy Generation and Transmission Special Uses** - The type of uses in this category include hydroelectric generation plants, oil and gas pipelines, and electrical transmission and distribution lines. One hydroelectric generation plant is authorized by special use permit and is located in an area that has been formally withdrawn from oil and gas leasing (Air Force Academy Withdrawal). There are several others that are authorized by Federal Energy Regulatory Commission (FERC) licenses. There are 19 miles of natural gas distribution lines located on the Pike and San Isabel National Forests. There are 397 miles of electrical transmission and distribution lines.

**Transportation Special Uses** - There are 204 permits authorizing 368 miles (3,539 acres) of railroad and road rights of way. This includes 32 miles of railroad right of way, 185 miles of State/County roads, and 150 miles of private access.

**Communication Special Uses** - There are 100 permits authorizing use of 21 sites for communication (microwave, two-way radio, radio broadcast, TV translators, etc.) uses. Total area involved is 65 acres. Most of the the sites are located at high elevations and involve small acreages. Sixteen permits authorize 292 miles (330 acres) of telephone lines.

**Water Related Special Uses** - There are 99 permits authorizing 160 miles (608 acres) for water transmission (pipelines, ditches, tunnels). There are 31 permits that authorize 7,571 acres for dams and reservoirs. An additional 36 permits authorized 26 acres for springs, windmills, wells, water storage tanks, etc.

**Exhibit III-15  
Grassland Vegetation Types**

***Shortgrass Prairie***

The shortgrass prairie type is usually dominated by blue grama, or less frequently, buffalo grass. Other grasses include western wheatgrass, alkali sacaton, sand dropseed, threeawn and bluestem. Sod-forming grasses enhance soil stability and water quality. Forbs also contribute to the vegetation cover, particularly when soil moisture conditions are favorable. Plant growth and vigor ranges from poor to good, depending on available soil moisture provided by winter snow and summer thunderstorms.

***Midgrass Prairie***

The midgrass prairie is usually dominated by sideoats grama, sand lovegrass, bluestem grasses and switchgrass. These grasses tend to be taller and form patches of "bunchgrass" when climatic conditions and grazing favor better range condition. Forbs fill in the open areas between "bunchgrass" clumps when soil moisture conditions are favorable. Sand sage and yucca are common in most of the midgrass areas. Areas with little or no vegetation cover are highly susceptible to wind erosion. Climatic and available soil moisture conditions are similar to those found in the shortgrass prairie type.

**Exhibit III-16  
Long-Term Special Use Authorizations  
Grassland Environment**

**Recreation Special Uses** - Playgrounds and target ranges are the types of recreation special use permits. There are a total of 2 permits totaling 21 acres.

**Agricultural Special Uses** - Fences and livestock pastures are included in these types of uses. There are 3 permits totaling 3 acres.

**Community or Public Information Special Uses** - Solid and liquid waste disposal sites are included in this category of uses. There are 2 permits covering 12 acres.

**Research and Historical Special Uses** - The SE Colorado Research Station is authorized under this category of use.

**Industrial Special Uses** - Storage sites, processing plants, (oil and gas related), and mineral materials (common variety) are the type of special uses in this category. Currently there are 16 permits occupying 171 acres. This includes one mile of access road.

**Energy Generation and Transmission Special Uses** - The types of uses in this category include oil and gas pipelines, and electrical transmission and distribution lines.

There are 226 authorizations which occupy 1,715 acres on the Comanche and Cimarron National Grasslands.

**Transportation Special Uses** - There are 12 permits authorizing 28 miles (256 acres) of road rights of way. These are State and County roads.

**Communication Special Uses** - There are five permits authorizing use of two sites for communication (microwave, two-way radio, radio broadcast, TV translators, etc.) uses. Total area involved is 10 acres.

Five permits authorize 51 miles (102 acres) of telephone lines.

**Water Related Special Uses** - There are 6 permits authorizing 32 miles (42 acres) for water transmission pipelines.

Exhibit III-17

Vegetation Summaries - Mountain Environment

(NFS lands, excluding designated and recommended wilderness)

Forest Type	GEOGRAPHIC ZONE 3			Total
	0-15%	16-40%	> 40%	
Aspen	5,074	13,244	5,283	23,601
Douglas-fir	5,753	37,054	56,387	99,194
Ponderosa pine	12,656	25,384	19,093	57,133
Lodgepole pine	609	5,124	3,459	9,192
Spruce-fir	2,644	14,323	12,458	29,425
Bristlecone pine	48	397	3,189	3,634
Pinon-juniper	915	10,186	22,739	33,840
<b>Total</b>	<b>27,699</b>	<b>105,712</b>	<b>122,608</b>	<b>256,019</b>

Non-Forest Type	GEOGRAPHIC ZONE 3			Total
	0-15%	16-40%	> 40%	
Mtn. grassland	6,233	11,128	2,671	20,032
Cambel oak	0	3,661	9,521	13,182
Sagebrush	0	125	99	224
Mtn. mahogany	18	901	2,499	3,418
*Other	1,574	2,144	7,607	11,325
<b>Total</b>	<b>7,825</b>	<b>17,959</b>	<b>22,397</b>	<b>48,181</b>

Forest Type	GEOGRAPHIC ZONE 4			Total
	0-15%	16-40%	> 40%	
Aspen	755	7,137	3,856	11,748
Douglas-fir	462	30,272	24,104	54,838
Ponderosa pine	1,612	13,174	7,901	22,687
Lodgepole pine	0	420	232	652
Spruce-fir	221	12,763	7,792	20,776
Bristlecone pine	124	8,315	5,178	13,617
Pinon-juniper	0	0	0	0
<b>Total</b>	<b>3,174</b>	<b>72,081</b>	<b>49,063</b>	<b>124,318</b>

Non-Forest Type	GEOGRAPHIC ZONE 4			Total
	0-15%	16-40%	> 40%	
Mtn. grassland	603	2,793	2,724	6,120
Cambel oak	352	1,119	1,152	2,623
Sagebrush	0	0	0	0
Mtn. mahogany	0	0	0	0
*Other	805	2,031	4,176	7,011
<b>Total</b>	<b>1,760</b>	<b>5,943</b>	<b>8,051</b>	<b>15,754</b>

Forest Type	GEOGRAPHIC ZONE 1			Total
	0-15%	16-40%	> 40%	
Aspen	3,263	18,323	10,013	31,599
Douglas-fir	724	8,433	10,585	19,742
Ponderosa pine	2,485	4,000	3,109	9,594
Lodgepole pine	10,043	41,019	25,160	76,222
Spruce-fir	2,158	45,768	36,529	84,455
Bristlecone pine	0	1,909	3,042	4,951
Pinon-juniper	28	1,944	3,895	5,867
<b>Total</b>	<b>18,701</b>	<b>121,396</b>	<b>92,333</b>	<b>232,430</b>

Non-Forest Type	GEOGRAPHIC ZONE 1			Total
	0-15%	16-40%	> 40%	
Mtn. grassland	898	14,973	22,936	38,807
Cambel oak	85	45	679	809
Sagebrush	361	1,949	1,153	3,463
Mtn. mahogany	0	759	1,701	2,460
*Other	2,647	22,841	49,919	75,407
<b>Total</b>	<b>3,991</b>	<b>40,567</b>	<b>76,388</b>	<b>120,946</b>

Forest Type	GEOGRAPHIC ZONE 2			Total
	0-15%	16-40%	> 40%	
Aspen	3,108	21,022	6,851	30,981
Douglas-fir	3,913	21,226	22,175	47,314
Ponderosa pine	3,797	7,825	4,685	16,307
Lodgepole pine	309	5,237	1,546	7,092
Spruce-fir	3,600	27,769	19,704	51,073
Bristlecone pine	15	1,018	7,243	8,276
Pinon-juniper	1,904	8,970	4,880	15,754
<b>Total</b>	<b>16,646</b>	<b>93,067</b>	<b>67,084</b>	<b>176,797</b>

Non-Forest Type	GEOGRAPHIC ZONE 2			Total
	0-15%	16-40%	> 40%	
Mtn. grassland	6,927	7,112	6,039	20,078
Cambel oak	79	3,526	5,034	8,639
Sagebrush	0	0	57	57
Mtn. mahogany	57	40	648	745
SPECIAL ECOSYSTEM				
Alpine				
Riparian				
*Other	907	2,062	16,654	19,623
<b>Total</b>	<b>7,970</b>	<b>12,740</b>	<b>28,432</b>	<b>49,142</b>

\*Other includes willow, krummolz, talus/rock and lake/pond.

Vegetation summaries continued -  
(NFS lands, excluding designated and recommended wilderness)

GEOGRAPHIC ZONE 5				
Forest Type	0-15%	16-40%	> 40%	Total
Aspen	2,528	3,268	0	5,796
Douglas-fir	8,079	85,039	54,033	147,151
Ponderosa pine	22,187	90,805	31,668	144,660
Lodgepole pine	3,642	19,929	3,011	26,582
Spruce-fir	1,477	7,892	1,017	10,386
Bristlecone pine	34	725	125	884
Pinon-juniper	0	1,037	231	1,268
<b>Total</b>	<b>37,947</b>	<b>208,695</b>	<b>90,085</b>	<b>336,727</b>

GEOGRAPHIC ZONE 5				
Non-Forest Type	0-15%	16-40%	> 40%	Total
Mtn. grassland	2,635	898	53	3,586
Gambel oak	75	1,009	1,865	2,949
Sagebrush	0	52	0	52
Mtn. mahogany	130	238	766	1,134
<b>*Other</b>	<b>1,393</b>	<b>136</b>	<b>641</b>	<b>2,170</b>
<b>Total</b>	<b>4,233</b>	<b>2,333</b>	<b>3,325</b>	<b>9,891</b>

GEOGRAPHIC ZONE 6				
Forest Type	0-15%	16-40%	> 40%	Total
Aspen	665	5,500	80	6,245
Douglas-fir	512	2,896	199	3,607
Ponderosa pine	613	1,627	0	2,240
Lodgepole pine	0	0	0	0
Spruce-fir	278	8,225	162	8,665
Bristlecone pine	173	7,251	2,040	9,464
Pinon-juniper	0	0	0	0
<b>Total</b>	<b>2,241</b>	<b>25,499</b>	<b>2,481</b>	<b>30,221</b>

GEOGRAPHIC ZONE 6				
Non-Forest Type	0-15%	16-40%	> 40%	Total
Mtn. grassland	2,871	11,498	0	14,369
Gambel oak	0	0	0	0
Sagebrush	0	0	0	0
Mtn. mahogany	0	0	0	0
<b>*Other</b>	<b>0</b>	<b>61</b>	<b>30</b>	<b>91</b>
<b>Total</b>	<b>2,871</b>	<b>11,559</b>	<b>30</b>	<b>14,460</b>

\*Other includes willow, krummolz, talus/rock and lake/pond.

GEOGRAPHIC ZONE 7				
Forest Type	0-15%	16-40%	> 40%	Total
Aspen	3,818	7,273	200	11,291
Douglas-fir	1,250	26,537	4,903	32,690
Ponderosa pine	23,727	41,388	3,411	68,526
Lodgepole pine	62	19,929	194	20,185
Spruce-fir	2,158	17,693	2,006	21,857
Bristlecone pine	1,776	11,782	2,730	16,288
Pinon-juniper	0	32	0	32
<b>Total</b>	<b>32,791</b>	<b>105,631</b>	<b>13,444</b>	<b>151,866</b>

GEOGRAPHIC ZONE 7				
Non-Forest Type	0-15%	16-40%	> 40%	Total
Mtn. grassland	17,203	11,273	229	28,705
Gambel oak	0	0	0	0
Sagebrush	0	0	0	0
Mtn. mahogany	86	186	11	283
<b>*Other</b>	<b>671</b>	<b>529</b>	<b>181</b>	<b>1,381</b>
<b>Total</b>	<b>17,960</b>	<b>11,988</b>	<b>421</b>	<b>30,369</b>

GEOGRAPHIC ZONE 8				
Forest Type	0-15%	16-40%	> 40%	Total
Aspen	7,042	20,165	1,968	29,175
Douglas-fir	1,816	5,833	2,071	9,720
Ponderosa pine	3,528	9,701	1,745	14,974
Lodgepole pine	6,967	30,810	5,250	43,027
Spruce-fir	4,519	45,630	8,858	59,007
Bristlecone pine	405	6,674	2,016	9,095
Pinon-juniper	0	0	0	0
<b>Total</b>	<b>24,277</b>	<b>118,813</b>	<b>21,908</b>	<b>164,998</b>

GEOGRAPHIC ZONE 8				
Non-Forest Type	0-15%	16-40%	> 40%	Total
Mtn. grassland	4,916	25,625	14,884	45,425
Gambel oak	0	0	0	0
Sagebrush	0	0	0	0
Mtn. mahogany	0	120	63	183
<b>*Other</b>	<b>2,968</b>	<b>11,901</b>	<b>14,057</b>	<b>28,926</b>
<b>Total</b>	<b>7,884</b>	<b>37,646</b>	<b>29,004</b>	<b>74,534</b>

**Exhibit III-18  
Summary of Alpine Area Acres  
Mountains**

Geographic Zone	Alpine Acres	Total NFS Acres	% Alpine
1	112229	322584	35
2	28359	206251	14
3	11441	277693	4
4	12176	127866	10
5	105	316407	0
6	0	40788	0
7	1170	166356	1
8	73169	218660	33
<b>TOTAL</b>	<b>238649</b>	<b>1676605</b>	

**Exhibit III-19  
Special Uses  
Mountain and Grassland Environments**

KIND OF USE - GEOGRAPHIC ZONE 4	NO.	ACRES	MILES
RECREATION	30	446	
AGRICULTURE			
COMMUNITY AND PUBLIC INFORMATION	2	2	1
RESEARCH AND HISTORIC	2	2	
INDUSTRY	4	33	1
ENERGY GENERATION AND TRANSMISSION	13	137	46
TRANSPORTATION	26	933	45
COMMUNICATION	20	76	74
WATER	31	1,340	43
<b>TOTAL USES</b>	<b>128</b>	<b>2,969</b>	<b>210</b>

KIND OF USE - GEOGRAPHIC ZONE 1	NO.	ACRES	MILES
RECREATION	38	1,511	
AGRICULTURE	1	1	
COMMUNITY AND PUBLIC INFORMATION	2	2	1
RESEARCH AND HISTORIC	2	3	
INDUSTRY	6	43	
ENERGY GENERATION AND TRANSMISSION	24	592	101
TRANSPORTATION	30	596	62
COMMUNICATION	36	82	49
WATER	31	2,130	28
<b>TOTAL USES</b>	<b>170</b>	<b>4,960</b>	<b>240</b>

KIND OF USE - GEOGRAPHIC ZONE 5	NO.	ACRES	MILES
RECREATION	116	391	1
AGRICULTURE	4	395	
COMMUNITY AND PUBLIC INFORMATION	8	6	1
RESEARCH AND HISTORIC			
INDUSTRY			
ENERGY GENERATION AND TRANSMISSION	10	409	118
TRANSPORTATION	82	624	84
COMMUNICATION	16	192	151
WATER	17	411	8
<b>TOTAL USES</b>	<b>253</b>	<b>2,428</b>	<b>367</b>

KIND OF USE - GEOGRAPHIC ZONE 2	NO.	ACRES	MILES
RECREATION	7	619	
AGRICULTURE	10	788	
COMMUNITY AND PUBLIC INFORMATION	3	3	1
RESEARCH AND HISTORIC			
INDUSTRY			
ENERGY GENERATION AND TRANSMISSION	4	10	2
TRANSPORTATION	10	475	26
COMMUNICATION	16	15	6
WATER	22	38	17
<b>TOTAL USES</b>	<b>72</b>	<b>1,948</b>	<b>52</b>

KIND OF USE - GEOGRAPHIC ZONE 6	NO.	ACRES	MILES
RECREATION			
AGRICULTURE	2	41	
COMMUNITY AND PUBLIC INFORMATION			
RESEARCH AND HISTORIC			
INDUSTRY			
ENERGY GENERATION AND TRANSMISSION			
TRANSPORTATION			
COMMUNICATION			
WATER			
<b>TOTAL USES</b>	<b>2</b>	<b>41</b>	

KIND OF USE - GEOGRAPHIC ZONE 3	NO.	ACRES	MILES
RECREATION	5	49	
AGRICULTURE	9	2,006	
COMMUNITY AND PUBLIC INFORMATION	2	1	
RESEARCH AND HISTORIC			
INDUSTRY	2	3	
ENERGY GENERATION AND TRANSMISSION	6	180	26
TRANSPORTATION	18	147	19
COMMUNICATION	14	31	14
WATER	22	55	16
<b>TOTAL USES</b>	<b>78</b>	<b>2,472</b>	<b>75</b>

Special Uses Continued

KIND OF USE - GEOGRAPHIC ZONE 7	NO.	ACRES	MILES
RECREATION	7	69	
AGRICULTURE	7	554	2
COMMUNITY AND PUBLIC INFORMATION	1	2	
RESEARCH AND HISTORIC	2	30	
INDUSTRY	6	669	106
ENERGY GENERATION AND TRANSMISSION	18	36	10
TRANSPORTATION	13	10	
COMMUNICATION	10	94	2
WATER			
TOTAL USES	64	1,494	120

KIND OF USE - GEOGRAPHIC ZONE 8	NO.	ACRES	MILES
RECREATION	49	168	
AGRICULTURE	2	62	
COMMUNITY AND PUBLIC INFORMATION	3	7	
RESEARCH AND HISTORIC	1	9	
INDUSTRY	3	190	18
ENERGY GENERATION AND TRANSMISSION	26	728	118
TRANSPORTATION	5	5	
COMMUNICATION	25	4,128	55
WATER			
TOTAL USES	114	5,297	191

KIND OF USE - GEOGRAPHIC ZONE 9	NO.	ACRES	MILES
RECREATION	1	1	1
AGRICULTURE			
COMMUNITY AND PUBLIC INFORMATION			
RESEARCH AND HISTORIC			
INDUSTRY	6	66	37
ENERGY GENERATION AND TRANSMISSION	1	128	7
TRANSPORTATION	3	21	16
COMMUNICATION			
WATER			
TOTAL USES	11	216	61

