



## CHAPTER 4



# ENVIRONMENTAL CONSEQUENCES

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## 4 ENVIRONMENTAL CONSEQUENCES

### 4.1 INTRODUCTION

#### 4.1.1 Impact Analysis Process

Chapter 4 describes the impacts of land use and resource management actions on the physical, biological, human, and management environments of the Planning Area under the Proposed Plan. These impacts are in the following analyses as direct and indirect onsite impacts, or offsite and cumulative impacts.

Direct impacts result from an action without an intervening step. Indirect impacts are also the result of an action, but with one or more intervening steps. Onsite impacts occur within the Planning Area. Offsite impacts occur outside the Planning Area, but as a result of an action within the Planning Area. The degree to which land uses, management actions, and environmental changes under the implemented alternative would affect other lands depends on the absolute and relative amount of onsite changes, the causal linkage between onsite changes and offsite consequences, and the relationship between changes resulting from the alternative and those that would occur without the alternative. Cumulative impacts result from the interaction of impacts of the implemented alternative with impacts resulting independently from unrelated actions and activities. For this RMPA/EIS, cumulative impacts may include private lands within the Planning Area and both private and public lands outside the Planning Area. Additionally, cumulative impacts are not necessarily limited to the types of actions and activities affecting BLM lands in the Planning Area.

Quantification of cumulative impacts is difficult for the resources, land uses, and management actions addressed by this RMPA/EIS. This is due to (1) unavoidable uncertainties regarding the location, scale, and rate of changes on BLM lands in the Planning Area resulting from the implemented alternative; (2) greater uncertainties about the location, scale, and rate of changes on private lands within the Planning Area that would occur irrespective of the implemented alternative; and (3) even greater uncertainties about the location, scale, and rate of changes due to the general human population growth of the County.

While focusing on the Proposed Plan, the following impact analyses include selected comparisons to the five alternatives analyzed in the Draft RMPA/EIS, particularly Alternative I (No Action) and Alternative III (Preferred Alternative). The five previous alternatives, summarized in Section 2.4, were constructed to represent a reasonable range of land uses and management actions for the Planning Area.

The Proposed Plan (summarized in Section 2.3) was constructed primarily from components excerpted from the five previous alternatives (especially Alternatives II and III) but includes some additional measures to further reduce environmental impacts. One of the most important of these is the adoption by BLM of measures proposed by CDNR as ways to reduce impacts of oil and gas development atop the plateau. These measures were proposed during the Consultation and Coordination process that followed the public comment period of the Draft RMPA/EIS and received a consensus of support from the other Cooperating Agencies (Chapter 6).

A key component of the Proposed Plan is incorporation of a requirement for phased and clustered development of oil and gas resources on top of the plateau, with a focus on developing along ridges and existing roads and with a limit on the amount of allowable disturbed land at any one time. This would rely heavily on the use of diagonal (directional) drilling to optimize recovery of oil and gas resources while significantly reducing the area of associated ground-disturbing activities. For areas at lower elevations below the rim, BLM would manage to maximize clustered development. However, more flexibility is needed in the lower areas due to the adjacency and irregular boundaries of private lands, currently leased Federal lands, and currently unleased Federal lands subject to future leasing under all alternatives except No Action.

**4.1.1.1 Direct and Indirect Onsite Impacts**

Of the potential impacts associated with future management of the Planning Area, the most marked in terms of direct physical change and the indirect consequences of change is the anticipated increasing level of oil and gas development. Therefore, much of the analysis focuses on the direct and indirect impacts expected to result from the construction of well pads and roads and the associated human activity.

The starting point for analysis of the Proposed Plan is the RFD for oil and gas development in the Planning Area, prepared by BLM as part of the planning process (Appendix H). The RFD is intended as a technical and scientific approximation of anticipated levels of oil and gas development during the planning timeframe. As such, the RFD and the planning process of which it is part are not intended to define the specific numbers and locations of wells and pads needed to develop the oil and gas resource. Instead, they are intended to allow flexibility during resource development while providing sufficient specificity to support the impact analysis and alternative selection processes. The actual level of oil and gas development associated with any specific alternative is likely to differ substantially from the RFD due to alternative-specific measures aimed at protection and management of other uses and resources.

Assumptions of the RFD incorporated into the impact analyses of Chapter 4 include the following:

- The assumed drilling rate, based on existing leases in the Planning Area, is completion of one well per 20 days per drill rig below the rim, and one well per 30 days atop the plateau (due to a greater thickness of overlying strata)(Appendix H).
- The assumed drilling season is 6 months per year on top of the plateau due to snow accumulation at these higher elevations, and 7 months per year below the cliffs due to the 5-month TL (December – April) for big game winter range.
- The assumed number of wells in 20 years is based on the assumptions above, as well as 10-acre downhole spacing for Mesaverde wells, and 160-acre downhole spacing for Wasatch wells, collocated with Mesaverde well pads.

Areas of surface impact of oil and gas development assumed for all alternatives include:

- 1.9 acres of long-term surface disturbance for single-well pads and associated surface facilities (including a pro-rata share of compressor facility impacts)
- 2.5 acres of long-term surface impacts for multi-well pads, including the same components as single-well pads
- 1.5 acres of temporary impacts for pads, comprising areas revegetated within 2 years

Estimates of miles of access roads needed to accommodate the anticipated levels of oil and gas development differ among alternatives, as follows:

- For Alternatives I through V – 0.6 mile of new or upgraded existing roads per pad, using an assumed surface density of one pad per 40 acres.
- For the Proposed Plan – Atop the plateau, 12 miles of upgraded existing roads from Cow Creek Road access point to center of developable area, plus 0.3 mile of new road per pad, using 160-acre surface density. Below the rim, 0.6 mile of new or upgraded road per pad.