KIND OF USE - GEOGRAPHIC ZONE 10	NO.	ACRES	MILES
RECREATION	1	10	
AGRICULTURE	1	1	1
COMMUNITY AND PUBLIC INFORMATION			
RESEARCH AND HISTORIC	1	3,908	
INDUSTRY	5	43	19
ENERGY GENERATION AND TRANSMISSION	2	24	4
TRANSPORTATION	5	36	13
COMMUNICATION	1	1	1
WATER			
TOTAL USES	15	4,022	37

KIND OF USE - GEOGRAPHIC ZONE 11	NO.	ACRES	MILES
RECREATION			
AGRICULTURE	2	12	1
COMMUNITY AND PUBLIC INFORMATION			
RESEARCH AND HISTORIC	3	35	
INDUSTRY	11	165	45
ENERGY GENERATION AND TRANSMISSION	3	52	6
TRANSPORTATION	1	1	1
COMMUNICATION			
WATER			
TOTAL USES	20	265	53

KIND OF USE - GEOGRAPHIC ZONE 12	NO.	ACRES	MILES
RECREATION			
AGRICULTURE	1	1	1
COMMUNITY AND PUBLIC INFORMATION			
RESEARCH AND HISTORIC			
INDUSTRY	20	214	44
ENERGY GENERATION AND TRANSMISSION	1	3	1
TRANSPORTATION			
COMMUNICATION			
WATER			
TOTAL USES	22	218	45

KIND OF USE - GEOGRAPHIC ZONE 13	NO.	ACRES	MILES
RECREATION	1	11	
AGRICULTURE			
COMMUNITY AND PUBLIC INFORMATION	13	136	
RESEARCH AND HISTORIC	184	1,227	490
INDUSTRY	5	49	10
ENERGY GENERATION AND TRANSMISSION	2	55	22
TRANSPORTATION	6	44	32
COMMUNICATION			
WATER			
TOTAL USES	211	1,522	554

KIND OF USE - GEOGRAPHIC ZONE 13	NO.	ACRES	MILES
RECREATION	1	11	
AGRICULTURE			
COMMUNITY AND PUBLIC INFORMATION	13	136	
RESEARCH AND HISTORIC	184	1,227	490
INDUSTRY	5	49	10
ENERGY GENERATION AND TRANSMISSION	2	55	22
TRANSPORTATION	6	44	32
COMMUNICATION			
WATER			
TOTAL USES	211	1,522	554

## FOOTNOTES

- <sup>1</sup> Greystone Development Consultants, Inc.; Socioeconomic and Cost Efficiency Analysis to Support the Oil and Gas Leasing EIS for the Pike/San Isabel National Forests and the Cimarron/Comanche National Grasslands; Englewood, CO.; November 1989. USDA, Forest Service; Smith, E. L., Oil and Gas Leasing, Economic Analysis Report, November 1991, pp 21-end.
- <sup>2</sup> Clean Air Act Amendments of 1977; Act of August 7, 1977 (P.L. 95-95, 91 Stat. 685, as amended; 42 U.S.C. 7401, 7418, 7470, 7472, 7474, 7475, 7491, 7506, 7602).
- <sup>3</sup> Colorado Oil and Gas Leasing and Development, Final Environmental Impact Statement, January 1991, U.S. Department of the Interior, Bureau of Land Management, Colorado State Office, p.3-18.
- <sup>4</sup> R.G. Walsh. 1988. A Comparison of Long Run Forecasts of Demand for Fishing, Hunting, and Nonconsumptive Wildlife Recreation BAsed on the 1980 and 1985 National Surveys. Department of Agriculture and Resource Economics, Colorado State University, Fort Collins, Colorado. pp 1-18.
- <sup>5</sup> P.L. Hansen, S.W. Chaddle, and R.D. Pfister. 1988. Riparian Dominance Types of Montana. Miscellaneous Publication No. 49. Montana Forest and Conservation Experiment Station. School of Forestry, University of Montana, Missoula, Montana. pp 1-18.
- <sup>6</sup> Ibid.
- <sup>7</sup> L.M. Cowardin, V. Carter, F.C.Golet and E.T. LaRoe. 1979. Classification of Wetlands and Deepwater Habitats of the United States. FSW/OBS-79/31. Office of Biological Sciences. U.S. Fish and Wildlife Service, Washington, DC, pp 1-24.
- <sup>8</sup> Ibid.
- <sup>9</sup> P.L. Hansen, S.W. Chaddle and R.D. Pfister. 1988. Riparian Dominance Types of Montana. Miscellaneous Publication No. 49. Montana Forest and Conservation Experiment Station. School of Forestry, University of Montana, Missoula, Montana. pp 1-18.
- <sup>10</sup> B.L. Melton, R.L. Hoover, R.L. Moore and D.J. Pfankuch. 1987. Aquatic and Riparian Wildlife, pp. 263 and 267, pp. 267-304 in R.L. Hoover and E.. Wills, eds. Managing Forested Lands for Wildlife. Colorado Division of Wildlife in Cooperation with USDA Forest Service, Rocky Mountain Region, Denver, Colorado, pp 263 and 267.
- <sup>11</sup> USDA, Forest Service; Johnston, B.C., (Draft) Alpine Ecosystems and Their Management in the Southern and Central Rocky Mountains, March 1991, pp 2.
- <sup>12</sup> Ibid, pp 4.
- <sup>13</sup> U.S. Fish and Wildlife Service. 1983. Revised Greenback Cutthroat Trout Recovery Plan. Prepared by the Greenback Cutthroat Trout Recovery Team. USFWS, Denver, Colorado.
- <sup>14</sup> USDA, Forest Service, letter of 10/26/88.
- <sup>15</sup> Extracted from Transportation Information System (TIS) 12/90 (system C, Fort Collins Computer Center (FCCC)).

- <sup>16</sup> Pike and San Isabel National Forests and Comanche and Cimarron National Grasslands, Land and Resource Management Plan, October 18, 1984, Chapter II, p 67.
- <sup>17</sup> U.S. Geological Survey-Water Supply Paper 1819-I, Ground-Water Development in the High Plains of Colorado, 1966, pg. 18.
- <sup>18</sup> USDA, Forest Service; Chavez, L. C., Hydrologist's Specialist Report, 5/10/91, p. 6.
- <sup>19</sup> Behnke, R. and Zarn, M., 1976. Biology and management of threatened and endangered trouts. USDA Forest Service General Technical Report RM-28. Rocky Mountain Forest and Rangae Experimental Forest. Fort Collins, Colorado, pp. 19-22.
- <sup>20</sup> Trotter, P.C., 1987. Cutthroat: Native Trout of the West. Colorado Associated University Press, Boulder, Colorado, pp 163-169.
- <sup>21</sup> Londquist, Clark J. and Livingston, Russell K., 1978. Water Resources Appraisal of the Wet Mountain Valley, in Parts of Custer and Fremont Counties, Colorado, U.S. Geological Survey, Water Resources Investigation, 78-1.
- <sup>22</sup> Behnke, R. and Zarn, M., 1976. Biology and management of threatened and endangered trouts. USDA Forest Service General Technical Report RM-28. Rocky Mountain Forest and Range Experimental Forest. Fort Collings, Colorado. Pp 19-22.
- <sup>23</sup> Ibid.
- <sup>24</sup> Pike and San Isabel National Forests, Comanche and Cimarron national Grasslands, Planning Action 4, 1981, Analysis of the Management Situation, p. 252.
- <sup>25</sup> Behnke, R. and Zarn, M., 1976. Biology and management of threatened and endangered trouts. USDA Forest Service General Technical Report RM-28. Rocky Mountain Forest and Range Experimental Forest. Fort Collins, Colorado, pp. 19-22.
- <sup>26</sup> Nehring, R.B. and Anderson, R., 1981. Stream Fisheries Investigations. Job Progress Report. Project F-51-R-6 Colorado Division of Wildlife, Denver, Colorado. Pp. 27-31.
- <sup>27</sup> Nehring, R.B., 1986. Stream Fisheries Investigations. Federal Aid Project F-51-R Colorado Division of Wildlife, Denver, Colorado, pp 26-28.
- <sup>28</sup> Behnke, R. and Zarn, M., 1976. Biology and management of threatened and endangered trouts. USDA Forest Service General Technical Report RM-28. Rocky Mountain Forest and Range Experimental Forest. Fort Collins, Colorado, pp. 19-22.
- <sup>29</sup> Colorado Water Quality Control Division, 1988. Colorado Nonpoint Assessment Report, Denver, Colorado, pp 36-62.
- <sup>30</sup> Behnke, R. and Zarn, M., 1976. Biology and management of threatened and endangered trouts. USDA Forest Service General Technical Report RM-28. Rocky Mountain Forest and Range Experimental Forest. Fort Collins, Colorado, pp. 19-22.
- <sup>31</sup> Schumm, S.A. and Lichty, R.W., 1963. Channel Widening and Flood jplain Construction Along the Cimarron River in Southwestern Kansas: U.S. Geological Survey Professional Paper 352-D, pg 73.

<sup>32</sup> Cross, F.B., Moss, R.E. and Collins, J.T., 1985. Assessment of Dewatering Impacts on Stream Fisheries in the Arkansas and Cimarron Rivers. Museum of Natural History, Lawrence, Kansas, pp 1-28, 63-70.

<sup>33</sup> Personal communication with Wayne Shepperd, Silviculturist, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, February 1991.

<sup>34</sup> USDA Forest Service, 1974. Visual Resource Management System, Handbook #462, Vol. 2, Chp. 1, p. 43.

## **CHAPTER IV**

# **CHAPTER IV**

## **ENVIRONMENTAL CONSEQUENCES**

### **INTRODUCTION**

#### **Decisions to be Made**

In this chapter, we will discuss the effects of four alternatives for the management of a leasing program on National Forest System (NFS) and split-estate lands within the Pike and San Isabel National Forests and the Comanche and Cimarron National Grasslands (the Unit). As discussed in more detail in the Purpose and Need section of Chapter I, the current Forest Plan does not meet the new requirements of the Forest Service oil and gas regulations which implement the Leasing Reform Act. The regulations require that a Forest or area-wide analysis be completed which discloses the effects of alternative management strategies. These effects are to be based on reasonably foreseeable post-leasing activity determined for each alternative. The regulations also require that the constraints (stipulations) which will be applied to a lease be disclosed through an analysis prior to the lease being offered for sale. This EIS will meet the requirements of the oil and gas regulations and the National Environmental Policy Act (NEPA). This chapter discusses the effects of the leasing alternatives and provides the effects disclosure the Forest Supervisor needs to make three related decisions: 1) Forest Plan amendment; 2) land availability decision; and 3) specific lands decision.

A Forest Plan amendment will be prepared to incorporate this analysis and its resulting land availability decisions. As discussed in more detail on the staged decision process in Chapter I of this EIS, the land availability decision will identify the lands that will be administratively available for leasing and the stipulations that will be necessary to protect the resources on those lands. This is a programmatic, planning level decision which requires analysis and disclosure of effects from a "reasonable foreseeable post-leasing activity" scenario, or RFD, to satisfy requirements of the oil and gas regulations. It also requires justification of supplemental stipulations which will be applied to leases on available lands.

The specific lands decision identifies the specific lands that will be authorized for leasing. The decision is subject to monitoring which will occur at the time that a specific lease parcel has been proposed to the Forest Service through the BLM. The monitoring will address the verification determinations made in the Record of Decision (ROD) based on this EIS: 1) adequate NEPA disclosure for specific lands; 2) inclusion of appropriate lease terms and stipulations with leases for specific lands; and 3) determination that operations and development can occur somewhere on each proposed lease, except where prohibited by the No Surface Occupancy stipulation. This monitoring will occur on all lands when they are proposed for lease. Pending lease monitoring forms may be included with the ROD. Activity authorized by the specific lands decision is also subject to analysis, after lease issuance, to approve or deny a proposed Surface Use Plan of Operation. This plan is submitted at the Application for Permit to Drill (APD) stage and allows additional mitigation requirements if necessary to adequately protect surface resources (36 CFR Section 228.107(b)(iii)).

# **The Leasing Process**

The leasing process is outlined in Figure I-7 and described in more detail in Chapter I. In summary, there are at least two site-specific NEPA decisions which must occur during the leasing process, the specific lands decision and the APD decision, which is the first time a specific ground-disturbing proposal is known. The decision to consent to lease specific land will be based upon this EIS. Approval of APD will be made based on additional NEPA and tiered to this document. The level of information available in this EIS is consistent with information used to make past decisions to lease lands. The decision is based on an anticipated level of development with no known proposal for specific ground-disturbing activities. That information is not available until the lessee makes a decision to explore for oil or gas and submits an APD.

In order to disclose the effects of reasonably foreseeable development activity this analysis assumes that we are applying the management alternatives to proposals at the APD stage (36 CFR Section 228.102(c)(4)). This development is hypothetical in nature for analysis purposes only and is not intended to reflect any actual proposals. In actual implementation, no ground-disturbing activities can occur until after the site-specific decision, based on future NEPA analysis at the APD stage, approves it.

## **Lessee Rights Granted During Leasing Process**

As outlined in Figure I-8 and described in more detail in that Chapter, the three related leasing decisions listed in the first paragraph of this chapter which will be documented in the ROD do not directly grant any lessee rights. Lessee rights are not granted until after the monitoring is completed, authorization is granted and the lease is purchased. At that time, the lessee has the exclusive right to apply for permission to drill on the purchased lease, subject to applicable lease terms, conditions of approval and supplemental stipulations. The lessee does not have the right to construct drilling and support facilities until an APD and associated Surface Plan of Operations is approved at the APD NEPA stage shown in the lower half of Figure I-7. The Forest Service can deny operating plans if necessary to adequately protect surface resources.

## **Speculative Nature of Oil and Gas Leasing**

As discussed on in Chapters I and III, oil and gas leasing and post-leasing activity are speculative in nature. Consent to lease specific lands does not always result in lease issuance by the BLM, submission of APD's by the lessee, approval of APD's by the Forest Service, or post-leasing activity by the lessee. These stages are subject to market conditions and industry interest at any given point in time, and approval of APD's.

Post-leasing activities are particularly speculative on the Mountains, which have few known or probable oil or gas deposits. This speculative nature distinguishes oil and gas leasing from other activities authorized by the Forest Service that are reasonably certain to proceed to development. Another oil and gas program distinction is that the actual location of ground-disturbing activity is not known until after a lease is sold and an APD is submitted and approved.

## Affected Environment

The affected environment encompasses the entire Unit which includes the Grasslands and Mountains of the Pike and San Isabel National Forests and Cimarron and Comanche National Grasslands and adjacent split-estate lands. Chapter III of this EIS describes the affected environment in detail. In summary, the Unit was divided into 13 geographic zones. Each zone was made up of several watersheds with similar environmental characteristics. The criteria used to determine similarity included landform, geology, climate, vegetation and soils. The Grasslands were subdivided into a total of 5 geographic zones, including 3 zones on the Comanche and 2 zones on the Cimarron. The Mountains were subdivided into 8 geographic zones.

Several representative wells hypothetical were located within each geographic zone and analyzed separately from the analysis of reasonably foreseeable development (RFD) in (Chapter IV representative wells analysis section). This additional analysis provides a basis for the justification of stipulations and supplements the effects disclosure should actual development not occur where it was projected by the RFD. The affected environment and alternative effects for representative wells are discussed together in this chapter. The RFD wells were also linked to geographic zones. This allows the effects disclosure for RFD to be applied to other similar environments when monitoring the specific lands decision.

The interdisciplinary team (IDT) used existing data base information, aerial photograph interpretation and personal knowledge to develop resource overlays for over 250 quad base maps on the Unit. These resource overlays provide site-specific resource information available at the "leasing specific lands" stage of the leasing process. Resource overlays were the basis for the effects analysis and development of supplemental stipulations for effects mitigation. They will also be used for implementation of leasing decisions, as described in more detail on pages I-39 through I-50 of this EIS. While we do not know exact locations of future wells, we do know the resources and, from past experience, the effects of drilling and mitigation available under Standard Lease Terms or stipulation.

## Level of Detail

In general, site-specificity requirements increase from the land availability decision, to the specific lands decision and, finally, to the APD NEPA decision. These are displayed in Figure I-7, the Leasing Process Flow Chart. The availability decision is programmatic and transfers no right to public resources. The specific lands decision is an intent to transfer right to public resources. However, as discussed in the "Lessee Rights Granted" section of this introduction, no right to public resources is transferred until monitoring is completed, authorization is granted, and the lease is purchased. Therefore, the availability and specific lands decisions will result in a Forest Plan amendment that makes no irreversible and irretrievable commitment of resources. The APD decision does commit resources, subject to approval of the APD and environmental analysis that meets the site-specificity requirements of NEPA appropriate for resource commitment.

The specific lands decision is the only site-specific decision that will be made in the ROD based on this EIS. It, again, will be subject to monitoring before the BLM is actually authorized to advertise a lease for sale. As discussed earlier, oil and gas leasing is speculative in nature. "Leasing site-specificity" is based on information available at the "leasing specific lands" stage of the leasing process. At this stage, we must project "reasonable foreseeable post-leasing activity" (RFD) without the knowledge of actual locations of ground-disturbing activities on sold lease parcels. The resource maps developed for this analysis provide an adequate level of detail for the specific lands

decision, knowing that this decision does not in itself grant lessee rights, is subject to monitoring prior to lease advertisement and sale, and does not preclude the opportunity to deny operating plans at the APD stage, if necessary to protect surface resources.

The most site-specific decision may or may not authorize ground-disturbing activities and the commitment of natural resources. This decision is made after a lease has been sold. "Drilling site-specificity" is based on information available at the time that an APD and Surface Use Plan of Operation is submitted and considered in the second site-specific NEPA stage. At that time, actual location of ground-disturbing activities is known and analyzed.

This section outlines the methodology used by the interdisciplinary team IDT to meet the requirements of the oil and gas regulations and NEPA.

## Methodology

This EIS provides the basis for the land availability decision and the specific lands decision. The affected environment and environmental consequences sections were combined for both decisions. These sections were made site-specific to the extent required and possible for the specific lands decision, rather than having separate discussions for the land availability and the specific lands decisions. The basic information available to make both decisions is the same. The only difference is that a parcel boundary is needed to monitor the specific lands decision prior to the authorization to advertise the lease. It is not known if, and or when, drilling may occur at the time of either decision.

The Pike and San Isabel National Forests and the Comanche and Cimarron National Grasslands could not effectively be analyzed as one unit and still meet site-specificity requirements. There is much variation between administrative subunits including the development and level of RFD. Three RFD's were developed. The Cimarron and Comanche each have individual RFD's based on historical activity and mineral potential. All of the Mountain districts were combined in the BLM established "Mountain RFD".