The actual number of drill rigs active at any one time, the number of wells and pads constructed during 20 years, the resultant acres of surface disturbance, and miles of new or upgraded access roads under any of the alternatives may differ from the assumed numbers due to factors subject to change through time, such as natural gas prices, technological advances, or new requirements related to other land uses and resource management goals.

#### 4.1.1.2 Offsite and Cumulative Impacts

All of the environmental impacts associated with implementation of any of the alternatives would be in addition to ongoing existing impacts on Federal lands in the Planning Area, private lands in the Planning Area, and both public and private lands adjacent to or near the Planning Area. For example, information for COGCC shows a current total of approximately 5,500 wells in Garfield County, while data provided by Garfield County show a county-wide projection of a total of 10,000 to 20,000 wells over the next 20-years. In comparison, the Planning Area currently includes approximately 800 wells, of which 200 are on BLM lands.

Even where an estimate of cumulative impacts due to offsite causes is available (e.g., 10,000 to 20,000 wells in Garfield County in 20 years), it is not known how much long-term surface disturbance would result, to what degree adverse impacts would be avoided or mitigated, and how the impacts would affect other resource values and land uses such as hunting, OHV travel, visual quality, livestock grazing, and so forth. Therefore, the descriptions of cumulative impacts for the individual resources addressed in Sections 4.2 through 4.5 are necessarily qualitative.

Also germane to the discussion of cumulative impacts are the boundaries used to define impact sources and levels. These differ by resource. For example:

- For wide-ranging wildlife such as deer and elk, the cumulative impact area may include offsite habitats that are used to some extent by onsite populations and that are subject to impacts from development in the offsite areas.
- For air quality, the cumulative impact area may be an entire airshed, including all emission sources that affect the same air quality parameters as potentially affected by the implemented alternative.
- For surface water quality, the cumulative impact area may be one or more watersheds, including all pollutant sources that affect the same water quality parameters as potentially affected by the implemented alternative.
- For socioeconomics, the cumulative impact area may be one or more towns or counties, including all sources of positive and negative impacts on tax revenues, employment, housing, and quality of life considerations reasonably (i.e., not too remotely) affected by changes related to the implemented alternative.

While these are only examples, they illustrate that cumulative impact boundaries not only differ considerably among resources, but that the boundaries may be either natural or artificial.

Beyond the 20-year timeframe, BLM believes that quantitative impact assessments are speculative and unreliable, and hence inappropriate. This is due to a large number of economic, geopolitical, environmental, regulatory, technological, and other factors that could affect conditions beyond 20 years and are themselves subject to change in unexpected ways or degrees. In general, however, it can reasonably be assumed that the Planning Area would continue to support existing multiple uses beyond the 20-year planning horizon. These include development of energy resources, grazing of domestic livestock, and recreation, including motorized and mechanized travel.

#### 4.1.2 Protective Stipulations and Other Restrictions on Surface Use

The RFD (Appendix H) does not incorporate all of the land management direction and multiple-use considerations that BLM must take into account as part of its responsibilities under FLPMA. Therefore, in developing the Proposed Plan and other alternatives, assumptions in the RFD were subjected to various “screens” or “filters” representing restrictions designed to protect specific resource values and meet BLM’s multiple use and sustainability mandates. Protection of specific resources is accomplished by a combination of management actions and the surface-use stipulations described in Section 2.2. These include:

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- **NGD (No Ground Disturbance)** – BLM would not allow long-term ground-disturbing activities (i.e., with an impact that would last longer than 2 years). For oil and gas leases, this stipulation is termed **NSO (No Surface Occupancy)**.
- **SSR (Site-Specific Relocation)** – BLM may place special restrictions, including shifting a ground-disturbing activity by more than 200 meters from the proposed location to another location to protect a specific resource. In oil and gas leases, this stipulation is termed **CSU (Controlled Surface Use)**.
- **TL (Timing Limitation)** – BLM may allow specified activities within the area, and at a proposed location, but not during certain sensitive seasons. Examples include raptor nesting areas, bald eagle winter roosting areas, and big game winter range. It is important to note that TL restrictions can apply to NGD/NSO and SSR/CSU areas, as well as to areas with standard restrictions and limitations.

Note that on split-estate lands (i.e., Federal minerals but private surface), the NGD/NSO, SSR/CSU, and TL restrictions would be applied only for activities related to mineral exploration and development, such as drilling for oil and gas. This is because the Federal mineral estate creates a nexus by which BLM may regulate aspects of these activities that occur on the surface as well as the subsurface. BLM does not regulate or manage other types of activities on split-estate lands (e.g., grazing, recreation, utilities rights-of-ways, etc.).

In addition to the restrictions and limitations on surface uses and management activities outlined above, BLM will require BMPs and set reclamation standards to ensure adequate protection and restoration of specific resource values. Examples from among the comprehensive list in Appendix I include the required use of:

- culverts at stream crossings
- special road design or dust suppression techniques to reduce impacts from aerial deposition of particulates on nearby streams and vegetation
- biodegradable erosion-control fabrics to ensure soil stability and enhance revegetation
- fences to exclude livestock from sensitive habitats
- specialized revegetation using only native species and possibly requiring that woody plants (trees and shrubs) be included in the seed mix or planted as containerized stock (“tubelings”)

These measures, and the protective stipulations cited above, would be applied not just to oil and gas development and grazing, but also as appropriate to recreation, development of salable minerals, aquatic and riparian habitat enhancements, forest management activities (including timber harvesting and prescribed fires), and construction or routine maintenance in rights-of-way and easements.

As described in Section 2.3, it is also BLM’s goal, in implementing the Proposed Plan or any other alternative selected, to encourage or require clustering, collocation, or consolidation of facilities where feasible and where the result would be to reduce impacts.