The analysis process varied between the Mountains and the Grasslands. The ability to project a reliable "known" level of activity and development is much greater on the Grasslands. They have a history of development that is documented on well roaded, flat lands of similar vegetative types. Actual disturbance created by well development was compared and found to be "statistically similar".<sup>1</sup> All wells on the Comanche were similar and all wells on the Cimarron were similar. Rather than identifying hypothetical well locations for 210 RFD wells on the Grasslands, the IDT analyzed effects of 12 representative wells located on the 4 major land types. The IDT used statistical similarities to project effects of 210 wells based on this representative well analysis and the RFD distribution by major land type.

The Mountains have a wider range of slope classes, greater variety in road densities, and no historical oil or gas development to base effects on. Individual hypothetical wells were located and analyzed to generate RFD effects. The effects of the few, widely distributed, RFD wells was of such limited scope that a Concentrated RFD was developed to identify a range of effects that are possible for each alternative. The development of Concentrated RFD is described in both Chapter II and Appendix B. The effects of both the BLM provided RFD and the Concentrated RFD are disclosed to identify a range of direct and indirect effects only.

## **ON THE MOUNTAIN DISTRICTS**

There has been very little oil and gas activity on the Mountain districts. One stratigraphic test well was drilled for exploratory purposes in the 1960's. The anticipated activity identified by the BLM of 4 wells over a fifteen year period is minimal. The 4 BLM RFD wells were placed on currently leased land. These areas are the most likely to be drilled upon. The effects of one exploratory well at each of these four sites were determined and are displayed later on in this chapter.

The Concentrated RFD wells were located by the IDT in the same sensitive drainage. If the effects of these concentrated wells could be mitigated and still allow the drilling activity to occur, the IDT was reasonably certain that impacts from 4 wells drilled anywhere in the mountains could be adequately mitigated. This disclosure provides the information to make the availability decision.

## **ON THE GRASSLANDS**

There has been considerable oil and gas activity on both of the Grasslands during the last 50 years. Historical information provided the basis for the RFD and projected disturbance. Statistical analysis identified that all wells on the Cimarron were very similar in the number of acres which were directly affected through ground-disturbance. The analysis further indicated that the future development could be anticipated within acceptable statistical standards. The same analysis was completed for the Comanche with similar results. The 210 BLM RFD wells projected for the Grasslands were not actually located on the ground since the effects would be so similar by major soil or land type.

The IDT used the ninety-fifth percentile figure for each of the projected acres of disturbance per well. In other words, 95 percent of the wells on each Grassland disturbed fewer acres than this figure, which would lead to a slightly exaggerated total effect. These figures for disturbed acres per well were used to analyze the effects of implementation. Information on the development of these figures can be found in Appendix B.

## **REPRESENTATIVE WELLS**

In order to make the specific lands decision across the Unit and assess possible site-specific effects of oil and gas activity across the various environments that occur on the Unit, representative wells were located in all of the geographic zones. These wells were used to justify the supplemental stipulations as required in the availability analysis. Representative wells are positioned in the zones, on representative environments, to allow the IDT to reasonably estimate their effects. The environments for the wells on the Mountains include alpine, riparian, and land types with slope ranges of 0-15%, 16-40%, and greater than 40%.<sup>2</sup> Since actual well locations are not known until the APD stage, the IDT had to analyze hypothetical situations. The actual effects of a well located at the APD stage will be different than those determined for the representative wells, but they are not expected to be significantly greater.

Representative wells are also located on the Grasslands in each of the geographic zones. The environments for the Grasslands include riparian, canyon lands, hard lands and sandy lands. Once again, the two primary purposes of the representative wells are to provide additional site-specific analysis and justification for the supplemental stipulations.

# DEFINITIONS

This chapter discusses the short-term, long-term, direct, indirect, and cumulative effects (or impacts) of each alternative considered in this EIS. Effects and impacts as used in this EIS are synonymous.

For the purpose of this analysis, short-term effects include those effects that do not last for the entire planning period. Long-term effects are those effects that are as long or longer in duration than the planning period.

Direct effects as defined in 40 CFR 1508.8 are "caused by the action and occur at the same time and place". Indirect effects as defined in 40 CFR 1508.8 are "caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable".

40 CFR 1508.7 defines cumulative effect as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time".

RFD - Reasonable Foreseeable Development based on anticipated post-leasing activity. On the Mountains this was identified by the BLM as four exploratory wells over the 15 year planning period. It was identified to be 214 wells on the Grasslands, exploratory and production combined.

BLM RFD - The RFD wells located on sites where the likelihood of development was determined to be greatest.

Concentrated RFD - The BLM identified level of development located on an area the IDT determined was "the most sensitive" based on risk to resources.

Representative Wells - Hypothetical wells used to justify stipulations and analyze effects on various land and ecosystem types.

## DESCRIPTION OF ALTERNATIVES

The following is a brief summary of the alternatives. Chapter II presents each alternative in detail. In the comparison of alternatives it is important to note the difference between the alternatives.

### Alternative I

Current management (no action). The land identified in the Forest Plan would be available for leasing with no changes in the current management direction. This alternative would allow the use of supplemental lease stipulations required to meet current Forest Plan direction in addition to the standard lease terms.

## **Alternative II**

All currently available lands would remain available for lease under the standard lease terms. There would be no additional stipulations attached to any lease agreements.

## **Alternative III**

Currently available lands would be analyzed and a new availability determination would be made. Available lands would be subject to supplemental stipulations in the lease agreements. Approximately 91 percent of the currently available lands would still be available for leasing. Supplemental stipulation would apply to approximately 65 percent of those available lands.

## **Alternative IV**

This alternative would remove all currently available National Forest System lands from future leasing. Expiring leases would not be resold but development could occur on already leased lands. Existing leases considered to be "producing" would still be in place at the end of the planning period. That is expected to include approximately 60 percent of the Grasslands. There would be no leases at the end of the planning period on the Mountain districts.

# **ENVIRONMENTAL CONSEQUENCES**

This section projects and discusses the environmental consequences associated with oil and gas exploration and production activities, including construction of roads, drill pads, pipelines and production facilities as required in 36 CFR 228.102(c), (d) and (e). Mitigation for oil and gas activities is described in Appendix A and includes Conditions of Approval, Standard Lease Terms, and Supplemental Lease Stipulations. Mitigation requirements are found in management direction established in Chapter III of the Forest Plan.

The Representative Well Analysis will be discussed first in this chapter. It will be followed by the RFD Analysis. The RFD Well Analysis meets the requirements for the leasing analysis and provides limited site-specific analysis to support specific lands decisions. The effects discussions are separated into two sections. The first section deals with the direct and indirect, short and long-term effects of the management alternatives. It discusses the effects of the Grassland and Mountain RFD's followed by the Concentrated RFD effects. The second section discloses the cumulative effects of the management alternatives based on the BLM provided RFD's.

# **REPRESENTATIVE WELL ANALYSIS**

The two primary purposes of the representative well analysis are to justify Supplemental Stipulations for the land availability decision and to provide additional site-specific analysis to support the specific lands decision. It is unlikely that the RFD wells will occur in the same locations analyzed in the RFD Analysis section of this chapter. The Representative Wells Analysis discloses effects of post-leasing activity in a variety of environments on the Mountains and Grasslands, including

environments more sensitive to post-leasing activity than the environments affected by the RFD wells, such as alpine and riparian on the Mountains. The IDT analyzed more representative wells on the Mountains than the Grasslands, due to the greater variability of environments and the lower capability to predict average disturbance acres on the Mountains.

The representative well locations are mapped in Figures III-4, III-5 and III-6. Descriptions can be found in Figure IV-1.

**Figure IV-1  
Well Site Locations**

WELL #	GZ #	WATER-SHED	QUAD NAME	QUAD SITE #	LEGAL DESCRIPTION
1	1	71	TINCUP	1	T14S R81W SEC. 25 NWSW
2	1	71	MT. YALE	1	T14S R79W SEC. 06 SWSE
3	1	71	MT. YALE	5	T14S R80W SEC. 33 NWSE
4	1	71	BUENA VISTA WEST	2	T14S R79W SEC. 15 NENW
5	1	71	BUENA VISTA WEST	3	T14S R79W SEC. 33 NWSW
6	2	83	WELLSVILLE	1	T48N R09E SEC. 03 NESW
7	2	83	WELLSVILLE	2	T49N R09E SEC. 34 SWSW
8	2	83	WELLSVILLE	3	T48N R09E SEC. 12 SESE
9	2	83	COALDALE	5	T47N R10E SEC. 10 SENW
10	3	81	JACK HALL MTN.	1	T50N R10E SEC. 23 SENW
11	3	81	CAMERON MTN.	2	T15S R76W SEC. 17 SWSW
12	3	81	GRIBBLES PARK	3	T51N R10E SEC. 22 SWSW
13	3	81	CAMERON MTN.	4	T15S R76W SEC. 29 SESW
14	3	81	SALIDA EAST	5	T50N R10E SEC. 31 NESW
15	3	81	CAMERON MTN.	6	T15S R76W SEC. 28 NENW
16	4	17	PALMER LAKE	1	T11S R67W SEC. 19 NWNW
17	4	17	PALMER LAKE	3	T12S R68W SEC. 02 NENE
18	4	17	CASCADE	4	T13S R68W SEC. 13 SESW
19	4	17	WOODLAND PARK	5	T12S R68W SEC. 28 NWNW
20	5	3	HACKETT MTN.	1	T11S R71W SEC. 36 SWNE
21	5	3	HACKETT MTN.	2	T11S R71W SEC. 13 NESE
22	5	3	HACKETT MTN.	3	T12S R71W SEC. 02 NWSW
23	5	3	SIGNAL BUTTE	4	T11S R70W SEC. 16 NESW
24	5	3	WEST CREEK	5	T10S R70W SEC. 21 SWSE
25	6	22	DICKS PEAK	1	T14S R74W SEC. 10 SENW
26	6	22	DICKS PEAK	2	T14S R74W SEC. 17 SESE
27	6	22	BLACK MTN.	3	T15S R74W SEC. 29 NWSE
28	6	22	BLACK MTN.	4	T15S R74W SEC. 20 SENW
29	7	2	OBSERVATORY ROCK	1	T09S R74W SEC. 16 NENE
30	7	2	OBSERVATORY ROCK	2	T09S R74W SEC. 05 SWSE

WELL #	GZ #	WATER-SHED	QUAD NAME	QUAD SITE #	LEGAL DESCRIPTION
31	7	2	TARRYALL	4	T12S R72W SEC. 02 NENW
32	7	2	TARRYALL	5	T11S R73W SEC. 25 NWSE
33	7	2	TARRYALL	6	T11S R72W SEC. 34 NENW
34	8	7	JEFFERSON	1	T07S R75W SEC. 06 NWSW
35	8	7	JEFFERSON	2	T07S R76W SEC. 23 SWNW
36	8	7	MT. EVANS	3	T06S R75W SEC. 24 NWNE
37	8	7	MT. EVANS	4	T06S R75W SEC. 13 SWNW
38	8	7	MT. EVANS	5	T06S R75W SEC. 13 NWNW
39	8	7	MT. EVANS	6	T06S R75W SEC. 01 SWNE
40	8	7	MONTEZUMA	7	T06S R75W SEC. 22 NWNE
41	8	7	MONTEZUMA	8	T06S R75W SEC. 15 NWNW
42	9	51	TIMPAS	1	T25S R58W SEC. 24 SESW
43	9	51	TIMPAS	2	T25S R57W SEC. 21 NENW
44	10	60	CAMPO NW	1	T32S R47W SEC. 21 SENW
45	10	60	CAMPO NW	2	T32S R47W SEC. 28 SWSW
46	10	60	CAMPO NW	3	T33S R46W SEC. 18 SESW
47	11	62	CARRIZO MTN.	1	T33S R50W SEC. 10 NWSE
48	11	62	CARRIZO MTN.	2	T33S R50W SEC. 26 SWNW
49	12	66	ELKHART NW	1	T32S R43W SEC. 28 SWNE
50	12	66	ELKHART NW	2	T33S R42W SEC. 06 SENW
51	13	64	ROLLA NW	1	T33S R40W SEC. 04 NWNW
52	13	64	ROLLA NW	2	T33S R40W SEC. 03 NENE
53	13	64	ROLLA NW	3	T33S R40W SEC. 02 SENE

## Effects Common to All Alternatives

The following effects pertaining to cultural, paleontological, or cave resources, the vegetation resource, and semiprimitive recreation, are common to all alternatives. Common effects shall be discussed early so that the differences between alternatives can be clearly displayed.

None of the representative wells would impact known cultural, paleontological or cave resources.

Representative wells would result in the disturbance or clearing of vegetation to construct well sites, access roads and, in the case of producing wells, pipelines. Standard Lease Terms and Conditions of Approval are generally adequate to mitigate vegetation impacts below timberline. Conditions of Approval necessary to protect soil productivity also facilitate revegetation and provide additional mitigation of vegetation impacts.

Some representative wells on the Mountains are located within semiprimitive nonmotorized areas or semiprimitive motorized areas. Post-leasing activity associated with exploratory wells would cause a short-term impact on the solitude experience sought by dispersed recreation users in these areas.

## **Alternative I**

In many cases, Alternative I would have similar effects on resources as Alternative II. Alternative I effects on soils and visual resources would be similar to Alternative III effects when site-specific environments meet one or more of the following criteria found on Page III-57 of the Forest Plan: slopes steeper than 60 percent, high erosion hazard rating, high geologic hazard rating or low visual absorption capacity that prevents reclamation to the established visual quality objective. Supplemental Stipulations available in Alternatives I and III to protect soil productivity also facilitate revegetation and provide additional mitigation of vegetation impacts. Alternative I and III effects on wildlife would also be similar when post-leasing activity would occur in critical wildlife areas and activity must be prohibited more than 60 days to mitigate wildlife impacts. In these situations, Supplemental Stipulations necessary to provide adequate resource protection to meet current Forest Plan direction would be applied under Alternative I.

## **Alternatives II and III**

The following representative well analysis describes the affected environments for different well locations and discusses the effects on resources associated with implementation of Alternative II and III. Alternative II would only allow the application of Standard Lease Terms. Under Standard Lease Terms, post-leasing activity can be moved up to 200 meters and activity can be prohibited up to 60 days to mitigate impacts on resources. Alternative III would allow application of both the Standard Lease Terms and the Supplemental Stipulations. Under Supplemental Stipulations, operations can be moved more than 200 meters and activity can be prohibited more than 60 days. Appendix A provides more information concerning the application of Standard Lease Terms and Supplemental Stipulations, as well as descriptions of the Supplemental Stipulations applicable to Alternative III.

Affected resources such as visual quality would be impacted to some degree by Alternative II or III. Alternative II impacts on a given resource are acceptable if Standard Lease Terms and/or Conditions of Approval are listed in the mitigation section for that resource. If Alternative II would result in unacceptable resource impacts, Supplemental Stipulations applicable under Alternative III are listed in the mitigation section.

## **Alternative IV**

Wells 17, 18, 19, 20 and 47 are on lands currently under lease with Standard Lease Terms. Oil and gas development impacts would be similar to Alternative II for these wells.

## **MOUNTAINS**

### **GEOGRAPHIC ZONE 1**

This zone encompasses the Sawatch Range of the Continental Divide and lower positioned landforms along the Upper Arkansas River valley.

None of the Zone 1 representative wells would impact special use permit areas or Forest Service developed recreation sites.

## Well 1

**Representative Well Site:** The drill pad would occur on a deep, somewhat poorly to poorly drained alluvial soil (Riparian). A typical undisturbed site on a 16 percent slope with 80 percent ground cover has a soil loss rate of approximately 1 ton/acre/year. The well is in an opening surrounded by dense vegetation. The site is in a semiprimitive non-motorized area which is visible from the Continental Divide and a wilderness area. It is not in any critical winter range, Big Game production area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat. The projected road to this site crosses drainages three times. The well pad itself is near water with an inadequate buffer area.

Potential soil loss after disturbance would increase to about 11 tons/acre/year or nearly 3 times the soil loss tolerance rate. Erosion hazard rates and Moderate and revegetation could be limited by soil wetness. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations from possible stream flow alterations and compaction or rutting damage to soil physical properties. The combined effects would have the potential for long-term detrimental impacts to soil productivity.<sup>3</sup> The site would directly impact the water quality since it is in a riparian area. All sediment would enter the drainage. The road to the site would cross 3 drainages. These crossings are also main source of sediment input to streams.<sup>4</sup>

**Table IV-1  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Drill Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
16	11	4	4.13	1.65	45	8

**Well Mitigation:** The Controlled Surface Use (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain. This would also protect the fisheries from increased sediment. Moving the site out the riparian area would allow an adequate buffer area which could trap eroded soil from the well site and prevent it from entering the drainage. The Controlled Surface Use (Visual) would allow more flexibility in mitigating the effects on visuals. This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required 1.65 acres of disturbance on a soil type with Moderate erosion hazard. Road crosses drainages three times.

**Road Mitigation:** Affects to soils could be mitigated under Standard Terms and Conditions of Approval.

## Well 2

**Representative Well Site:** The drill pad would occur in spruce-fir growing on deep, well-drained colluvial soil with moderate limitations. A typical undisturbed site on a 16 percent slope with 80

percent ground cover has a soil loss rate of approximately 1 ton/acre/year. The well is within a semiprimitive nonmotorized area, in the middle ground as viewed from the Colorado Trail and a Wilderness Area. It is also in an Elk Winter Range.

Potential soil loss after disturbance would increase to about 4 tons/acre/year which equates to the soil loss tolerance value. Erosion hazard rates and Slight on this gently sloping bench area, and revegetation would have moderate limitations. Short-term soil losses would occur prior to effective mitigation. The well site is located over 200 feet away from a drainage. Adequate buffer area would exist to trap over 90% of the erosion from the site.

**Table IV-2  
USLE Predicted Surface Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 16	4	4	4.13		17	3
ROAD 40	13	4		20	260	46

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil and visual resource protection. Erosion mitigation is designed to keep as much sediment on site as possible and to provide timely revegetation measures. A Timing Limitation Stipulation (For Elk Winter Range) would be applied to restrict exploration, drilling, and development activities between December 1 and April 15.

**Access Road:** Road access required approximately 20 acres of vegetation disturbance on soils that have moderate erosion potential. The road would have 2 stream crossings.

**Road Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil resource protection. The road would be closed between December 1 and April 15 (Timing Limitation Stipulation) to protect the critical elk winter range.

### Well 3

**Representative Well Site:** The drill pad would occur on a deep, well-drained residual soil in an alpine ecosystem. A typical undisturbed site on a 12 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.3 ton/acre/year. The well is in the middle ground zone from established viewpoints. The visual quality objective is modification. The site is in a Mountain Goat Concentration Area and an elk winter range. It is also in the elk Management Indicator Species habitat.

Based on water erosion model results, potential soil loss after disturbance would only increase to about 3 tons/acre/year which is less than the soil loss tolerance value. Although erosion hazard is rated as slight for water erosion, exposed bare ground is also subject to severe wind erosion on mountain summits. Alpine soils are considered sensitive because harsh climatic conditions only provide limited opportunity for soil formation, and processes are reduced even further when vegetation has been removed. Revegetation potential is rated Severe, and long-term reductions

to soil productivity could result from surface impacts.<sup>5</sup> This site is over 1600 feet away from the nearest drainage and sediment delivery is projected to be only 1% of the potential soil loss.

Under Alternative II, well 3 and its road would disturb a total of 20 acres of vegetation, including 4 acres above timberline and 16 acres of subalpine forest. Under Alternative III, well 3 would disturb a maximum of one acre of alpine vegetation and no subalpine vegetation. Costly, carefully designed and implemented rehabilitation measures have resulted in successful and timely revegetation on several disturbed sites in the Rocky Mountain alpine zone.<sup>6</sup> The effects on alpine vegetation, soils, and visual quality would be short-term or long-term, depending on the success of site-specific rehabilitation measures. Alternative II would disturb more acres and would have a higher potential for long-term effects on alpine and subalpine vegetation.

Alternative II and Alternative III would be subject to special monitoring requirements for alpine lease proposals and special Conditions of Approval at the APD stage. However, the Controlled Surface Use (Alpine) stipulation could only be applied under Alternative III. This stipulation is necessary to severely restrict surface disturbance in fragile alpine ecosystems. It would also allow relocation of wells greater than 200 meters, either outside alpine or to alpine microsites more favorable for disturbance, subsequent reclamation, and mitigation of visual impacts.<sup>7</sup> Alternative III would minimize the potential for long-term, significant impacts on alpine surface resources and visual quality.<sup>8</sup> Alternative II or III would cause short-term auditory impacts during the exploratory drilling phase.

**Table IV-3**  
**USLE Predicted Surface Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 12	3	4	3.81		12	1
ROAD 40	13	4		16	169	30

**Well Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation and other special forms of mitigation which may be required to adequately protect the soil resource. The Controlled Surface Use (Alpine Ecosystems) stipulation is necessary to minimize disturbance to fragile alpine surface resources.

To protect the Mountain Goat Concentration Area, Elk Winter Range, and an Elk Calving Area. The stipulations would restrict activities between December 1 and July 1 to protect wildlife.

**Access Road:** Road access required approximately 16 acres of disturbance on forested soils adjacent to the alpine ecosystem. Erosion factors have moderate erosion potential. There are 4 stream crossings.

**Road Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil resource protection. Under Alternative IV the Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife. The CSU (Alpine Ecosystem) would prohibit new road construction in alpine. This would eliminate the stream crossing and associated increase in sediment yield.

## Well 4

**Representative Well Site:** The drill pad would occur in a grassy opening on a deep, somewhat excessively drained glacial soil. A typical undisturbed site on a 12 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.4 tons/acre/year. The site is within an Abert's Squirrel Winter Concentration Area, Elk and Mule Deer Winter Range, and is in Elk, Albert's Squirrel and Mule Deer Management Indicator Species habitat. The well and road would be located in an area with a visual quality objective of modification. The well site is over 600 feet away from the nearest drainage. Sediment yield would only be 1% of the potential soil loss.

Potential soil loss after disturbance would increase to about 4 tons/acre/year which equates to the soil loss tolerance value. Erosion hazard rates Slight on this gently sloping ground moraine, but revegetation potential is limited by droughty moisture conditions and surface rock. Short-term soil losses would occur prior to effective revegetation.

**Table IV-4**  
**USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
12	4	4	3.81	15	3

**Well Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil and visual resource protection. Under Alternative III Timing Stipulations would be applied to protect the wildlife. It would restrict activities in the area from December 1 through July 1.

**Access Road:** Road access required minimal disturbance on a soil type with slight erosion hazard.

**Road Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil resource protection. There are no stream crossings.

## Well 5

**Representative Well Site:** The drill pad would occur in aspen growing on a shallow, somewhat excessively drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 12 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.3 tons/acre/year. The site is in a natural opening and is visible from South Cottonwood Creek, a heavily used dispersed recreation area. It is also in a Mule Deer Winter Range and an Elk Calving Area. This site is near an ephemeral drainage and there would not be an adequate buffer between the site and the drainage. Sediment yield would be 100% of the mitigated potential soil loss.

Potential soil loss after disturbance would increase to about 3 tons/acre/year or approximately 3 times the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible.

**Table IV-5  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 12	3	1	3.81		11	2
ROAD 12	3	1		0.07	0.2	0
16	4	4		2.75	11	2
30	13	4		1.57	21	4
40	13	4		1.48	19	3

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. Under Alternative III, the Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad and a short segment of road (12 percent slope) beyond 200 meters where deeper soils may exist. This would also provide adequate buffer to help trap sediment and prevent it from reaching the drainage. Timing Stipulations applied to protect wildlife would restrict activities in the area from December 1 to July 1.

**Access Road:** Road access required approximately 6 acres of disturbance on soils and other erosion factors that have moderate erosion potential. The road has 3 stream crossings, which increase the potential of sediment yield to reach a stream.

**Road Mitigation:** If the small segment of road on 12 percent slope could be moved to a deeper soil in close proximity, the Standard Terms and Conditions of Approval would allow adequate soil resource protection for remaining road segments. Timing Stipulations under Alternative III would prohibit road use between December 1 and July 1 to protect wildlife.

## Geographic Zone 2

This zone includes the southern end of the Wet Mountain Range which is the eastern extent of the Rocky Mountains, the Sangre de Cristo Range, and the prominent Spanish Peaks which are a pair of volcanic plugs which rise sharply from the surrounding plains.

None of the Zone 2 Representative Wells would impact special use permit areas, Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use.

## Well 6

**Representative Well Site:** The drill pad would occur on a deep, somewhat poorly to moderately well-drained alluvial soil (Riparian). A typical undisturbed site on a 20 percent slope with 80 percent ground cover has a soil loss rate of approximately 1 ton/acre/year. The site is visible from a 4WD road. It is in Mule Deer Winter Range, a Turkey Winter Range and Concentration Area, an Elk Production/Calving Area, and a Deer fawning area.

Potential soil loss after disturbance would increase to about 14 tons/acre/year which exceeds the soil loss tolerance rate by over 3 times. Erosion hazard rates Moderate and revegetation could be

limited by soil wetness. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations from possible stream flow alterations and compaction or rutting damage to soil physical properties. The combined effects would have the potential for long-term detrimental impacts to soil productivity. Since the site is in a riparian area, 100% of the potential soil loss could reach the stream due to an inadequate buffer area.

**Table IV-6  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
20	14	4	4.52	63	12

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. Under Alternative III, the Controlled Surface Use (CSU) (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain. This would also protect the fisheries from increased sediment, and give more flexibility in mitigating the effects on visuals (well site could be moved more than 200 meters). In addition, Timing Stipulations would be applied to protect wildlife. It would prohibit activities in the area from December 1 to July 1. This riparian area is narrow enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required minimal disturbance on the same riparian soil type and potential for significant adverse impacts. There are no stream crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain. Timing stipulations would restrict road use between December 1 and July 1 to protect wildlife.

## Well 7

**Representative Well Site:** The drill pad would occur in spruce-fir growing on a deep, well-drained colluvial soil with moderate limitations. A typical undisturbed site on a 20 percent slope with 80 percent ground cover has a soil loss rate of approximately 1 ton/acre/year. The well is visible from a 4WD road. It is in a Mule Deer Winter Range, a Turkey Winter Range and Concentration Area, and a Mule Deer fawning area. The well and road would not be located in a visually sensitive area.

Potential soil loss after disturbance would increase to about 10 tons/acre/year which exceeds the soil loss tolerance rate by over 3 times. Erosion hazard rates Moderate, and revegetation potential would have moderate limitations. Short-term soil losses would occur prior to effective mitigation. The site is over 200 feet away from a drainage so the sediment yield would only be about 1% of the potential soil loss.

**Table IV-7  
USLE Predicted Surface Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 20	10	4	4.52		18	8
ROAD 30	15	3		2.22	33	6

**Well Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil and visual resource protection. Under Alternative III, Timing Stipulations would be applied to protect wildlife. It would prohibit activities in the area from December 1 and July 1.

**Access Road:** Road access required approximately 2 acres of disturbance on a moderately deep soil with moderate erosion potential. The road has 2 drainage crossings which increases the potential for sediment yield to reach a stream.

**Road Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil resource protection. The supplemental Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife.

### Well 8

**Representative Well Site:** The drill pad would occur in Douglas-fir growing on a moderately deep, well-drained residual soil with Severe limitations. A typical undisturbed site on a 40 percent slope with 80 percent ground cover has a soil loss rate of approximately 2 tons/acre/year. The road and well site are visible from the Rainbow Trail. It is not in any critical winter range, Big Game production areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 18 tons/acre/year which exceeds the soil loss tolerance rate by 6 times. Erosion hazard rates Severe, and revegetation potential would have Severe limitations. The risk of significant impacts and long-term reductions to soil productivity would result from surface impacts on this soil. Mitigation would be costly and long-term. This site is over 800 feet from the nearest drainage and sediment yield would only be about 1% of the potential soil loss.

**Table IV-8  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 40	18	3	8.35		150	28
ROAD 30 50	26 27	4 3		6.01 3.19	159 86	30 16

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. Under Alternative III, the Controlled Surface Use (Soils) stipulation offers opportunity for relocation to an area with less slope gradient. If relocation is not possible, special mitigation and conservation practices will be required to adequately protect the soil from long-term damage and to facilitate timely revegetation.

**Access Road:** Road access required approximately 9 acres of disturbance on soil types with severe management implications. Steep slopes should be avoided to prevent significant amounts of accelerated erosion. The road segment on 30 percent slope occurred in a riparian ecosystem where potential exists for long-term detrimental impacts. There are 2 drainage crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation to avoid unnecessary impacts to fragile soils on steep slopes and/or riparian drainageways.

### Well 9

**Representative Well Site:** The drill pad would occur in Douglas-fir growing on a deep, well-drained glacial soil with moderate limitations. A typical undisturbed site on a 8 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.3 tons/acre/year. It is not in any critical winter range, Big Game production areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat. The well and road would not be located in a visually sensitive area.

Potential soil loss after disturbance would increase to about 3 tons/acre/year which equates to the soil loss tolerance value. Erosion hazard rates Slight on this gently sloping bench area, and revegetation would have moderate limitations. Short-term soil losses would occur prior to effective mitigation. Although the well site is over 400 feet from the nearest drainage, there is a steep slope between the site and drainage. The sediment yield will be 30% of the potential soil loss.

**Table IV-9  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 8	3	4	3.53		10	2
ROAD 30	15	4		4.05	60	11
40	19	3		2.23	43	8
50	27	3		2.77	75	14

**Well Mitigation:** The Standard Terms and Conditions of Approval would allow adequate protection of all resources.

**Access Road:** Road access required approximately 9 acres of disturbance on soils and other erosion factors that have Severe erosion potential. Access Road on steep slopes should be avoided to prevent significant amounts of accelerated erosion. There are 2 drainage crossings which increase the potential for sediment yield to reach a stream.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation to areas with less slope gradient to reduce significant impacts on these fragile soil types.

### GEOGRAPHIC ZONE 3

This zone is in the Upper Arkansas River valley including the Arkansas Hills; as well as in the Wet Mountain Range north of Greenhorn Mountain.

None of the Zone 3 representative wells would impact special use permit areas, Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use.

### Well 10

**Representative Well Site:** The drill pad would occur in pinyon-juniper growing on a shallow, somewhat excessively drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 40 percent slope with 80 percent ground cover has a soil loss rate of approximately 1 ton/acre/year. The site is in a Mule Deer Winter Range and a Deer fawning area. The well and road would be located in an area with a visual quality objective of modification.

Potential soil loss after disturbance would increase to about 23 tons/acre/year which significantly exceeds the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. The well site is over 200 feet away from a drainage and sediment yield is expected to be 2% of the potential soil loss.

**Table IV-10  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 40	23	1	8.34		192	35
ROAD 20	8	4		6.42	51	9
40	23	1		2.23	51	9
50	33	1		0.56	19	3
60	38	1		11.15	424	77

**Well Mitigation:** Standard Lease Terms would adequately protect the visual resource. The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad beyond 200 meters where deeper soils may exist. If relocation is not possible, special mitigation and conservation practices may be required to adequately protect the soil from long-term damage and to facilitate revegetation. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1.

**Access Road:** Road access required approximately 20 acres of disturbance on shallow soils with Severe management implications. Access Road on shallow soils with steep slopes should be avoided to prevent significant amounts of accelerated erosion and long-term impacts to the soil resource. The access road has 8 drainage crossings. This greatly increases the potential for road sediment to reach a stream.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of road segments to areas with less slope gradient and possibly deeper soils and fewer drainage crossings. Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife.

## Well 11

**Representative Well Site:** The drill pad would occur in aspen growing on a shallow, somewhat excessively drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 8 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.3 tons/acre/year. The well site is visible from Forest Service Road 187. The site is in a Mule Deer Winter Range and Fawning area.

Potential soil loss after disturbance would increase to about 4 tons/acre/year or approximately 4 times the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. The well site occurs in an ephemeral drainage. Sediment yield could be 100% of the potential soil loss.

**Table IV-11  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
8	4	1	3.53	15	2

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. Under Alternative III, the Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad and a short segment of road beyond 200 meters where deeper soils may exist. If relocation is not possible, special mitigation and conservation practices may be required to adequately protect the soil from long-term damage. Timing Stipulations would be applied to protect wildlife. It would prohibit activities in the area from December 1 to July 1.

**Access Road:** Road access required minimal disturbance on a gentle slope with the same shallow soil. There are no drainage crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the access road and drill pad to a deeper soil. Timing Stipulations would prohibit road use between December 1 and July 1 to protect wildlife.

### Well 12

**Representative Well Site:** The drill pad would occur on a deep, somewhat poorly to moderately well-drained alluvial soil (Riparian). A typical undisturbed site on a 20 percent slope with 80 percent ground cover has a soil loss rate of approximately 1 ton/acre/year. The site is in a Mule Deer Winter Range and Fawning area. The well and road would not be located in a visually sensitive area.

Potential soil loss after disturbance would increase to about 14 tons/acre/year which exceeds the soil loss tolerance rate by over 3 times. Erosion hazard rates Moderate and revegetation could be limited by soil wetness. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations from possible stream flow alterations and compaction or rutting damage to soil physical properties. The combined effects would have the potential for long-term detrimental impacts to soil productivity. The sediment yield would be 100% of the potential soil loss since the site is in a riparian area.

**Table IV-12  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
20	14	4	4.52	63	12

**Well Mitigation:** Standard Lease Terms would adequately protect the visual resource. The Controlled Surface Use (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain. This would also protect the fisheries from

increased sediment. Timing Stipulations would also be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1. This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required minimal disturbance on the same riparian soil type and potential for significant adverse impacts. There are no drainage crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain. Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife.

### Well 13

**Representative Well Site:** The drill pad would occur in aspen growing on a shallow, well-drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 4 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.04 tons/acre/year. The site is in a Mule Deer Winter Range and Fawning area. The well and road would not be located in a visually sensitive area.

Potential soil loss after disturbance would increase to about 1 ton/acre/year which equates to the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. The site is over 1000 feet from the nearest drainage and no sediment is expected to reach the drainage.

**Table IV-13  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
4	1	1	3.30	3	0.4

**Well Mitigation:** Standard Lease Terms would adequately protect the visual resource. The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad and a short segment of road beyond 200 meters where deeper soils may exist. If relocation is not possible, special mitigation and conservation practices may be required to adequately protect the soil from long-term damage. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1.

**Access Road:** Road access required minimal disturbance on a gentle slope with the same shallow soil. There are no drainage crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the access road and drill pad to a deeper soil. Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife.

## Well 14

**Representative Well Site:** The drill pad would occur in pinyon-juniper growing on a shallow, well-drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 6 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.2 tons/acre/year. The site is within a Big Horn Sheep Concentration Area and Lambing Area, and Mule Deer Winter Range and Fawning Area. The well and road would not be located in a visually sensitive area.

Potential soil loss after disturbance would increase to about 3 tons/acre/year or approximately 3 times the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. The site is located over 500 feet from the nearest drainage. The steep, south facing slope between the site and the drainage would allow 3% of the potential soil loss to reach the drainage.

**Table IV-14  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 6	3	1	3.41		10	2
ROAD 30	18	1		8.63	155	28
50	33	3		1.73	57	10
30	13	1		2.48	33	6

**Wells Mitigation:** Standard Lease Terms would adequately protect the visual resource. The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad beyond 200 meters where deeper soils may exist. If relocation is not possible, special mitigation and conservation practices may be required to adequately protect the soil from long-term damage and to facilitate revegetation. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1.

**Access Road:** Road access required approximately 13 acres of disturbance on shallow soils with Severe management implications on over 85 percent of the road acres. Access Road on shallow erodible soils should be avoided to prevent significant amounts of accelerated erosion and long-term impacts to the soil resource. There are 2 drainage crossings which increase the potential for sediment to reach a drainage.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of road segments to areas with less slope gradient and/or deeper soils. Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife.

## Well 15

**Representative Well Site:** The drill pad would occur in a grassy opening on a deep, well-drained alluvial-outwash soil. A typical undisturbed site on a 10 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.1 tons/acre/year. The site is in a Mule Deer Winter Range and Fawning area. The well and road would not be located in a visually sensitive area.

Potential soil loss after disturbance would increase to about 4 tons/acre/year which equates to the soil loss tolerance value. Erosion hazard rates Slight on this gently sloping alluvial fan, but revegetation potential is often limited by droughty moisture conditions and surface rock. Short-term soil losses would occur prior to effective mitigation. There is inadequate buffer between the site and nearest drainage and sediment yield is expected to be 100% of the potential soil loss.