Table 4-1 presents the restrictions on surface use that would apply to BLM lands in the Planning Area under the Proposed Plan and other alternatives. The “deferred leasing” category shown in Table 4-1 for Alternative III reflects the component in which the area of Federal mineral estate atop the plateau would not be leased or developed for oil and gas until at least 80 percent of the total wells anticipated below the rim have been drilled. Although deferred drilling may affect the types and levels of impacts both above and below the rim, it is not a protective measure *per se* because all of the lands would become available for oil and gas development at some point, probably during the 20-year period of analysis. The no-lease and deferred-lease categories apply only to oil and gas, while the other restrictions apply to all land uses or management actions that could result in adverse impacts to resources.

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Table 4-1. Acres (ac) and Percent (%) of Surface Use Restrictions in the Planning Area

Category	Alt. I No Action	Alt. II	Alt. III Preferred	Alt. IV	Alt. V	Proposed Plan
<b>BLM Lands Atop the Plateau = 34,758 Acres</b>						
No Lease (Oil and Gas) <sup>1</sup>	33,355 ac (96%)	10,382 ac (29.9%)	0	0	0	0
Deferred Lease <sup>2</sup>	0	0	34,758 ac (100%)	0	0	0
No Ground Disturbance (NGD/NSO) <sup>3</sup>	221 ac (0.6%)	15,365 ac (44.2%)	11,364 ac (32.7%)	11,364 ac (32.7%)	7,408 ac (21.3%)	15,821 ac (45.5%)
Site-Specific Relocation (SSR/CSU) <sup>3</sup>	525 ac (1.5%)	1,572 ac (4.5%)	15,179 ac (43.7%)	15,179 ac (43.7%)	10,750 ac (30.9%)	18,937 ac (54.5%)
Standard Restrictions and Limitations <sup>3</sup>	657 ac (1.9%)	7,440 ac (21.4%)	8,215 ac (23.6%)	8,215 ac (23.6%)	16,600 ac (47.8%)	0
<b>BLM Lands Below the Rim = 38,844 Acres</b>						
No Lease (Oil and Gas) <sup>1</sup>	10,912 ac (28.1%)	11,000 ac (28.3%)	0	0	0	0
Deferred Lease <sup>2</sup>	0	0	0	0	0	0
No Ground Disturbance (NGD/NSO) <sup>3</sup>	13,691 ac (35.2%)	15,835 ac (40.8%)	19,564 ac (50.4%)	19,564 ac (50.4%)	14,201 ac (36.6%)	22,590 ac (58.2%)
Site-Specific Relocation (SSR/CSU) <sup>3</sup>	7,731 ac (19.9%)	5,443 ac (14.0%)	14,415 ac (37.1%)	12,307 ac (31.7%)	10,767 ac (27.7%)	11,896 ac (30.6%)
Standard Restrictions and Limitations <sup>3</sup>	6,510 ac (16.8%)	4,574 ac (11.8%)	2,873 ac (7.4%)	4,981 ac (12.8%)	13,786 ac (35.7%)	4,358 ac (11.2%)
<b>Total BLM Lands in the Planning Area = 73,602 Acres</b>						
No Lease (for Oil and Gas) <sup>1</sup>	44,267 ac (60.1%)	21,382 ac (29.1%)	0	0	0	0
Deferred Lease <sup>2</sup>	0	0	34,758 ac (47.2%)	0	0	0
No Ground Disturbance (NGD/NSO) <sup>3</sup>	13,912 ac (18.9%)	31,200 ac (41.4%)	30,928 ac (42.0%)	30,928 ac (42.0%)	21,609 ac (29.4%)	38,411 ac (52.2%)
Site-Specific Relocation (SSR/CSU) <sup>3</sup>	8,256 ac (11.2%)	7,015 ac (9.6%)	29,594 ac (40.2%)	27,486 ac (37.3%)	21,517 ac (29.2%)	30,833 ac (42.2%)
Standard Restrictions and Limitations <sup>3</sup>	7,167 ac (9.7%)	14,006 ac (19.0%)	13,080 ac (17.8%)	15,188 ac (20.6%)	30,476 ac (41.4%)	4,358 ac (5.9%)

<sup>1</sup> Existing leases would not be affected.

<sup>2</sup> Leasing and drilling deferred until 80% of anticipated total wells (Federal and private, new and existing) below the rim have been effectively completed, estimated at 16 years).

<sup>3</sup> See text for definitions and assumptions.

Throughout Chapter 4, reference is made to the application, extension, retention, or deletion of existing stipulations vis-à-vis new leases under the Proposed Plan. These references are meant to describe whether the type and level of protection provided by new stipulations would differ from that provided under the 1999 FSEIS and associated ROD and RMP Amendment.

As pertains to oil and gas development, existing stipulations would continue to apply to existing leases, while new stipulations would apply only to new leases issued subsequent to this RMPA/EIS process. However, many of the proposed new stipulations are based on, and in most cases essentially identical to, existing stipulations. Note that the protective stipulations for oil and gas leases also include provisions by which an exception, modification, or waiver could be granted. These are defined as follows (see Appendix C):

- **Exception** – A case-by-case exemption with a specified duration and for which it has been demonstrated that suspending the stipulation would not adversely affect the resource value being protected.
- **Modification** – A fundamental change in the stipulation based on data demonstrating that one or more components are no longer needed to protect the resource value.
- **Waiver** – A permanent exemption to a stipulation, based on monitoring data, changed conditions, or other situation demonstrating that a less restrictive measure would adequately protect the resource.

While an NGD/NSO, SSR/CSU, or TL restriction may be subject to an exception, modification, or waiver, granting one of these changes would, by definition, not adversely affect the resource value that was the subject of the restriction. Therefore, the impact analyses throughout Chapter 4 assume that the restrictions and limitations would apply throughout the Planning Area and 20-year planning period.

### 4.1.3 General Levels of Impacts

In an attempt to reduce the necessarily complex impact analysis process to readily understandable terms, the following subsections use a qualitative approach for summarizing impacts to specific resources, management actions, and uses. For adverse (negative) impacts, these general impact categories are:

- **None** – Unlikely to impair the resource.
- **Negligible** – May impair the resource, but not at levels that would be noticed by the public, cause the resource value to drop to a lower category, or violate a regulatory standard or environmental law. A more severe impact may be negligible if it is of temporary (duration <2 years).
- **Minor** – Likely to impair the resource at levels that would be noticed by the public, but not to a degree that would detract significantly from the overall value of that resource or a specific use. Unlikely to cause the resource value to drop to a lower category or violate a regulatory standard or environmental law. Relatively few impacts are likely to be permanent (duration >50 years).
- **Moderate** – Likely to impair the resource at levels that would be noticed by the public and detract significantly from the overall value of that resource or a specific use. Could cause the resource value to drop to a lower category but unlikely to violate a regulatory standard or environmental law. Some impacts are likely to be permanent (duration >50 years).
- **Major** – Definitely would impair the resource at levels that would be noticed by the public and would eliminate most or all of the value of that resource or a specific use. Expected to cause the resource value to drop to a lower category and could violate a regulatory standard or environmental law unless mitigated. Many impacts are likely to be permanent (duration >50 years).

Note that impacts to a specific resource under a given land use or management scenario may also be beneficial (positive). The same terms defined above are also used to describe beneficial impacts,

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although generally in a more relative sense. For some specific resources discussed in subsequent sections of this chapter, the adverse impacts are defined more quantitatively, while the beneficial impacts remain as general levels of effect. In terms of duration, impacts may be temporary (<2 years) or long-term (>2 years).

Although the impact definitions above may be applied to any resource, land use, or management action, it is impossible to develop terminology that applies equally well to all analyses. Therefore, some of the impact analyses employ specific definitions for negligible, minor, moderate, and major which, while consistent with the terms above, are better suited to the specific resource.

Tables 4-2 and 4-3 summarize the assumed level of oil and gas development and associated surface impacts under the Proposed Plan and other alternatives. Table 4-2 provides information separately for areas atop the plateau and below the rim to assist in the analysis of impacts in these environmentally distinct areas. Table 4-3 presents summary information on potential cumulative impacts, incorporating current and anticipated future (20-year) conditions for the entire Planning Area (Federal and private mineral estates). Actual numbers of oil and gas wells and pads, miles of access roads, and acres of long-term or temporary surface disturbance could vary due to a variety of circumstances that may change during the 20-year life of the Plan, including technical, economic, and societal considerations.

The totals shown in Table 4-3 for Alternatives I through V differ slightly those shown in the Draft RMPA/EIS. This reflects a larger number of existing wells than at the time the Draft was prepared, as well as some different assumptions under the current RFD (Appendix H). Note also that Table 4-3 assumes similar levels of development on available acres of private lands below the rim (after subtracting slopes steeper than 50 percent) as on available acres of Federal lands below the rim (after subtracting slopes steeper than 50 percent, plus other NGD/NSO areas). Although the lack of a winter range TL on private lands affects the seasonal distribution of available drilling locations—some drilling on Federal lands apparently shifts to nearby private lands during the winter—this analysis assumes that it would not affect the total number of wells on private versus Federal lands in 20 years.

It should be pointed out that the Planning Area contains some additional leasable mineral resources, including oil shale, coal, and coalbed natural gas. Oil shale is not currently considered economically viable but could be leased and developed in the future. Research tracts are currently being pursued in the Piceance Basin, but not in the Planning Area. Coal occurs at depths too great for economic recovery at current prices or with current technology. Coalbed natural gas, like coal, is present at depths and/or quantities that do not support development with current technology and economics.

Because of the low likelihood of recovering these leasable mineral resources during the 20-year period of analysis, this RMPA/EIS assumes that the Planning Area would not be subject to entry under the Mineral Leasing Act for the purpose of development during the life of the Plan. Similarly, no locatable minerals (e.g., base metals or precious metals) are known to occur that would result in entry and development under the 1872 Mining Law. Some salable materials (rock and gravel) do occur, but economic use does not currently exist and is not anticipated as part of this RMPA/EIS. Therefore, the following impact analyses make little reference to potential development of these other mineral resources.

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Table 4-2. Surface Impacts of Oil and Gas Development on Federal Lands in 20 Years (ac = acres, mi = miles)