**Table IV-15**  
**USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
10	4	4	3.66	15	1

**Well Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil and visual resource protection. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1. Standard Lease Terms would allow the site to be moved up to 200 meters which would allow for an adequate buffer area.

**Access Road:** Road access required minimal disturbance on a soil type with Slight erosion hazard.

**Road Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil and visual resource protection. Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife. There is one drainage crossing which increase the potential for road sediment to reach a stream.

## GEOGRAPHIC ZONE 4

This zone is comprised of Pikes Peak and surrounding mountains, the southern portion of Rampart Range, and inclusions of dispositional fans lying east of Manitou Park.

None of the Zone 4 representative wells would impact Forest Service developed recreation sites. Well 17 is the only oil and gas development that could impact a special use permit area.

## Well 16

**Representative Well Site:** The drill pad would occur on a deep, moderately well-drained alluvial soil (Riparian). A typical undisturbed site on level relief with 80 percent ground cover has a no appreciable soil loss. It is not in any critical winter range, Big Game Production Area, or Management Indicator Species or T&E habitat. The well and road would not occur in visually sensitive area or an area of concentrated dispersed recreation use.

Potential soil loss after disturbance would increase to about 0.3 tons/acre/year which is less than the soil loss tolerance value. Erosion hazard rates Slight and revegetation could be limited by soil wetness. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations from possible stream flow alterations and compaction or rutting damage to soil physical properties. The combined effects would have the potential for long-term detrimental impacts to soil productivity. Sediment yield would be 100% of the potential soil loss since the site is in a riparian area and there is little or no buffer area.

**Table IV-16  
USLE Predicted Surface Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 0	0.3	4	3.10		1	0.1
ROAD 40	17	1		7.23	123	24

**Well Mitigation:** Standard Lease Terms would adequately protect the visual resource. The Controlled Surface Use (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain. This would also protect the fisheries from increased sediment, and give more flexibility in mitigating the effects on visuals (well site could be moved more than 200 meters). This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required approximately 7 acres of disturbance on a shallow soil with Severe management implications. Access Road on shallow soils with steep slopes should be avoided to prevent significant amounts of accelerated erosion and long-term impacts to the soil resource. The road has 2 drainage crossings which increase the potential for road sediment to reach a stream.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road to areas with less slope gradient and/or deeper soils.

### Well 17

**Representative Well Site:** The drill pad would occur in Douglas-fir growing on a shallow, somewhat excessively drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 14 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.4 tons/acre/year. It is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat. The site is in a drainage which is over its sediment Threshold Limit. Oil and gas development would occur near a recreation special use permit area (Beaver Lakes).

Potential soil loss after disturbance would increase to about 4 tons/acre/year or approximately 4 times the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses

can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. Oil and gas development and traffic would cause a short-term, direct impact on the Beaver Lakes summer home group. Sediment yield would only be 1% of the potential soil loss since there is adequate buffer area between the site and the nearest drainage. This 1% increase would still be a violation of the Forest Plan since the drainage is exceeding sediment threshold limits.

**Table IV-17  
USLE Predicted Surface Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 14	4	1	3.96		16	3
ROAD 20	7	1		8.13	57	10

**Well Mitigation:** Standard Lease Terms would protect the visual resource and permittee investments on the Beaver Lakes special use permit area. The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of activities to areas where deeper soils may exist, but direct impacts on moderate slopes can generally be mitigated through carefully applied erosion-control Conditions of Approval. The Controlled Surface Use (Water) stipulation would be applied to protect the drainage from increased sediment loading. No sediment producing activities (Well site, road, etc.) would be allowed until existing disturbed acres in the watershed are revegetated.

**Access Road:** Road access required approximately 8 acres of disturbance on a shallow soil with Severe management implications. Access Road on shallow erodible soils should be avoided where possible to prevent significant amounts of accelerated erosion and potential long-term impacts. There is one drainage crossing.

**Road Mitigation:** Direct impacts on moderate slopes can generally be mitigated through carefully applied erosion-control Conditions of Approval (for soils). The CSU (Water) stipulation would allow new road construction, but only after enough existing disturbed acres in the watershed are rehabilitated.

## Well 18

**Representative Well Site:** The drill pad would occur in Douglas-fir growing on a shallow, somewhat excessively drained residual soil on a ridge top with management limitations associated with soil depth. A typical undisturbed site on a 16 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.5 tons/acre/year. The well site and road is visible in the foreground from the Rampart Range Road. This road receives substantial dispersed recreation use. There is sparse vegetation for cover. It is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 6 tons/acre/year or approximately 6 times the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be mini-

mized to the extent possible. The site is over 200 feet from the nearest drainage and sediment yield is only expected to be 1% of the potential soil loss. Even this small amount would be a violation of the Forest Plan since this watershed exceeds sediment threshold limits.

**Table IV-18**  
**USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
16	6	1	4.13	25	4

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of activities to areas where deeper soils may exist, but direct impacts on moderate slopes can generally be mitigated through carefully applied erosion-control Conditions of Approval. If relocation is not an option, special mitigation and conservation practices may be required to adequately protect the soil from potential long-term damage and to facilitate revegetation. The Controlled Surface Use (Water) stipulation would be applied to protect the drainage from increased sediment loading. No sediment producing activities (well site, road, etc.) would be allowed until enough existing disturbed acres are rehabilitated.

**Access Road:** Road access required minimal disturbance on a gentle slope with the same shallow soil. Access Road on shallow erodible soils should be avoided where possible to prevent significant amounts of accelerated erosion and potential long-term impacts. There are no drainage crossings.

**Road Mitigation:** Direct impacts on gentle slopes can generally be mitigated through carefully applied erosion-control Conditions of Approval (for soils). Because the drainage is at its sediment threshold limit, the CSU (Water) stipulation would allow new road construction, but only after enough existing disturbed acres are rehabilitated.

## Well 19

**Representative Well Site:** The drill pad would occur in spruce-fir growing on a deep, well-drained soil. A typical undisturbed site on a 12 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.2 tons/acre/year. The access road is visible, but not the well site. The site is within a Mule Deer Winter Range and Fawning area. The site is in an area which receives concentrated dispersed recreation use.

Potential soil loss after disturbance would increase to about 3 tons/acre/year which is less than the soil loss tolerance value. Erosion hazard rates Slight on this gently sloping alluvial fan, and revegetation potential is rated Moderate. Short-term soil losses would occur prior to effective mitigation. Sediment yield would only be 1% of the potential soil loss. Even this small amount would be a violation of the Forest Plan since this watershed exceeds sediment threshold limits.

**Table IV-19  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
12	3	4	3.81	11	2

**Well Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil and visual resource protection. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1. The Controlled Surface Use (Water) stipulation would be applied to protect the drainage from increased sediment loading. No sediment producing activities (well site, road, etc.) would be allowed until enough existing disturbed acres in the watershed are rehabilitated.

**Access Road:** Road access required minimal disturbance on a soil type with Slight erosion hazard. There are no drainage crossings.

**Road Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil resource protection. Timing Stipulations would restrict road use between December 1 and July 1. Because the drainage is at its sediment threshold limit, the CSU (Water) stipulation would allow new road construction, but only after enough disturbed acres are rehabilitated.

## GEOGRAPHIC ZONE 5

This zone covers most of the Rampart Range north of the South Platte River Canyon and a portion of land east of Mt. Evans Wilderness, and adjacent lands to the west including the eastern foothills of the Tarryall mountains and Lost Creek Wilderness.

None of the Zone 5 representative wells would impact special use permit areas, Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use.

### Well 20

**Representative Well Site:** The drill pad would occur in Douglas-fir growing on a deep, well-drained soil. A typical undisturbed site on a 6 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.1 tons/acre/year. The well site is visible in the foreground from the Cedar Mountain Road. The site is not in any critical winter range, Big Game Production Areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 4 tons/acre/year which equates to the soil loss tolerance value. Erosion hazard rates Moderate on this gently sloping alluvial fan, and revegetation potential is rated Slight. Short-term soil losses would occur prior to effective mitigation. Sediment yield would only be 1% of the potential soil loss.

**Table IV-20  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
6	4	4	3.41	14	1

**Well Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil resource protection. The Controlled Surface Use (Visual) would allow flexibility to mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on a soil type with Moderate erosion hazard. There are no drainage crossings.

**Road Mitigation:** The Standard Terms and Conditions of Approval would allow adequate soil resource protection. The CSU (Visual) would mitigate visual impacts.

### Well 21

**Representative Well Site:** The drill pad would occur in Douglas-fir growing on a shallow, somewhat excessively drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 8 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.2 tons/acre/year. The well site and access road are visible in the foreground from the Cedar Mountain Road. The site is not in any critical winter range, Big Game Production Areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 3 tons/acre/year or approximately 3 times the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. Sediment yield is only expected to be 1% of the potential soil loss.

**Table IV-21  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
8	3	1	3.53	11	2

**Well Mitigation:** Direct impacts on moderate slopes can generally be minimized through carefully applied erosion-control Conditions of Approval and mitigation. If relocation is not an option, special mitigation and conservation practices may be required to adequately protect the soil from potential long-term damage and to facilitate revegetation. The Controlled Surface Use (Visual) would allow more flexibility to mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on a gentle slope with the same shallow soil. Access Road on shallow erodible soils should be avoided where possible to prevent signifi-

cant amounts of accelerated erosion and potential long-term impacts. There are no drainage crossings.

**Road Mitigation:** Direct impacts on gentle slopes can generally be mitigated through carefully applied erosion-control Conditions of Approval. The CSU (Visual) would mitigate visual impacts.

## Well 22

**Representative Well Site:** The drill pad would occur in Douglas-fir growing on a shallow, somewhat excessively drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 16 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.5 tons/acre/year. The site would be seen from Forest Service Road 204. The site is within a Mule Deer Winter Range and Fawning Area.

Potential soil loss after disturbance would increase to about 6 tons/acre/year or approximately 6 times the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. There is inadequate buffer area between the site and nearest drainage. Sediment yield could be 100% of the potential soil loss.

**Table IV-22**  
**USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
16	6	1	4.13	25	4

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. Direct impacts on moderate slopes can generally be mitigated through carefully applied erosion-control measures under the Conditions of Approval. If relocation is not an option, special mitigation and conservation practices may be required to adequately protect the soil from potential long-term damage and to facilitate revegetation. Standard Lease Terms would allow the well to be relocated up to 200 meters. This would provide adequate buffer area to reduce sediment yield. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1.

**Access Road:** Road access required minimal disturbance on a gentle slope with the same shallow soil. Access Road on shallow erodible soils should be avoided where possible to prevent significant amounts of accelerated erosion and potential long-term impacts. There are no drainage crossings.

**Road Mitigation:** Direct impacts on gentle slopes can generally be mitigated through carefully applied erosion-control Conditions of Approval. Timing Stipulations would restrict road use between December 1 and July 1 for wildlife.

## Well 23

**Representative Well Site:** The drill pad would occur on a deep, somewhat poorly to moderately well-drained alluvial soil (Riparian). A typical undisturbed site on a 30 percent slope with 80 percent ground cover has a soil loss rate of approximately 1 ton/acre/year. The site is visible from Turkey

Creek and Lost Valley Ranch. The site is not in any critical winter range, Big Game Production Areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 19 tons/acre/year which exceeds the soil loss tolerance rate by over 4 times. Erosion hazard rates Moderate and revegetation could be limited by soil wetness. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations from possible stream flow alterations and compaction or rutting damage to soil physical properties. The combined effects would have the potential for long-term detrimental impacts to soil productivity. Since the site is in a riparian area, soil loss is expected to directly impact the drainage. Sediment yield would be 100% of the potential soil loss.

**Table IV-23**  
**USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
30	19	4	5.88	111	10

**Well Mitigation:** Standard Lease Terms would mitigate visual and riparian impacts. The well would be moved out of the riparian area under Standard Lease Terms. The Controlled Surface Use (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain.

**Access Road:** Road access required minimal disturbance on the same riparian soil type and potential for significant adverse impacts. There are no drainage crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain. The No Surface Occupancy (Riparian) stipulation would not allow the road in the riparian, other than to cross it.

## Well 24

**Representative Well Site:** The drill pad would occur in Douglas-fir growing on a shallow, somewhat excessively drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 8 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.2 tons/acre/year. The well site and access road are visible in the foreground from Forest Service Road 523. The site is not in any critical winter range, Big Game Production Areas, Management Indicator Species, or T&E habitat.

Potential soil loss after disturbance would increase to about 3 tons/acre/year or approximately 3 times the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. This site occurs over 1000 feet away from the nearest drainage. No sediment yield to the drainage is expected.

**Table IV-24  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
8	3	1	3.53	11	2

**Well Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad and a short segment of road beyond 200 meters where deeper soils may exist. If relocation is not possible, special mitigation and conservation practices be required to adequately protect the soil from long-term damage and to facilitate timely revegetation. The Controlled Surface Use (Visual) stipulation would be necessary to mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on a gentle slope with the same shallow soil. There are no drainage crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the access road and drill pad to a deeper soil. The CSU (Visual) stipulation would mitigate visual impacts.

## GEOGRAPHIC ZONE 6

This zone lies in the southwest corner of the Pike National Forest, extending northeast from Black Mountain beyond Thirty-nine Mile Mountain to the vicinity of Saddle Mountain.

None of the Zone 6 representative wells would impact special use permit areas, Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use.

### Well 25

**Representative Well Site:** The drill pad would occur on a deep, somewhat poorly drained alluvial soil (Riparian). A typical undisturbed site on a 8 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.2 tons/acre/year. The well site is adjacent to an existing road. The site is not in any critical winter range, Big Game Production Areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 5 tons/acre/year which exceeds the soil loss tolerance rate. Erosion hazard rates Moderate and revegetation could be limited by soil wetness. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations from possible stream flow alterations and compaction or rutting damage to soil physical properties. The combined effects would have the potential for long-term detrimental impacts to soil productivity. Since the site is in a riparian area, there will be direct impacts to the drainage 100% of the potential soil loss is expected to reach the drainage.

**Table IV-25  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
8	5	4	3.53	18	2

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. The Controlled Surface Use (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain. This would also protect the fisheries from increased sediment. This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required minimal disturbance on the same riparian soil type and potential for significant adverse impacts. There is one drainage crossing which could add road sediment directly to the stream.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain. The No Surface Occupancy (Riparian) would not allow the road in the riparian, other than to cross it.

### Well 26

**Representative Well Site:** The drill pad would occur in grassy opening on a deep, well-drained residual soil with moderate limitations. A typical undisturbed site on a 10 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.1 ton/acre/year. The well site is visible below an existing road. The site is not in any critical winter range, Big Game Production Areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 5 tons/acre/year which exceeds the soil loss tolerance rate. Erosion hazard rates Moderate, and revegetation potential would have moderate limitations. Short-term soil losses would occur prior to effective mitigation. Sediment yield is only expected to be 1% of the potential soil loss.

**Table IV-26  
USLE Predicted Surface Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 10	5	4	3.66		18	2
ROAD 16	8	3		0.64	5	1

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil and visual resource protection.

**Access Road:** Road access required less than 1 acre of disturbance on the same soil type with moderate erosion potential. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection of all resources.

## Well 27

**Representative Well Site:** The drill pad would occur in spruce-fir growing on a deep, well-drained residual soil with moderate limitations. A typical undisturbed site on a 16 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.7 ton/acre/year. The site is not in any critical winter range, Big Game Production Areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat. The site is in a middle ground zone with a retention visual quality objective.

Potential soil loss after disturbance would increase to about 8 tons/acre/year which exceeds the soil loss tolerance rate by 2 times. Erosion hazard rates Moderate, and revegetation potential has moderate limitations. Short-term soil losses would occur prior to effective mitigation. The site is over 1000 feet away from the nearest drainage so no sediment yield is anticipated.

**Table IV-27**  
**USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 16	8	4	4.13		33	6
ROAD 12	6	3		1.78	11	1
16	8	4		0.73	6	1
20	10	3		1.61	16	3
30	20	4		3.78	76	13

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. The Controlled Surface Use (Visual) would allow adequate visual resource protection.

**Access Road:** Road access required approximately 8 acres of disturbance on similar soils with moderate erosion potential. The road has 3 drainage crossings. They would increase the potential of road sediment reaching a drainage.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. The CSU (Visual) would mitigate visual impacts.

## Well 28

**Representative Well Site:** The drill pad would occur in spruce-fir growing on a deep, well-drained residual soil with moderate limitations. A typical undisturbed site on a 16 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.7 ton/acre/year. The site is not in any

critical winter range, Big Game Production Areas, Management Indicator Species, or T&E habitat. The site is in a middle ground zone with a retention visual quality objective.

Potential soil loss after disturbance would increase to about 8 tons/acre/year which exceeds the soil loss tolerance rate by 2 times. Erosion hazard rates Moderate, and revegetation potential has moderate limitations. Short-term soil losses would occur prior to effective mitigation. The site is over 700 feet away from the nearest drainage. No sediment yield is expected.

**Table IV-28  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 16	8	4	4.13	33	6

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. The Controlled Surface Use (Visual) would allow adequate visual resource protection.

**Access Road:** Road access required minimal disturbance on the same soil type with moderate erosion potential. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. The CSU (Visual) would mitigate visual impacts.

## GEOGRAPHIC ZONE 7

This zone lies west of Lost Creek Wilderness and includes portions of the Kenosha Mountains and Tarryall Mountains extending south beyond the Puma Hills to the Eleven Mile Canyon area.

None of the Zone 7 representative well would impact special use permit areas or Forest Service developed recreation sites.

### Well 29

**Representative Well Site:** The drill pad would occur on a deep, somewhat poorly drained alluvial soil (Riparian). A typical undisturbed site on a 8 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.2 tons/acre/year. The access road is visible from U.S. Hwy 140, but hilly terrain hides the well site. Development would be near the Tarryall Road, which receives substantial dispersed recreation use. The site is within Elk and Mule Deer Winter Range, Elk calving area, and a Deer Fawning area.

Potential soil loss after disturbance would increase to about 5 tons/acre/year which exceeds the soil loss tolerance rate. Erosion hazard rates Moderate and revegetation could be limited by soil wetness. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations from possible stream flow alterations and compaction or rutting damage to soil physical properties. The combined effects would have the potential for

long-term detrimental impacts to soil productivity. Potential soil loss will directly impact the drainage since the site is in a riparian area.