Category	Alternative I No Action	Alternative II	Alternative III Preferred	Alternative IV	Alternative V	Proposed Plan
<b>Atop the Plateau = 34,758 Acres</b>						
Area Available for Surface Facilities <sup>1,2</sup>	1,182 ac (3.4%)	9,011 ac (26%)	23,394 ac (67%)	23,394 ac (67%)	27,350 ac (79%)	18,937 ac (54.5%)
Estimated New Pads (Wells) <sup>3</sup>	7 (10)	66 (87)	39 (51)	126 (168)	175 (234)	13 (210)
Long-term Disturbance for Pads <sup>4</sup>	20 ac	135 ac	104 ac	180 ac	244 ac	32 ac
Long-term Disturbance for Roads <sup>4</sup>	11 ac (4 mi)	108 ac (40 mi)	62 ac (23 mi)	203 ac (76 mi)	280 ac (105 mi)	43 ac (16 mi)
Total Long-term Disturbance <sup>2,3</sup>	31 ac (<0.1%)	243 ac (0.7%)	166 ac (0.5%)	474 ac (1.4%)	641 ac (1.8%)	75 ac (0.2%)
Temporary Disturbance <sup>5</sup>	20 ac	196 ac	114 ac	373 ac	518 ac	58 ac
<b>Below the Rim = 38,844 Acres</b>						
Area Available for Surface Facilities <sup>1</sup>	14,241 ac (37%)	12,009 ac (31%)	19,280 ac (50%)	19,280 ac (50%)	24,643 ac (63%)	16,254 ac (41.8%)
Estimated New Pads (Wells) <sup>3</sup>	247 (845)	244 (818)	363 (1,273)	323 (1,156)	409 (1,348)	180 (1,360)
Long-term Disturbance for Pads <sup>4</sup>	618 ac	610 ac	840 ac	808 ac	1,022 ac	450 ac
Long-term Disturbance for Roads <sup>4</sup>	502 ac (148 mi)	495 ac (146 mi)	755 ac (218 mi)	658 ac (194 mi)	832 ac (245 mi)	287 ac (108 mi)
Total Long-term Disturbance <sup>4</sup>	1,120 ac (2.9%)	1,105 ac (2.8%)	1,595 ac (4.1%)	1,466 ac (3.8%)	1,854 ac (4.8%)	737 ac (1.9%)
Temporary Disturbance <sup>5</sup>	730 ac	720 ac	1,073 ac	956 ac	1,208 ac	260 ac
<b>Total BLM Lands in the Planning Area = 73,602 Acres</b>						
Area Available for Surface Facilities <sup>1</sup>	15,423 ac (21%)	21,021 ac (29%)	42,674 ac (58%)	42,674 ac (58%)	51,993 ac (71%)	35,191 ac (47.8%)
Estimated New Pads (Wells) <sup>3</sup>	254 (855)	310 (905)	402 (1,324)	449 (1,324)	584 (1,582)	193 (1,570)
Long-term Disturbance for Pads <sup>4</sup>	638 ac	745 ac	944 ac	988 ac	1,266 ac	482 ac
Long-term Disturbance for Roads <sup>4</sup>	513 ac (152 mi)	603 ac (186 mi)	817 ac (241 mi)	861 ac (270 mi)	1,112 ac (350 mi)	330 ac (124 mi)
Total Long-term Disturbance <sup>4</sup>	1,151 ac (1.6%)	1,348 ac (1.8%)	1,761 ac (2.4%)	1,940 ac (2.6%)	2,495 ac (3.4%)	812 ac (1.1%)
Temporary Disturbance <sup>5</sup>	750 ac	916 ac	1,187 ac	1,329 ac	1,726 ac	318 ac

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Footnotes for Table 4-2	
<i>Alternatives I through V</i>	<i>Proposed Plan</i>
<p><sup>1</sup> Leasable area minus ND/NSO restrictions.</p>	<p><sup>1</sup> Leasable area minus NGD/NSO restrictions.</p>
<p><sup>2</sup> Atop the plateau: Leasing and drilling atop the plateau would be deferred until 80% of the total wells anticipated below the rim under Alternative III have been effectively completed to total depth and a production test performed.</p>	<p><sup>2</sup> Atop the plateau: Leased as Federal Unit specifying minimum spacing between pads, use of clustering, staged development, and placement of oil and gas facilities on ridgetops with slopes of 20% or less.</p>
<p><sup>3</sup> 40-acre surface density, except 20-acre surface spacing for directional drilling below cliffs. Downhole spacing as follows: Mesaverde: atop the plateau: 40 acres; below the rim: 80% at 10 acres, 20% at 20 acres; Wasatch: 160 acres throughout.</p>	<p><sup>3</sup> Atop the plateau: Minimum of 0.5 mile between pads (160-acre surface density) and clustering of up to 17 wells per pad (10 Mesaverde with 10-acre downhole spacing and Wasatch at 160-acre downhole spacing. Below the rim: Manage to maximum clustering practicable. Assumed surface density for impact assessment: 40 acres on 25%, 80 on 50%, and 160 acres of 25%. Downhole spacing: 10 acres for Mesaverde and 160 acres for Wasatch.</p>
<p><sup>4</sup> Pad impacts as follows: 1.9 acres for single-well pads, 2.5 acres for multi-well pads. Road impacts as follows: 0.6 mile of new or upgraded road per pad. Atop the plateau: 80% new roads 30 feet wide and 20% existing roads widened by 20 feet. Below the rim: 20% new roads 30 feet wide and 80% existing roads widened by 20 feet.</p>	<p><sup>4</sup> Pad impacts as follows: 2.5 acres for multi-well pads. Road impacts as follows: Atop the plateau: 12 miles from Cow Creek access point to approximate center of developable area, plus 0.3 mile per pad. Below the rim: 0.6 mile of new or upgraded road per pad. Both areas: 20% new roads 30 feet wide and 80% existing roads widened by 20 feet.</p>
<p><sup>5</sup> Includes 1.5 acres at each pad and 10 feet on each side of new or upgraded roads.</p>	<p><sup>5</sup> Includes 1.5 acres at each pad and 10 feet on each side of new or upgraded roads.</p>

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### Assumed Drilling Scenario for Proposed Plan

The number of oil and gas wells assumed to be drilled on Federal land in the Planning Unit during the 20-year period of analysis is derived from assumptions used in the RFD (Appendix H) and current drilling levels in the Planning Area. The assumptions used for the purpose of impact analyses in this RMPA/EIS are summarized below.

Atop the Plateau – BLM assumes that for most of the 20-year period, two drill rigs would be operating on Federal lands on top of the plateau. This assumption is based on the much thicker section of bedrock that must be penetrated, combined with difficult access and an assumed 6-month drilling season due to inclement winter weather and snowpack. Additionally, BLM assumes that only one rig would be operating for the first 4 years as part of the initial exploration and “ramping up” phase. Other assumptions, taken directly from the RFD, are that a drill rig can complete 6 wells per year, based on 30 days per well and 6 months of drilling. Together, these assumptions result in an estimated 210 wells atop the plateau during the 20-year period of analysis.

Below the Rim – BLM assumes that seven drill rigs would be operating on Federal lands below the rim for most of the 20-year period. Assumptions taken directly from the RFD include an average of 10 wells per drill rig per year, based on 20 days per well and a 7-month drilling window due to the 5-month TL for big game winter range. BLM also assumes that only six rigs would operate for the first 4 years because of current drilling programs in the area. Together, these assumptions result in an estimated 1,360 wells in 20 years.

Combined Area – Summarizing the analyses presented above for the upper and lower plateau, the assumed development scenario for Federal lands includes one drill rig atop the plateau and six below the rim for the first 4 years, and then two drill rigs on top and seven below for the remaining 16 years. The combined total of new wells is therefore assumed to be 1,570 wells at the end of the 20-year period. The actual number and distribution of rigs, and the actual number of wells, may vary from the assumed level due to a variety of economic, geopolitical, environmental, and technological factors, including availability of drill rigs and crews. Changes due to currently unanticipated factors associated with other resources, land uses, or management priorities for BLM could also affect future development rates. However, the assumed total of 1,570 wells in 20 years is believed to be reasonable for the purposes of analysis of impacts under the Proposed Plan and comparison with the five previous alternatives.

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**Table 4-3. Cumulative Impacts of Oil and Gas Development on Federal plus Private Land in the Planning Area in 20 Years**

Category	Alt. I No Action	Alt. II	Alt. III Preferred	Alt. IV	Alt. V	Proposed Plan
<b>Atop the Plateau = 53,798 Acres</b>						
Area Available for Oil and Gas Facilities <sup>1,2</sup>	17,227 ac (32%)	25,056 ac (47%)	39,439 ac (73%)	39,439 ac (73%)	43,395 ac (81%)	34,926 ac (65%)
Total Pads (Wells) <sup>3</sup>	66 (259)	125 (336)	98 (298)	188 (417)	234 (483)	72 (459)
Long-term Disturbance <sup>4</sup>	299 ac (0.6%)	510 ac (0.9%)	434 ac (0.8%)	741 ac (1.4%)	908 ac (1.7%)	344 ac (0.6%)
Temporary Disturbance <sup>5</sup>	194 ac	370 ac	288 ac	547 ac	692 ac	232 ac
<b>Below the Rim = 73,209 Acres</b>						
Area Available for Oil and Gas Facilities <sup>1,2</sup>	38,951 ac (53%)	36,719 ac (50%)	43,990 ac (60%)	43,990 ac (60%)	49,353 ac (67%)	41,122 ac (56%)
Total Pads (Wells) <sup>3</sup>	688 (2,717)	685 (2,690)	804 (3,145)	764 (3,028)	850 (3,220)	597 (3,232)
Long-term Disturbance <sup>4</sup>	2,968 ac (4.1%)	2,952 ac (4.0%)	3,435 ac (4.7%)	3,306 ac (4.5%)	3,694 ac (5.0%)	2,447 ac (3.3%)
Temporary Disturbance <sup>5</sup>	2,033 ac	2,022 ac	2,374 ac	2,259 ac	2,510 ac	1,392 ac
<b>Combined Area = 127,007 Acres</b>						
Area Available for Oil and Gas Facilities <sup>1,2</sup>	56,178 ac (44%)	61,775 ac (49%)	83,429 ac (66%)	83,429 ac (66%)	92,748 ac (73%)	76,048 ac (60%)
Total Pads (Wells) <sup>3</sup>	754 (2,976)	810 (3,036)	902 (3,443)	952 (3,445)	1,084 (3,703)	669 (3,691)
Long-term Disturbance <sup>4</sup>	3,267 ac (2.6%)	3,462 ac (2.7%)	3,869 ac (3.0%)	4,047 ac (3.2%)	4,602 ac (3.6%)	2,791 ac (2.2%)
Temporary Disturbance <sup>5</sup>	2,227 ac	2,392 ac	2,662 ac	2,806 ac	3,202 ac	1,624 ac

<sup>1</sup> Same as Table 4-2, except for private lands excludes only steep slopes (no NGD/NSO).

<sup>2</sup> Same as Table 4-2.

<sup>3</sup> Same as Table 4-2, except average of 40-acre surface density and 10-acre downhole spacing for private lands above and below the rim. Number below the rim includes 197 existing wells in currently leased areas of Federal lands and 583 existing wells on private lands; number atop the plateau includes 7 wells on private land (RFD, Appendix H).

<sup>4</sup> Same as Table 4-2.

<sup>5</sup> Same as Table 4-2.

## 4.2 PHYSICAL ENVIRONMENT

### 4.2.1 Geological Resources

#### 4.2.1.1 Introduction

As described in Sections 3.5.5 and 3.5.6, the Planning Area does not contain mineral resources (other than fluid mineral resources, oil shale, and some potential salable construction materials) that would affect or be affected by implementation of any of the alternatives analyzed as part of this RMPA/EIS. Additionally, the area is not known for rockhounding because of a virtual lack of metallic minerals or gemstones. Therefore, the major geologic issues are potential geologic hazards and the Anvil Points Cave system. Issues related to the presence of paleontological resources within the Planning Area are discussed in Section 4.2.2.

#### 4.2.1.2 Impacts of Proposed Plan

Geologic hazards are associated primarily with rockfall hazard along the Roan Cliffs. The combination of topographic relief in excess of 900 feet, steep slope angles, and instability associated with interbedded resistant and erosive layers contribute to rockfall. Indeed, the visual quality of the cliffs is due in large part to slope instability, which results in continual erosion and exposure of fresh bedrock and debris cones (talus and scree). Slopes steeper than 50 percent would be protected by an NGD/NSO stipulation under all of the alternatives, but only in areas with BLM surface or mineral estate. Consequently, the rockfall hazard in the non-BLM portion of the Planning Area could be greater.