**Table IV-29  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
8	5	4	3.53	18	2

**Well Mitigation:** Standard Lease Terms would allow adequate protection of the visual and riparian resources. The well could be moved out of the riparian area under Standard Lease Terms. The Controlled Surface Use (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain. This would also protect the fisheries from increased sediment. Timing Stipulations would also be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1. This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required minimal disturbance on a shallow soil with Severe management implications. Access Road on shallow erodible soils should be avoided to prevent significant amounts of accelerated erosion and long-term impacts. There is one drainage crossing.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the access road to a more gentle slope and/or deeper soil. Timing Stipulations would restrict road use between December 1 and July 1.

### Well 30

**Representative Well Site:** The drill pad would occur in a grassy opening on a shallow, well-drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 5 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.04 tons/acre/year. The access road is visible from Forest Service Road 842. Development would be near the Terryall Road, which receive substantial dispersed recreation use. The site is within Elk and Mule Deer Winter Range, Elk calving area, and a Deer Fawning area.

Potential soil loss after disturbance would increase to about 2 ton/acre/year which exceeds the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. Sediment delivery is expected to be 1% of the potential soil loss.

**Table IV-30  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
5	2	1	3.35	7	0.4

**Well Mitigation:** Standard Lease Terms would provide adequate protection of the visual resource. The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad and a short segment of road beyond 200 meters where deeper soils may exist. If relocation is not possible, special mitigation and conservation practices may be required to adequately protect the soil from long-term damage. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1.

**Access Road:** Road access required minimal disturbance on a gentle slope with the same shallow soil. There are 2 drainage crossings which would increase the potential for road sediment to reach a stream.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the access road and drill pad to a deeper soil. Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife.

### Well 31

**Representative Well Site:** The drill pad would occur in a grassy opening on a shallow, somewhat excessively drained residual soil with management limitations associated with soil depth. A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The site is within a Mule Deer Winter Range and Fawning Area. The well would be in a middle ground zone with a partial retention visual quality objective.

Potential soil loss after disturbance would increase to about 0.2 tons/acre/year which is less than the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. However, the risk of erosion damage in this case is reduced by lack of slope gradient. Even though the site is over 1000 feet away from the nearest drainage, 1% of the potential soil loss is expected to reach the drainage. This is due to the sparse vegetation in the buffer area which is on a south facing aspect.

**Table IV-31  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
0	0.2	1	3.10	0.6	0

**Well Mitigation:** Standard Lease Terms would allow adequate protection of the visual resource. Development openings would be designed to mimic natural openings in this middle ground area. The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection if mitigative measures are carefully implemented. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1.

**Access Road:** Road access required minimal disturbance on level ground with the same shallow soil. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection if mitigative measures are carefully implemented. Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife.

## Well 32

**Representative Well Site:** The drill pad would occur in dense Douglas-fir on a deep, well-drained colluvial soil with moderate limitations. A typical undisturbed site on a 20 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.1 tons/acre/year. The site is within a Big Horn Sheep, Elk, and Mule Deer Wintering Area. Development would occur in a middle ground zone, in dense vegetation.

Potential soil loss after disturbance would increase to about 5 tons/acre/year which exceeds the soil loss tolerance value. Erosion hazard rates Moderate on this moderately sloping foot slope, and revegetation has moderate limitations. Short-term soil losses would occur prior to effective mitigation. This site is 2000 feet away from the nearest drainage. No sediment yield is anticipated.

**Table IV-32**  
**USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 20	5	4	4.51	23	4

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil and visual resource protection. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from December 1 to July 1.

**Access Road:** Road access requires minimal disturbance on soils that have moderate erosion potential. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil and visual resource protection. Timing Stipulations would restrict road use between December 1 and July 1 to protect wildlife.

## Well 33

**Representative Well Site:** The drill pad would occur in a grassy opening on a shallow, well-drained residual soil with management limitations associated with soil depth. A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The site is within an Elk and Mule Deer Winter Range, Elk and Deer Calving and Fawning areas, and Bald Eagle Winter Habitat/Winter Range (T&E species). Development would occur in a middle ground zone with natural openings.

Potential soil loss after disturbance would increase to about 0.1 tons/acre/year which is less than the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. However, the risk of erosion damage in this case is reduced by lack of slope gradient. Sediment yield is expected to be 1% of the potential soil loss over through the site is 800 feet away from the nearest drainage. This is due to the sparse vegetation in the buffer area which occurs on a south facing aspect.

**Table IV-33  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
0	0.1	1	3.10	0.3	0

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil and visual resource protection if mitigative measures are carefully implemented. Timing Stipulations would be applied to protect wildlife. It would restrict activities in the area from November 15 to July 1.

**Access Road:** Road access required minimal disturbance on level ground with the same shallow soil. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil and visual resource protection if mitigative measures are carefully implemented. Timing Stipulations would restrict road use between November 15 and July 1.

## GEOGRAPHIC ZONE 8

This zone lies along a north-south ridge between the Arkansas and South Platte River from the Continental Divide to the northern edge of the Arkansas Hills. The mountainous terrain which comprises most of this area is often referred to as the Mosquito Range.

None of the Zone 8 representative wells would impact special use permit areas.

### Well 34

**Representative Well Site:** The drill pad would occur on a deep, well-drained residual soil in an alpine ecosystem. A slope of 12 percent gradient with 80 percent ground cover has a soil loss rate of approximately 0.3 ton/acre/year. Development would occur in a middle ground viewing zone with low vegetation screening capability. It is not in any critical winter range, Big Game Production Areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would only increase to about 3 tons/acre/year which is less than the soil loss tolerance value. Although erosion hazard rates Slight for water erosion, exposed bare ground is also subject to Severe wind erosion on mountain summits. Alpine soils are considered sensitive because harsh climatic conditions only provide limited opportunity for soil formation, and processes are reduced even further when vegetation has been removed. Revegetation potential is rated Severe, and long-term reductions to soil productivity could result from surface impacts.<sup>9</sup> Disturbance of alpine soils would be minimized to the extent possible. Sediment yield is expected to be 1% of the potential soil loss.

Under Alternative II, well 34 and its road would disturb a total of 17 acres of vegetation including 13 acres above timberline and 4 acres of subalpine forest. Under Alternative III, well 34 would disturb a maximum of 1 acre of alpine vegetation and no subalpine vegetation. The effects on alpine vegetation, soils, and visual quality would be short-term or long-term, depending on the success of site-specific rehabilitation measures. Alternative I would disturb more acres and would have a higher potential for long-term effects on alpine.

Alternative II and Alternative III would be subject to special monitoring requirements for alpine lease proposals and special Conditions of Approval at the APD stage. However, the Controlled Surface Use (Alpine) stipulation could only be applied under Alternative III. This stipulation is necessary to severely restrict surface disturbance in fragile alpine ecosystems. It would also allow relocation of wells greater than 200 meters, either outside alpine or to alpine microsites more favorable for disturbance, subsequent reclamation, and mitigation of visual impacts. Alternative III would minimize the potential for long-term, significant impacts on alpine surface resources and visual quality.<sup>10 11</sup> Alternative II or III would cause short-term auditory impacts during the exploratory drilling phase.

**Table IV-34  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 12	3	4	3.81		12	1
ROAD 30	10	4		7.06	71	13
40	13	4		3.89	51	9
50	27	4		1.94	52	10

**Well Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation and other special forms of mitigation which may be required to adequately protect the soil resource. The Controlled Surface Use (Alpine Ecosystems) would be applied to mitigate the effects on the fragile alpine ecosystem. The Controlled Surface Use (Visual) would be necessary to minimize impacts.

**Access Road:** Road access required approximately 9 acres of disturbance on soils with moderate to steep slopes. Approximately 2 acres of disturbance is anticipated on soils with Severe erosion potential. Under Alternative II, the road would have 6 drainage crossings. The potential for road sediment to reach a drainage would be greatly increased.

**Road Mitigation:** Under Alternative III, the Controlled Surface Use (Soils) stipulation allows relocation of this road segment to a more gentle slope. The Standard Lease Terms and Conditions of Approval would adequately protect soils on sections of road under 40 percent slope. The CSU (Alpine Ecosystem) would prohibit new road construction in alpine and would restrict surface disturbance. This would eliminate the sediment from the road.

### Well 35

**Representative Well Site:** The drill pad would occur in a dense spruce-fir growing on a deep, well-drained glacial soil. A typical undisturbed site on a 12 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.4 tons/acre/year. The well site and access road is adjacent to a high use portion of the Colorado Trail in Jefferson Creek. Development could also be visible from the Beaver Ponds Picnic Area. It is not in any critical winter range, Big Game Production Areas, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 4 tons/acre/year which equates to the soil loss tolerance value. Erosion hazard rates Moderate on this gently sloping ground moraine, and revegetation potential has moderate limitations. Short-term soil losses would occur prior to effective mitigation. The site is over 1000 feet away from the nearest drainage. No sediment yield is expected.

**Table IV-35  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 12	4	4	3.81		15	3

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. Controlled Surface Use (Visual) stipulation would be applied to mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on a soil type with Slight erosion hazard. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. The CSU (Visual) would be applied to help mitigate the effects of the road on visuals.

### Well 36

**Representative Well Site:** The drill pad would occur on a deep, poorly drained alluvial soil (Riparian). A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The well would be visible from Colorado Hwy 62 in Geneva Park, a high use dispersed recreation area. The site is within an Elk calving area. The Greenback cutthroat trout is within the drainage of the well site (T&E fish species).

Potential soil loss after disturbance would only increase to about 0.4 tons/acre/year which is less than the soil loss tolerance rate. Erosion hazard rates Slight and revegetation could be limited by soil wetness. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations from possible stream flow alterations and compaction or rutting damage to soil physical properties. The combined effects would have the potential for long-term detrimental impacts to soil productivity. Since the site is in a riparian area, all of the potential soil loss is expected to impact the drainage.

**Table IV-36  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 0	0.4	4	3.10		0.1	0

**Well Mitigation:** The Controlled Surface Use (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain. This would also protect the fisheries from increased sediment. Timing Stipulations would also be applied to protect wildlife. It would restrict activities in the area from April 15 to July 1. This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters. The Controlled Surface Use (Visual) stipulation would be applied to mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on the same riparian soil type and potential for significant adverse impacts. The road has no drainage crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation allows relocation of this road outside the stream terrace or flood plain. Timing Stipulations would restrict road use between April 15 and July 1. The CSU (Visual) would be used to mitigate the effects of the road on visuals.

### Well 37

**Representative Well Site:** The drill pad would occur on a grassy opening on a deep, well drained alluvial soil. A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The well would be visible from Colorado Hwy 62 in Geneva Park, a high use dispersed recreation area. The Greenback cutthroat trout is within the drainage of the well site (T&E fish species).

Potential soil loss after disturbance would only increase to about 0.2 tons/acre/year which is less than the soil loss tolerance value. Erosion hazard rates Slight on this gently sloping alluvial fan, and revegetation potential is rated Moderate. Short-term soil losses would occur prior to mitigation. Sediment yield is expected to be 1% of the potential soil loss even though the site is over 1000 feet away from the nearest drainage. The buffer area is on a south facing aspect and has sparse vegetation cover.

**Table IV-37  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 0	0.2	4	3.10		0.6	0

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. A Controlled Surface Use (Visual) stipulation would be applied to mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on a soil type with Moderate erosion hazard. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. The CSU (Visual) would be used to mitigate visual impacts.

### Well 38

**Representative Well Site:** The drill pad would occur in dense lodgepole pine growing on a moderately deep, well-drained residual soil with moderate limitations. A typical undisturbed site on a 12 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.3 tons/acre/year. The Greenback cutthroat trout is within the drainage of the well site (T&E fish species): The well would be within one-quarter mile of the Duck Creek Picnic Area.

Potential soil loss after disturbance would only increase to about 3 tons/acre/year which is less than the soil loss tolerance rate. Erosion hazard and revegetation potential both have Moderate ratings. Short-term soil losses would occur prior to effective mitigation. The site is over 700 feet from the nearest drainage. There is adequate vegetation in this buffer area to prevent any sediment yield from reaching the drainage.

Oil and gas development would cause a short-term increase in traffic, noise and dust in the vicinity of the picnic area.

**Table IV-38  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 12	3	3	3.81		11	1

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. A Controlled surface Use (Visual) stipulation would be applied to mitigate visual impacts. A No Surface Occupancy (Recreation) stipulation would prohibit oil and gas development within one-quarter mile of the Duck Creek Picnic Area.

**Access Road:** Road access required minimal disturbance on a deep soil with Moderate erosion potential. There are no road crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. The CSU (Visual) stipulation would be used to mitigate visual impacts. The NSO (Recreation) would prohibit road construction within 1/4 mile of the Duck Creek Picnic Area, unless alternative routes would be more environmentally damaging.

## Well 39

**Representative Well Site:** The drill pad would occur in spruce-fir growing on a deep, well-drained glacial soil. A typical undisturbed site on a 30 percent slope with 80 percent ground cover has a soil loss rate of approximately 1 ton/acre/year. Development would occur in Geneve Creek, a high use dispersed recreation area. The well site would not be visible from Colorado Hwy 62. The road would be located through the Geneva Basin Ski area.

Potential soil loss after disturbance would only increase to about 15 tons/acre/year which exceeds the soil loss tolerance value by nearly 4 times. Erosion hazard rates Moderate on this Moderately sloping ground moraine, and revegetation potential has moderate limitations. Short-term soil losses would occur prior to effective mitigation. Sediment yield would be 1% of the potential soil loss.

**Table IV-39  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 30	15	4	5.88		15	16
ROAD 30	15	4		1.31	20	2
40	19	4		1.11	21	2
50	27	4		1.51	41	4

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil and visual resource protection.

**Access Road:** Road access would require approximately 4 acres of disturbance on deep soils with moderate to steep slopes. Approximately 2.5 acres of disturbance is anticipated on soils with Severe erosion potential. The road would be located through a proposed ski area. There are no drainage crossings.

**Mitigation:** The Controlled Surface Use (Soils) stipulation allows relocation of this road segment to a more gentle slope. The Standard Lease Terms and Conditions of Approval would adequately protect soils on sections of road under 40 percent slope. The NSO (Winter Sports Sites) stipulation would prohibit road construction through the ski area, unless alternative routes would be more environmentally damaging.

## Well 40

**Representative Well Site:** The drill pad would occur in bristlecone pine growing on a shallow, well-drained residual soil with management limitations associated with soil depth. A typical undisturbed site on a 7 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.1 tons/acre/year. Development would occur in a middle ground zone with natural openings. The Greenback cutthroat trout is within the drainage of the well site (T&E fish species).

Potential soil loss after disturbance would increase to about 2 ton/acre/year which exceeds the soil loss tolerance value. Revegetation potential is limited by shallow rooting depths and droughty conditions. Accelerated soil loss on shallow soils is a concern because even minor losses can significantly reduce potential soil productivity. Disturbance of shallow soils should be minimized to the extent possible. Sediment yield would be 1% of the potential soil loss.

**Table IV-40  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 7	2	1	3.47		7	1
ROAD 20	5	3		2.41	12	2
30	10	1		3.67	37	7
40	13	3		5.19	67	12
40	26	4		1.85	48	9

**Well Mitigation:** Standard Lease Terms would allow adequate visual resource protection. The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad beyond 200 meters where deeper soils may exist. If relocation is not possible, special mitigation and conservation practices may be required to adequately protect the soil from long-term damage and to facilitate revegetation.

**Access Road:** Road access required approximately 13 acres of disturbance on forested soils with moderate to steep slopes. Approximately 5.5 acres of disturbance is anticipated on soils with Severe erosion potential. The road has 3 drainage crossings which increase the potential for road sediment to reach a stream.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation allows relocation of these road segments to more gentle slopes for soil resource protection.

### Well 41

**Representative Well Site:** The drill pad would occur in aspen growing on a deep, well-drained glacial soil. A typical undisturbed site on a 30 percent slope with 80 percent ground cover has a soil loss rate of approximately 2 tons/acre/year. Development would occur in an area with natural openings. The site is within an Elk calving area. The Greenback cutthroat trout is within the drainage of the well site (T&E fish species).

Potential soil loss after disturbance would increase to about 20 tons/acre/year which exceeds the soil loss tolerance value by 5 times. Erosion hazard rates Severe on this moderately sloping glacial moraine, and revegetation potential has moderate limitations. Sediment yield is expected to be about 4% of the potential soil loss because of the steep (80%) slope between the site and the nearest drainage.

**Table IV-41  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 30	20	4	5.88		118	21
ROAD 20	5	4		0.80	4	1
30	10	4		0.92	9	2
40	13	4		3.89	51	9

**Well Mitigation:** Standard Lease Terms would provide adequate protection of the visual resource. The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the drill pad to a more gentle slope. If relocation is not possible, special mitigation and conservation practices may be required to adequately protect the soil from long-term damage. Timing stipulation would be applied to protect wildlife. It would restrict activities in the area from April 15 to July 1.

**Access Road:** Road access required approximately 6 acres of disturbance on deep soils with moderate erosion potential. There are no road crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval allow adequate soil and visual resource protection. Timing Stipulations would restrict road use between April 15 and July 1 to protect wildlife.

## Grasslands - Comanche

### GEOGRAPHIC ZONE 9

This zone is comprised of Timpas Creek, East Purgatoire River, and Mustang Creek portions of the Comanche National Grasslands (Otero and Las Animas counties).

None of the Zone 9 representative wells would impact special use permit areas or Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use. The visual quality objective is maximum modification.

### Well 42

**Representative Well Site:** The drill pad would occur on a deep, well-drained alluvial soil (Riparian). A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The well would occur in a roaded area with existing visual impacts. It would not be visible from a nearby highway. It is within a Scaled Quail Winter Concentration Area.

Potential soil loss after disturbance would increase to about 0.4 tons/acre/year which is less than the soil loss tolerance rate. Surface erosion hazard by water rates Slight, and revegetation potential has slight limitations. Short-term soil losses would occur prior to effective mitigation, and on-site erosion could be controlled to less than the soil loss tolerance value. However, soils on these landscape positions are also susceptible to gully formations and accelerated soil loss by wind

erosion. The combined effects would have the potential for long-term detrimental impacts to soil productivity. Since the site is in a riparian area, 100% of the potential soil loss is expected to affect the drainage.

**Table IV-42  
USLE Predicted Surface Erosion for Drill Pad and Roads**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 0	0.4	4	3.10		1	0
ROAD 6	4	4		2.61	10	2

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. The Controlled Surface Use (Soils) stipulation would allow adequate protection through relocation of the drill pad outside the stream terrace or flood plain. A Timing Stipulation would be applied to protect wildlife. It would restrict activities in the area from December 1 to April 15. This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required disturbance on the same alluvial soil type (Riparian) and potential for significant adverse impacts. There are no road crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain. A Timing Stipulation would restrict road use between December 1 and April 15 to protect wildlife in this area. The No Surface Occupancy (Riparian) stipulation would move the road out of the riparian, other than to cross it.

### Well 43

**Representative Well Site:** The drill pad would occur on a moderately deep, well-drained upland soil. A typical undisturbed site on a 14 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.7 tons/acre/year. The well would be visible from private land, in an area with existing visual impacts. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species or T&E habitats.

Potential soil loss after disturbance would increase to about 7 tons/acre/year which exceeds the soil loss tolerance value by over 2 times. Surface erosion hazard by water and revegetation potential have moderate ratings. Short-term soil losses would occur prior to effective mitigation. There would be no sediment yield from the site since it is over 1000 feet away from the nearest drainage.

**Table IV-43  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
14	7	3	4.10	29	6

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate protection for all resources.

**Access Road:** Road access required minimal disturbance on a deep alluvial soil (Riparian) with moderate erosion potential. However, potential exists for adverse impacts from gully formations and accelerated wind erosion. There are no drainage crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain to avoid potential impacts (move more than 200 meters).

### GEOGRAPHIC ZONE 10

This zone is comprised of Bear Creek and Sand Arroyo portions of the Comanche National Grasslands (Carrizo Unit).

None of the Zone 10 representative wells would impact special use permit areas or Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use.

### Well 44

**Representative Well Site:** The drill pad would occur on a deep, well-drained upland soil. A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The well could not be screened from view by existing vegetation, but the visual quality objective is maximum modification. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species or T&E habitats.

Potential soil loss after disturbance would increase to about 0.4 tons/acre/year which is less than the soil loss tolerance value. Surface erosion hazard by water and revegetation potential have moderate ratings. Short-term soil losses would occur prior to effective mitigation. No sediment yield is expected, since the site is over a mile away from the nearest drainage.

**Table IV-44  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
0	0.4	4	3.10	1	0

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate protection for all resources.

**Access Road:** Road access required minimal disturbance on a deep upland soil with moderate erosion potential. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would provide adequate protection for all resources.

## Well 45

**Representative Well Site:** The drill pad would occur on a deep, somewhat excessively drained alluvial soil (Riparian). A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The visual quality objective is maximum modification. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitats.

Potential soil loss after disturbance would increase to about 0.3 tons/acre/year which is less than the soil loss tolerance rate, and surface erosion hazard by water rates Slight. However, potential soil loss from wind erosion would increase to about 134 tons/acre/year, and the wind erosion hazard rates Severe. Soils on these landscape positions are also susceptible to gully formations, but accelerated soil loss by wind erosion is the primary concern for this site. Revegetation potential has moderate limitations. The combined effects would have the potential for long-term detrimental impacts to soil productivity. Since the site is in a riparian area, sediment yield is expected to be 100% of the potential soil loss.

**Table IV-45  
Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
WATER 0	0.3	4	3.10	1	0
WIND 0	134	4	3.10	415	28

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. The Controlled Surface Use (Soils) stipulation would allow relocation of the drill pad outside the stream terrace or flood plain. This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required minimal disturbance on the same alluvial soil (Riparian) and potential for significant adverse impacts. The road has 1 drainage crossing.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain. The No Surface Occupancy (Riparian) would move the road out of the riparian area, other than to cross it.

## Well 46

**Representative Well Site:** The drill pad would occur on a deep, excessively drained sandy soil. A typical undisturbed site on level ground with 80 percent ground cover has a soil loss rate of approximately 9 tons/acre/year from wind erosion. The site is visible from U.S. Hwy 287/385. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 134 tons/acre/year which exceeds the soil loss tolerance rate by over 30 times. Natural soil loss amounts already exceed soil loss tolerance values, and the removal of existing ground cover protection significantly accelerates wind erosion soil losses. Surface erosion hazard by water rates Slight, but wind erosion hazard and revegetation potential have Severe ratings. Although revegetation is often difficult on sandy soils, the risk for significant impacts is reduced through carefully applied erosion-control Conditions of Approval. Erosion control netting and heavy applications of mulch are initially used to provide protective cover until revegetation can be accomplished. Successful reclamation from past and current leases has been demonstrated under Standard Lease Terms. Unavoidable soil losses would occur on barren surfaces, but losses should be short-term in nature until effective ground cover is restored through revegetation practices appropriate for the grassland environment. Treatment areas can be restored to soil loss levels commensurate with natural ecological conditions within 5 years. No sediment yield is expected due to the high permeability rate of sandy soils.

**Table IV-46  
Predicted Surface Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 0	134	4	3.10		415	28
ROAD 0	134	4		0.36	48	3

**Well Mitigation:** Carefully applied Standard Lease Terms and Conditions of Approval would allow adequate protection of the soil resource. The Controlled Surface Use (Visual) stipulation would be necessary to mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on the same sandy soil with Severe management implications as the well site. There is 1 drainage crossing.

**Road Mitigation:** Impacts can be controlled through carefully applied erosion-control measures under the Conditions of Approval. The CSU (Visuals) stipulation would be used to mitigate the effects of the road on visuals.

## GEOGRAPHIC ZONE 11

This zone is comprised of the Carrizo Creek portion of the Comanche National Grasslands (Carrizo Unit).

None of Zone 11 representative wells would impact special use permit areas, or Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use.

### Well 47

**Representative Well Site:** The drill pad would occur on a deep, somewhat excessively drained sandy soil. A typical undisturbed site on a 4 percent slope with 80 percent ground cover has a soil loss rate of approximately 9 tons/acre/year from wind erosion. The well site would be visible from higher ground, but the visual quality objective is maximum modification. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 134 tons/acre/year which exceeds the soil loss tolerance rate by over 30 times. Natural soil loss amounts already exceed soil loss tolerance values, and the removal of existing ground cover protection significantly accelerates wind erosion soil losses. Surface erosion hazard by water rates Slight, but wind erosion hazard and revegetation potential have Severe ratings. Although revegetation is often difficult on sandy soils, the risk for significant impacts is reduced through carefully applied erosion-control measures under the Conditions of Approval. Erosion control netting and heavy applications of mulch are initially used to provide protective cover until revegetation can be accomplished. Successful reclamation from past and current leases has been demonstrated under Standard Lease Terms. Unavoidable soil losses would occur on barren surfaces, but losses should be short-term in nature until effective ground cover is restored through revegetation practices appropriate for the grassland environment. Treatment areas can be restored to soil loss levels commensurate with natural ecological conditions within 5 years. No sediment yield is expected due to the high permeability rates of sandy soils.

**Table IV-47  
Predicted Wind Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 4	134	4	3.30		442	30
ROAD 4	134	4		0.70	94	6

**Well Mitigation:** Carefully applied Standard Lease Terms and Conditions of Approval would allow adequate protection of all resources.

**Access Road:** Road access required minimal disturbance on the same soil type with Severe management implications as the well site. There are no drainage crossings.

**Road Mitigation:** Impacts can be controlled through carefully applied erosion-control measures under the Conditions of Approval.

## Well 48

**Representative Well Site:** The drill pad would occur on a shallow, somewhat excessively drained upland soil of a canyon scarp slope. A typical undisturbed site on a 8 percent slope with 80 percent ground cover has a soil loss rate of approximately 0.5 tons/acre/year. Access road is visible from County Rd 539; the well site is not visible from the Carrizo Picnic Area. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 6 tons/acre/year which exceeds the soil loss tolerance value by 6 times. Surface erosion hazard by water and revegetation potential have Severe ratings. Short-term soil losses would occur prior to effective mitigation.

**Table IV-48**  
**USLE Predicted Surface Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 8	6	1	3.54		21	4
ROAD 16	12	1		0.44	5	1

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. Slope lengths are generally short enough on these canyon side slopes that the Standard Lease Terms would normally allow relocation to more stable sites. In the event relocation was required beyond 200 meters, the Controlled Surface Use (Soils) stipulation is used as a precaution to avoid and protect this fragile soil from adverse impacts.

**Access Road:** Road access required minimal disturbance on shallow soils with Severe management implications. Access Road on shallow soils should be avoided to prevent significant amounts of accelerated erosion and long-term impacts to the soil resource. There are no road crossings.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation offers opportunity for relocation of the access road to an area with less slope gradient and possibly deeper soils.

## Grasslands - Cimarron

### GEOGRAPHIC ZONE 12

The northern portion of the Cimarron National Grassland is characterized by undulating topography along the North Fork of the Cimarron River, and a relatively flat upland plain which extends to the northern boundary of the grassland.

None of Zone 12 representative wells would impact special use permit areas, or Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use.

## Well 49

**Representative Well Site:** The drill pad would occur on a deep, well-drained alluvial soil (Riparian). A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The site is within the river corridor, and is not visible from the Santa Fe Trail. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 0.3 tons/acre/year which is less than the soil loss tolerance rate, and surface erosion hazard by water rates Slight. However, potential soil loss from wind erosion would increase to about 134 tons/acre/year, and the wind erosion hazard rates Severe. Soils on these landscape positions are also susceptible to gully formations, but accelerated soil loss by wind erosion is the primary concern for this site. Revegetation potential has moderate limitations. The combined effects would have the potential for long-term detrimental impacts to soil productivity. All potential soil loss would directly impact the drainage since this site is in a riparian area.

**Table IV-49  
Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
WATER 0	0.3	4	3.10	1	0
WIND 0	134	4	3.10	415	28

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. The Controlled Surface Use (Soils) stipulation would allow relocation of the drill pad outside the stream terrace or flood plain. This riparian area is small enough that the well could be relocated outside of the riparian area using Standard Lease Terms that allows for well movement up to 200 meters.

**Access Road:** Road access required minimal disturbance on the same alluvial soil (Riparian) and potential for significant adverse impacts. There is one drainage crossing.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain. The No Surface Occupancy (Riparian) would move the road outside of the riparian area, other than to cross it.

## Well 50

**Representative Well Site:** The drill pad would occur on a deep, well-drained upland soil. A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The well would be in the foreground along a County road, in an area with existing visual impacts and visual quality objective of modification. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat or T&E habitat.

Potential soil loss after disturbance would increase to about 0.3 tons/acre/year which is less than the soil loss tolerance value. Surface erosion hazard by water and revegetation potential have moderate ratings. Short-term soil losses would occur prior to effective mitigation. There would be no sediment yield since the site is over a mile away from the nearest drainage.

**Table IV-50  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
0	0.3	4	3.10	1	0

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate protection for all resources.

**Access Road:** Road access required minimal disturbance on a deep upland soil with moderate erosion potential. There are no road crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would provide adequate protection of all resources.

### **GEOGRAPHIC ZONE 13**

The southern portion of the Cimarron National Grassland is characterized by the flood plain and river escarpments on both sides of the Cimarron River channel, comparatively minor areas of loamy "hard lands", and extensive areas of rolling to hilly sandy uplands.

None of Zone 13 representative wells would impact special use permit areas, or Forest Service developed recreation sites or occur in areas of concentrated dispersed recreation use.

### **Well 51**

**Representative Well Site:** The drill pad would occur on a deep, well-drained upland soil. A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The site is visible from the Sante Fe Trail. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat. The Cimarron River has been a historical habitat for the Flathead Chub, Arkansas River Shiner, and Arkansas Chub (all T&E fish species).

Potential soil loss after disturbance would increase to about 0.3 tons/acre/year which is less than the soil loss tolerance value. Surface erosion hazard by water and revegetation potential have moderate ratings. Short-term soil losses would occur prior to effective mitigation. The site is over 2000 feet away from the drainage so no sediment yield is expected.

**Table IV-51  
USLE Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
0	0.3	4	2.07	0.6	0

**Well Mitigation:** The Standard Lease Terms and Conditions of Approval would allow adequate soil resource protection. The Controlled Surface Use (Visual) stipulation would be used to mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on a deep upland soil with moderate erosion potential. There are no drainage crossings.

**Road Mitigation:** The Standard Lease Terms and Conditions of Approval would provide adequate soil resource protection. The CSU (Visual) would be used to mitigate visual impacts.

### Well 52

**Representative Well Site:** The drill pad would occur on a deep, well-drained alluvial soil (Riparian). A typical undisturbed site on level ground with 80 percent ground cover has no appreciable soil loss. The site is visible in the foreground from U.S. Hwy 51, and may be visible from the Sante Fe Trail. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat. The Cimarron River has been a historical habitat for the Flathead Chub, Arkansas River Shiner, and Arkansas Chub (all T&E fish species).

Potential soil loss after disturbance would increase to about 0.3 tons/acre/year which is less than the soil loss tolerance rate, and surface erosion hazard by water rates Slight. However, potential soil loss from wind erosion would increase to about 134 tons/acre/year, and the wind erosion hazard rates Severe. Soils on these landscape positions are also susceptible to gully formations, but accelerated soil loss by wind erosion is the primary concern for this site. Revegetation potential has moderate limitations. The combined effects would have the potential for long-term detrimental impacts to soil productivity. The sediment yield is expected to be 100% of the potential soil loss since the site occurs in a riparian area.

**Table IV-52  
Predicted Surface Erosion for Drill Pad**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad/Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
WA- TER 0	0.3	4	1.38	1	0
WIND 0	134	4	1.38	185	12

**Well Mitigation:** Standard Lease Terms would mitigate visual impacts. Under Alternative III, the Controlled Surface Use (Soils) stipulation would allow relocation of the drill pad outside the stream terrace or flood plain. The No Surface Occupancy (Riparian) stipulation would be applied to mitigate riparian, watershed and fishery impacts.

**Access Road:** Road access required minimal disturbance on the same alluvial soil and potential for significant adverse impacts. The road would have 1 drainage crossing.

**Road Mitigation:** The Controlled Surface Use (Soils) stipulation would allow relocation of the access road outside the stream terrace or flood plain. The NSO (Riparian) would move the road out of the riparian area, other than to cross it.

### Well 53

**Representative Well Site:** The drill pad would occur on a deep, excessively drained sandy soil. A typical undisturbed site on level ground with 80 percent ground cover has a soil loss rate of approximately 9 tons/acre/year from wind erosion. The site is visible in the foreground from Highway 51. The site is not in any critical winter range, Big Game Production Area, nor will it affect any critical Management Indicator Species (MIS) habitat. The Cimarron River has been a historical habitat for the Flathead Chub, Arkansas River Shiner, and Arkansas Chub (all T&E fish species).

Potential soil loss after disturbance would increase to about 134 tons/acre/year which exceeds the soil loss tolerance rate by over 30 times. Natural soil loss amounts already exceed soil loss tolerance values, and the removal of existing ground cover protection significantly accelerates wind erosion soil losses. Surface erosion hazard by water rates Slight, but wind erosion hazard and revegetation potential have Severe ratings. Although revegetation is often difficult on sandy soils, the risk for significant impacts is reduced through carefully applied erosion-control Conditions of Approval. Erosion control netting and heavy applications of mulch are initially used to provide protective cover until revegetation can be accomplished. Successful reclamation from past and current leases has been demonstrated under Standard Lease Terms. Unavoidable soil losses would occur on barren surfaces, but losses should be short-term in nature until effective ground cover is restored through revegetation practices appropriate for the grassland environment. Treatment areas can be restored to soil loss levels commensurate with natural ecological conditions within 5 years.<sup>12</sup> No sediment yield is expected since the site is on highly permeable sandy soils.

**Table IV-53  
Predicted Wind Erosion for Drill Pad and Road**

Slope %	Potential tons/acre/yr	Tolerance tons/acre/yr	Pad acres	Road acres	Potential soil loss (tons/yr)	With mitigation tons/yr
PAD 0	134	4	2.07		277	19
ROAD 0	134	4		0.31	42	3

**Well Mitigation:** Carefully applied Standard Lease Terms and Conditions of Approval would allow adequate protection of the soil resource. Standard Lease Terms would also mitigate visual impacts.

**Access Road:** Road access required minimal disturbance on the same sandy soil with Severe management implications like the well site. There are no drainage crossings.

**Road Mitigation:** Impacts can be controlled through carefully applied erosion-control Conditions of Approval.

## **EFFECTS OF MANAGEMENT ALTERNATIVES**

### **RFD Well Analysis**

As discussed in the introduction to this Chapter, the two primary purpose of the RFD Well Analysis are to disclose effects from a "reasonable foreseeable post-leasing activity" scenario, or RFD, for the land availability decision; and to provide site-specific analysis to support the specific lands decision. The scope of the effects disclosure will assume that an APD and Surface Plan of Operations has been received and that the management alternatives are being applied to the lessee proposal. The BLM RFD projects a total of 214 new oil or gas wells over the 15 year planning period, including 165 wells on the Cimarron, 45 wells on the Comanche and 4 wells on the Mountains.

In the remainder of this chapter, we will discuss the effects of the BLM RFD on the Grasslands, the effects of the BLM RFD on the Mountains, the effects of the Concentrated RFD on the Mountains, and the cumulative effects of the BLM RFD on the Unit. As discussed in more detail in the introduction to this chapter, the purpose of the Concentrated RFD well analysis is to identify a high range of effects for each alternative associated with the development of 4 exploratory wells on the Mountains. The IDT analyzed 4 wells in one drainage with a more sensitive environment than the 4 dispersed drainages with the BLM RFD wells. The Concentrated RFD is only for comparison purposes. The effects of the 4 BLM RFD wells on the Mountains are not expected to be significantly greater than the effects of the Concentrated RFD wells. However, the BLM RFD is the more likely scenario and will be analyzed for the Cumulative Effects Analysis.

### **COMPARING ALTERNATIVES**

It is important for the reader to understand that there are similarities between alternatives. The total number of projected wells are constant across all alternatives on the Cimarron, the Comanche and the Mountains. The BLM agreed that the identified RFD would occur on already leased lands under any alternative and that no alternative would reduce the level and distribution of that RFD. The well locations are the same for all alternatives, unless current Forest Plan direction (Alternative I) or Supplemental Stipulations (Alternative III) require well relocation to less sensitive locations to adequately protect surface resources. Alternative I and III effects on most resources are similar, as shown in Table IV-69. There is little quantifiable difference in effects between Alternatives II and IV. However, the alternatives do vary in the amount of land administratively available for leasing and the amount of land subject to Supplemental Stipulations, as depicted in Table II-11. The alternatives also vary in terms of conformance with direction and policy, as depicted in Table II-13.