The Anvil Points Claystone Cave is located within an existing oil and gas lease with an NSO to protect this resource from surface disturbance. Similar protection would be applied to other land uses and management activities under an analogous NGD restriction. Therefore, negligible negative impacts to the cave are expected from ground-disturbing land uses or management actions. However, the cave remains vulnerable to potential for moderate to major impacts from unregulated recreation.

### 4.2.2 Paleontological Resources

#### 4.2.2.1 Introduction

While high erosion rates on steep slopes in the Planning Area may be an issue in terms of rockfall hazard (see above), they have the benefit of constantly exposing subsurface materials, including new fossils. Exposed for long periods of time, these fossils erode from the confining sediments, often “float” on the ground surface, and gradually deteriorate. Cumulative impacts such as mechanical breakage and disarticulation of surface fossils due to trampling by animals and damage caused by human activities undoubtedly occurs in the Planning Area. Collecting of common invertebrates and plant fossils is a traditional and ongoing recreational activity in western Colorado. Although several fossil enthusiasts have reported vertebrate and other scientifically important fossil discoveries to land managers and BLM-permitted paleontologists, illegal collection of surface fossils still occurs and is an ongoing problem. Recreational activities such as exploring off designated roads and trails, either on foot or by mechanized means, create the need for further protective measures to preserve fossil resources.

When oil and gas activity, pipelines, and associated roads are cut into outcrops, paleontological resources are placed at risk of destruction. The ROD for the 1999 FSEIS outlines stipulations for what are now called Condition 1 and Condition 2 paleontological areas. Prior to ground-disturbing activities in a Condition 1 area (and prior to sample surveys in a Condition 2 area for larger projects), the GSFO Geologist must determine, in consultation with the BLM Regional Paleontologist, whether an inventory should be conducted by an accredited paleontologist approved by BLM. This determination is based on whether the area is likely to yield fossils of scientific importance.

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Condition 1 areas (void of well-developed soils, lacking thick vegetation, and with unsafe slopes) should be recommended for a paleontological survey for all projects. Larger projects, greater than 500 acres or longer than one linear mile, should be surveyed for Condition 2 (likely to be fossiliferous). The purpose of the surveys is to add to the knowledge base of paleontological resources in the area and help in decision-making concerning actions that may affect these resources. When scientifically important paleontological resources are already known to be present or are found as the result of these surveys, the resources should be avoided, monitored, and/or mitigated as appropriate given the type of action and specific resources.

Fossil resources on BLM lands are managed under FLPMA, NEPA, specific Federal regulations, and other guidance outlined in BLM 8270 Manual and Handbook for the Management of Paleontological Resources (BLM 1998b) and in accordance with DM 411 for the Management of Museum Collections. The BLM 8270 Handbook ranks formations according to their paleontological potential, as follows:

- **Condition 1** – Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. Consideration of paleontological resources would be necessary if the Field Office review of available information indicates that such fossils are present in the area.
- **Condition 2** – Areas with exposures of geologic units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. The presence of geologic units from which such fossils have been recovered elsewhere may require further assessment of these same units where they are exposed in the area of consideration.
- **Condition 3** – Areas that are unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils based on deep soils, surficial geology, igneous or metamorphic bedrock, and extremely young alluvium, colluvium, or eolian deposits. However, if possible it should be noted at what depth bedrock may be expected in order to determine whether fossiliferous deposits may be uncovered during ground-disturbing activities.

Although these guidelines apply primarily to vertebrate fossils, they are designed to help protect rare plant and invertebrate fossils, especially “type” localities. Likewise, many fossils, though common and unimpressive in and of themselves, can be important indicators of paleoenvironment, depositional regime, and chronostratigraphy (i.e., temporal relationships). Based on the definitions developed using the BLM 8270 Manual, the upper member of the Wasatch Formation and the A-B groove of the Parachute Creek Member of the Green River Formation would be considered as having Condition 1 paleontological potential. Until other fossiliferous units can be identified, all other Tertiary and all Quaternary deposits would be considered Condition 2.

### 4.2.2.2 Impacts of Proposed Plan

#### Direct and Indirect Onsite Impacts

Impacts to paleontological resources under the Proposed Plan would be similar to the Preferred Alternative of the Draft RMPA/EIS. The Sharrard Park Paleontological area would continue to be protected, and motorized or mechanized travel would mostly be limited to designated routes, except cross-country travel by snowmobile. Because the Sharrard Park area has been specifically identified in public documents, increased vandalism and illegal fossil collecting is possible.

Designation of the Hubbard Mesa area for open OHV travel (i.e., not limited to designated routes) would represent potentially serious threat to paleontological resources in that area. Construction of any new routes should be preceded by a paleontological survey to minimize the potential for damaging a high-quality outcrop.

Atop the plateau, management to maintain WSR eligibility along East Fork Parachute Creek adds a level of protection for Condition 1 paleontological resources of the A-B groove of the Parachute Creek

Member. The WSR areas are protected from direct and indirect impacts associated with ground-disturbing activities by NGD/NSO restrictions and the inaccessibility from the steep slopes where they occur. However, unless special provisions are made, the NGD/NSO restrictions can also hinder scientific access to paleontological resources.

Areas with SSR/CSU restrictions provide some additional protection for fossil resources, because these restrictions include a requirement for a paleontological survey prior to ground-disturbing activities and monitoring during construction. Thus, SSR/CSU areas provide opportunities not only to protect the fossil resources but, just as important, to catalog and study them. The overall effect of the Proposed Plan would be negligible, with potentially moderate beneficial impacts of SSR/CSU designations offsetting potentially moderate negative impacts in the Hubbard Mesa area.