### **Disturbed Acres**

The immediate direct effects of proposed activities are a result of site clearing for road, well pad and pipeline construction. These shall be discussed throughout the analysis as "disturbed acres".

The disturbed acres are consistent for all resources and are constant throughout an alternative. Disturbed acres will include total acres disturbed during the 15-year planning period.

The actual placement of wells for the RFD analysis resulted in the site-specific distribution of BLM RFD, and Concentrated RFD wells on the Mountain districts. It resulted in the general placement of wells on the Grasslands in soil, or ecosystem, types. These types are hard lands, sandy lands, riparian and canyon lands. These wells are described in Chapter II and mapped in Figures II-1, II-2, and II-3. The locations of the RFD wells, as well as direct disturbance, are displayed in Tables IV-54 and 55.

**Table IV-54  
Site-Specific Well Locations by Alternatives**

Well	Legal Description	Geographic Zone		Acres dist. by Alt.			
		Number	Description	I	II	III	IV
<b>BLM RFD (Mountains)</b>							
1	T20s,R70W,Sec4,NWSW	3	Wet Mountains	4	4	4	4
2	T8S, R75W,Sec13,SWSE	7	Tarryall Mtns	5	5	5	5
3	T13S,R67W,Sec20,NENE	4	Rampart Range	5	5	5	5
4	T11S,R67W,Sec21,NWNE	4	Rampart Range	4	4	4	4
<b>TOTAL Disturbed Mountain Acres by Alternative</b>				<b>18</b>	<b>18</b>	<b>18</b>	<b>18</b>
<b>Concentrated RFD (Mountains)</b>							
1C	T9S,R69W,Sec22,NWNW	5	Jackson Creek		13		13
2C	T9S,R69W,Sec22,SWNW	5	Jackson Creek		11		11
3C	T9S,R69W,Sec23,NWSE	5	Jackson Creek		11		11
4C	T9S,R69W,Sec26,NWSW	5	Jackson Creek		9		9
1R	T9S,R69W,Sec21,SWSE	5	Jackson Creek	8		8	
2R	T9S,R69W,Sec22,NESW	5	N. Jackson Cr	9		9	
3R	T9S,R69W,Sec14,SWSE	5	Watson Prk Cr	8		8	
4R	T9S,R69W,Sec26,SWSE	5	Jackson Creek	4		4	
<b>TOTAL Disturbed Mountain Acres by Alternative</b>				<b>29</b>	<b>44</b>	<b>29</b>	<b>44</b>

Table IV-54 provides the legal description and acres disturbed for each well in each alternative on the Mountains. Alternatives I and III relocate Concentrated RFD wells based on the application of protection requirements.

The *total* disturbed acres remain constant on the Grasslands across the alternatives. Disturbed acres occur in different soil/vegetation types by alternative, as depicted in Table IV-55

The well distribution by alternative on the Cimarron has changed since the Draft Environmental Impact Statement. Further analysis of the current Forest Plan and its Final Environmental Impact Statement revealed that riparian wells on the Cimarron could not be relocated to less sensitive land types. The effects of Alternative I on water, aquatic, riparian and visual resources would be similar to Alternative II or IV. This change in Alternative I effects is reflected in this RFD analysis.

**Table IV-55  
Grassland Disturbed Acres by Alternative  
BLM RFD**

Soil/Vegetation Type	Alt. I		Alt. II		Alt. III		Alt. IV	
	# of Wells	Dist. Acres						
<b>Cimarron</b>								
Shortgrass prairie Hard lands	57	136	57	136	58	138	57	136
Midgrass prairie Sandy lands	101	241	101	241	107	256	101	241
Riparian	7	17	7	17	0	0	7	17
<b>TOTALS</b>	<b>165</b>	<b>394</b>	<b>165</b>	<b>394</b>	<b>165</b>	<b>394</b>	<b>165</b>	<b>394</b>
<b>Comanche</b>								
Shortgrass prairie Hard lands	14	25	13	23	14	25	13	23
Midgrass prairie Sandy lands	31	56	30	54	31	56	30	54
Shortgrass prairie/ Pinyon-juniper Canyon lands	0	0	1	2	0	0	1	2
Riparian	0	0	1	2	0	0	1	2
<b>TOTALS</b>	<b>45</b>	<b>81</b>	<b>45</b>	<b>81</b>	<b>45</b>	<b>81</b>	<b>45</b>	<b>81</b>

### Abandonment and Reclamation

The interdisciplinary team (IDT) worked with managers of oil and gas programs on the Unit to identify trends in well abandonment and reclamation. The development of those trend estimates can be found in Appendix B. In general, reclamation shall be ongoing for up to 5 years after the abandonment of a well. Total reclaimed acres are identified for the end of the 15-year planning period. Unreclaimed acres include acres disturbed by exploratory wells in the last 5 years of the planning period. These acres would be reclaimed shortly after the planning period.

The number of acres reclaimed and unreclaimed by vegetation and soil type for each alternative are displayed in Table IV-56.

**Table IV-56  
Reclaimed/Unreclaimed Acres for Each Alternative**

Vegetation Type Soil/Land Type	Reclaimed	Unreclaimed	Reclaimed	Unreclaimed
<b>CIMARRON NG</b>	<b>Alternative III</b>		<b>Alternatives I, II, IV</b>	
Shortgrass prairie Hard lands	48	90	48	88
Midgrass prairie Sandy lands	90	166	84	157
Riparian	0	0	6	11
<b>CIMARRON TOTALS</b>	<b>138</b>	<b>256</b>	<b>138</b>	<b>256</b>
<b>COMANCHE NG</b>	<b>Alternatives I, III</b>		<b>Alternatives II, IV</b>	
Shortgrass Prairie Hard lands	12	13	11	12
Midgrass Prairie Sandy lands	25	31	24	30
Shortgrass pinyon- juniper/ Canyon lands	0	0	0	2
Riparian	0	0	1	1
<b>COMANCHE TOTALS</b>	<b>37</b>	<b>44</b>	<b>36</b>	<b>45</b>
<b>CONCENTRATED RFD-MTNS</b>	<b>Alternatives I, III</b>		<b>Alternatives II, IV</b>	
Ponderosa Pine Fragile soils	9	0	0	0
Douglas Fir Fragile soils	16	0	0	44
Lodgepole Pine Fragile soils	0	4	0	0
<b>CONC. RFD TOTALS</b>	<b>25</b>	<b>4</b>	<b>0</b>	<b>14</b>

(Continued on following page)

BLM-RFD - Mtns	Alternatives I,II,III		Alternative IV	
Ponderosa Pine Non-Fragile soils	9	4	13	0
Douglas Fir Non-Fragile soils	5	0	5	0
<b>BLM-RFD TOTALS</b>	<b>14</b>	<b>4</b>	<b>18</b>	<b>0</b>

### Effects Common To All Alternatives

Since the RFD is constant for all alternatives there are many common effects. Common effects shall be discussed early so that differences between alternatives can be clearly displayed.

The BLM RFD on the Grasslands and Mountains would generally cause short-term effects on the ground cover vegetation and long-term effects on the original forest vegetation. Soil loss on cleared acres due to wind and water erosion would generally be a short-term effect. Well pad and access clearing would undergo rehabilitation and reclamation as soon as the wells have been abandoned. Pipeline disturbances would undergo rehabilitation as soon as possible after construction. Exploratory well abandonment and initiation of reclamation would occur in the year the well is drilled. Exploratory wells would generally cause short-term impacts to vegetation, while producing wells on the Grasslands would cause long-term impacts on vegetation.

Effects on threatened and endangered plant, animal and fish species, including their habitat, can be lessened or avoided through inclusion of specific provisions in lease notices issued at the time of lease. Such provisions describe the measures necessary to protect threatened and endangered species or to mitigate harmful effects. Significant cultural resources can be protected, or harmful effects mitigated through inclusion of similar provisions in the lease notice.

The effects to air resources would be localized based on the possible discharge of hydrogen sulfide, exhaust and dust created by exploration and development traffic. These activities would also provide short-term effects to the visual quality along and adjacent to the roads being used for oil and gas activities.

The highest visual impact would come at the time of exploration, when the well is actually being drilled, and during periods of heavy maintenance. This short-term impact would occur because the drill rig that would be used for this work has a mast that is over 60 feet in height. There is little vegetation on the Unit that would provide full screening of these activities. New road construction would have a visual impact until rehabilitation has been completed. Various types of mitigation are available and effectiveness would be identified when the alternative effects are discussed.

All alternatives would result in detrimental impacts to soils, vegetation and groundwater from saltwater and/or oil leaks related to production activities. Since production is not expected on any of the Mountain districts these impacts would be found in all alternatives on the Grasslands. Mitigation is designed to minimize the potential for leaks. Should leaks occur outside riparian areas they are anticipated to cause minor short-term effects. Leaks in riparian areas could cause significant long-term impacts.<sup>13</sup>

Some level of sediment input to stream and lake fishery resources would occur. This would be through wind or water erosion on clearings. The total input would vary by alternative but all would impact the resource to some degree.

There would be minor short-term effects to grazing and range activities since the oil and gas activities would reduce the amount of grazing land available. This loss of land is minimal in comparison to the available land base, and it is expected to be a short term effect. No reduction in grazing capacity is anticipated as a result of these effects.

All alternatives would provide income to the federal treasury and local communities. The amounts and distribution of that income would shift based on alternative.

Producing wells on the Grasslands would cause a significant decrease in nonrenewable oil and gas resources during the planning period. These nonrenewable resources would eventually be depleted on affected fields.<sup>14</sup> On the Mountain districts, all four alternatives would have minimal direct effects on cultural resources, paleontological resources and cave resources. On the Grasslands, there would be no foreseeable effects on paleontological resources or cave resources. Conclusions regarding impacts have been based on what is presently known about each resource.

## **Comparison of Alternatives by Resource**

### **VEGETATION**

Oil and gas activities on the Grasslands and the Mountains will effect 13 basic vegetation types, which are described in Chapter III. Effects on alpine and riparian areas are discussed separately in this chapter.

Disturbance or loss of vegetation would occur from well pad, road and pipeline construction. These direct effects may be short-term or long-term, depending on the plant community affected and the success of natural or artificial revegetation. Timely revegetation, even if artificially induced, is less certain on sites with a combination of steep slopes, shallow, highly erosive soils, dry aspects and relatively low precipitation during the growing season.

Soil compaction caused by ground-disturbing activities could cause potentially long-term direct or indirect effects on revegetation potential or vegetation growth on affected areas. The potential for soil compaction would be greater on fine-textured clay loams, such as the hard lands on the Grasslands.<sup>15</sup> Shut-down of ground-disturbing activities during periods of inclement weather would mitigate this impact.

Exploratory post-leasing activities would cause a minor, long-term loss of timber production. Tree planting would be required on sites suitable for timber production to facilitate minimum stocking within 5 years of well abandonment.

Construction and increased human activity could cause indirect effects on vegetation due to increased fire potential or accidental fuel spills.

Standard Lease Terms and Conditions of Approval required by the Forest Service and BLM would generally eliminate or reduce vegetation impacts to acceptable levels. Mitigation measures include revegetation of disturbed areas with approved seed mixes and fertilizer, shrubs or trees. Mulch and/or erosion control devices would be used where necessary to enhance timely revegetation.

Mitigation would also include fire prevention provisions, salvage of cut timber and safe handling and storage of fuels and other materials.

Refer to Tables IV-55 and IV-56 for disturbed and reclaimed acres on the Grasslands.

### **Grasslands-BLM RFD**

#### ***Alternative I***

On the Cimarron, approximately 35% of the disturbed shortgrass and midgrass acres would be revegetated by the end of the planning period. On the Comanche, approximately 46% of the disturbed shortgrass and midgrass acres would be revegetated by the end of the planning period.

These relatively low reclamation acreages are due to the higher frequency of producing wells on the grasslands, particularly the Cimarron. Alternative I would cause short-term and long term insignificant impacts on the vegetation resource on the Cimarron or Comanche.

#### ***Alternative II***

On the Cimarron and Comanche, the total acres of disturbed shortgrass and midgrass prairie are less than under Alternative I, due to disturbed riparian acres under Alternative II. However, the same percentages of shortgrass and midgrass reclamation would apply.

Similar to Alternative I, these relatively low reclamation acreages are due to the higher frequency of producing wells on the grasslands, not anticipated problems with revegetation. Alternative II would not cause significant impacts on the vegetation resource.

#### ***Alternative III***

On the Comanche National Grassland, the BLM RFD would disturb the same number of acres by vegetation type as Alternative I. On the Cimarron National Grassland, the BLM RFD would disturb slightly more acres of shortgrass and midgrass prairie, due to relocation of riparian wells onto the prairie types. Alternative III would not cause significant impacts on the vegetation resource on either grassland.

#### ***Alternative IV***

The BLM and Forest Service agreed there were enough acres under lease on the Grasslands for placement of all BLM RFD wells. Therefore, on each Grassland, the BLM RFD would disturb the same number of acres by vegetation type and would result in the same effects on the vegetation resource as Alternative II.

### **Mountains-BLM RFD**

Refer to Figures II-1 and II-2 for well locations.

#### ***Alternatives I, II and III***

All disturbed acres would be revegetated during or shortly after the planning period. All three alternatives would cause insignificant impacts on the vegetation resource.

#### ***Alternative IV***

Effects on vegetation would be similar to the other alternatives, except all wells would be abandoned and all acres reclaimed during the planning period.

### **Mountains-Concentrated RFD**

#### ***Alternative I***

Concentrated RFD wells 1R through 4R shown in Figure II-1 and II-2 would disturb 29 acres of coniferous vegetation on moderate slopes with moderate revegetation potential. Alternative I would cause a short-term impact on ground cover vegetation and a long-term impact on forest vegetation. Wells 1R through 3 R would occur on sites unsuitable for timber production. Well 4 R would cause an insignificant, but not irreversible, loss of timber production.

#### ***Alternative II***

Post-leasing activities, shown in Table IV-56, would disturb 44 acres of Douglas-fir on steep slopes with shallow, erosive soils and low reclamation potential. Wells 1C, 2C and 3C are on dry aspects. Alternative I would cause potentially long-term impacts on ground cover vegetation. Clearing would have a long-term impact on mature forest vegetation on sites unsuitable for timber production.

#### ***Alternative III***

Effects on vegetation would be similar to Alternative I.

#### ***Alternative IV***

Effects on vegetation would be similar to Alternative II.

### **SOILS**

Managing soils for sustained productivity and protection of water quality is a priority of National Forest management. Oil and gas activities, like other forms of land use activities, can cause varying degrees of soil disturbance. The type of disturbance and duration of activities primarily determine whether or not site productivity is significantly affected by changes in soil properties.

Construction of access roads and drill pads for mineral operations would remove or destroy protective vegetative cover and expose soils to accelerated erosion. The potential for soil loss during the construction period is an impact of major concern because the transport of soil particles takes place more rapidly than natural erosion, and there is a greater probability of indirect or off-site impacts to water quality and aquatic life.

The severity of soil erosion depends on many factors such as soil type, slope, climatic conditions, and both the season and duration of ground-disturbing activities. In general, water is the erosive force that has been the most damaging to soils in the Mountain environment, and wind erosion is more damaging in the Grasslands. Surface disturbances in areas of steep terrain typically result in greater soil loss amounts than landforms with gentle to moderate slope gradients.

Soil management objectives for controlling wind erosion on the loose sandy soils of the Grasslands focus on maintaining ground cover protection. Wind erosion damage is evident in several ways.

- (1) the removal of surface soils along with plant materials,
- (2) loss of organic matter and finer soil particles bringing about a change in surface soil texture,
- (3) deposition that forms drifts that bury vegetation, and
- (4) wind-blown sand particles that cut off young plants at the soil surface.

Soil erosion estimates are relative values and should only be used as an indicator of relative soil loss amounts for comparison purposes. Potential soil loss values are based on the probable erosion amounts from bare surface soils resulting from complete removal of vegetation and litter. These values can then be compared with soil loss tolerance rates to determine whether erosion is excessive. These facts were considered in using an Erosion Hazard Rating Guide<sup>8</sup> to evaluate potential impacts and assign adjective interpretation ratings. "Severe" erosion hazard ratings indicate soils with potential soil loss rates that exceed tolerance values to an extent that impacts could become long term if timely reclamation cannot be successfully accomplished. Research has shown that surface erosion resulting from cut and fill slopes is greater on soils that have been physically disturbed. Erosion rates are highest during the first year after construction, and surface erosion on disturbed areas decreases rapidly after extremely high initial rates.

Predicted soil loss for the Grasslands and Mountains are presented in Table IV-57. The magnitude of effects is dependent upon slope steepness and the kind, amount, and location of surface and vegetation disturbance. The longevity of direct impacts and reclamation potential are also determined by similar variables, and different combinations of soil/landform characteristics influence response to soil disturbance.

## **Grasslands-BLM RFD**

### *Alternative I*

On the Grasslands, direct effects to soils on the hard lands and sandy lands can be effectively mitigated under Standard Lease Terms. Table IV-57 indicates potential soil loss that would occur if all wells were drilled on the Grasslands in one year. Effective reclamation of disturbed acres (outyear mitigation) would reduce soil erosion approximately 93 percent within the first year, and erosion rates would be restored to natural levels within 5 years. Fragile soils on canyon escarpments and sensitive alluvial soils in riparian or flood plain areas can be avoided under this alternative for most areas on the Mountains and Grasslands. Under Standard Lease Terms, wells can be relocated up to 200 meters. This is not enough distance to totally relocate wells outside of the extensive riparian areas that occur along the Cimarron River. It is important to note that successful reclamation on gentle slopes of the Grasslands can generally be accomplished with less complications than usually exist in the Mountain environment. Although the sandy soils are highly susceptible to severe wind erosion, successful reclamation from past and current leases has been demonstrated using special erosion control practices.

### *Alternative II*

On the Grasslands, short-term unavoidable effects can be effectively mitigated with exception of canyon escarpments and riparian areas. Accelerated erosion on shallow soils of canyon escarpments on the Comanche may cause irreversible damage by removing a substantial amount of soil.<sup>10</sup> This alternative only allows wells to be relocated up to 200 meters. This might not be enough distance to move the wells off of the extensive wetland and riparian areas that occur along the Cimarron River, or out of the canyon lands on the Comanche.