Some of the impacts to fossil resources could represent an irreversible and irretrievable commitment of natural resources (Section 4.6).

#### **Offsite and Cumulative Impacts**

Differing levels of paleontological resource protection or discovery under the alternatives analyzed would not be expected to have demonstrable offsite or cumulative impacts. Potentially, the increased levels of oil and gas development would make the area less suitable for fossil enthusiasts. Thus, while the Sharrard Park Paleontological Area would continue to receive SSR/CSU protection, the increased “industrialization” of nearby areas might detract from the overall fossil-hunting experience and shift some use to offsite localities. However, given the relatively small amount of this type of use compared to other recreational activities and other, non-recreation-oriented land uses, any shift to offsite areas would be negligible.

Long-term cumulative impacts of oil and gas development in the Planning Area are associated primarily with the fact that a considerable amount of future development would occur on private land within the Planning Area and nearby areas with the same type of fossil-bearing rock exposures. Because private landowners do not require paleontological assessments before and during construction activities, much less any mitigation of at-risk resources, some important fossil specimens or paleontological data could be lost. Additionally, private landowners may restrict access to significant fossil locations on public land that are not readily accessible except across their property. Oil and gas development both within and outside BLM lands within the Planning Area is likely to exacerbate the problem by limiting public access except on designated roads.

### **4.2.3 Soils**

#### **4.2.3.1 Introduction**

Direct soil impacts of concern in the Planning Area include soil erosion, mixing of horizons, changes in infiltration from compaction and fire, and chemical contamination. Some or all of these impacts can occur from OHV travel, recreation, grazing, range management activities, fire management, oil and gas development, and ground-disturbing activities associated with rights-of-way such as roads, pipelines, and electric transmission corridors. Impacts on the physical, biological, and chemical properties of the soils can have indirect effects on sedimentation, infiltration and permeability, soil biota, and plant productivity. The categories of impacts used in this analysis (i.e. negligible, minor, moderate, or major) are described in Section 4.1.

Soil erosion is a concern for future management of the Planning Area, particularly regarding anticipated oil and gas development. Impacts may include reduced ecological, visual, and agricultural (livestock) quality due to removal of vegetation cover, mixing of soil horizons, soil compaction, and contamination from drilling and production wastes or fuel spills. Exposed, mixed, compacted, or contaminated soils exhibit loss of productivity, decreased infiltration, increased runoff, and increased erosion. Wind erosion

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is not as important a factor in the Planning Area, although the combination of increased areas of bare soils and increased road traffic would increase the generation of fugitive dust (airborne particulates).

Although soil erosion is a natural process that occurs even in “pristine” areas, the rate of erosion can be greatly accelerated by anthropogenic (human-use-related) activities such as grazing, cultivation, forestry, recreation, and construction that remove vegetation cover and disturb the soil surface. Soil loss can occur as sheet, rill, or gully erosion associated with precipitation runoff, as well as from wind erosion. The most important factors affecting runoff erosion are the intensity and duration of precipitation, inherent erodibility of the soil, slope length and steepness, vegetation cover, and erosion control practices (Wischmeier and Smith 1978).

Soil erosion rates can be increased by as much as an order of magnitude (i.e., tenfold) during construction, when vegetation has been cleared, topsoil removed and stockpiled, and subsoils exposed to rainfall and snowmelt. In the Universal Soil Loss Equation, input values used to represent the ameliorating effect of plant cover are 12 times as high with 60 percent grass cover, and 5 times as high with 40 percent grass cover, as for areas with zero percent grass cover (Wischmeier and Smith 1978). This increase in erosion potential is exacerbated when the disturbance occurs in soils that are inherently more erodible (Section 3.2.3). For example, soils with a “very severe” erosion hazard can lose 12 to 30 tons per acre per year under normal conditions, compared to only 1 to 2 tons per acre per year for soils with a “low” erosion hazard.

Surface disturbance from oil and gas development would be spread over time throughout and beyond the 20-year period of analysis, reducing the amount of new disturbance in any given year. This is important because runoff, erosion, and sedimentation associated with wells are highest initially, when soils are freshly disturbed, and decline as revegetation gradually reduces the amount of bare soil. Runoff and erosion are likely to be greater from roads, although smaller in total area, than from oil and gas pads, because roads may slope and may approach or cross streams, while oil and gas pads are relatively flat and could not be located adjacent to a stream or on a steep slope.

Because of the importance of reducing soil loss and protecting sensitive ecological resources on Federal lands in the Planning Area, BLM has established and NGD/NSO for areas steeper than 50 percent due to the high potential for erosion and the difficulty of rehabilitating these areas (Map 14). SSR/CSU restrictions have been established for areas steeper than 30 percent having soils with a severe or very severe erosion hazard, based on the NRCS (SCS 1985) soil survey of the Rifle area (see Map 15). The application of these protective stipulations to the alternatives considered in this RMPA/EIS is discussed in the following subsections.

Assessing the potential severity of soil erosion from oil and gas development is not as simple as comparing the amount of newly disturbed ground to the total project area. For example, achieving a level well pad often requires cut-and-fill slopes that affect the erosion potential related to pad construction. Additionally, NGD/NSO and SSR/CSU restrictions to avoid problematic areas and BMPs and reclamation standards to reduce erosion potential are likely to vary in their effectiveness. In general, areas atop the plateau or less subject to soil erosion, based on a relatively low proportion of soils in the severe or very severe erosion classes and the denser vegetation cover. However, the small sizes and low flow volumes of streams at the higher elevations make these drainages susceptible to adverse impacts from relatively small amounts of sediments. In comparison, the area below the rim has naturally sparser vegetation and a higher proportion of highly erodible soils, which contribute to naturally higher levels of suspended solids (sediment loads) in Parachute Creek (see Table 3-2b) and the Colorado River. Therefore, a given amount of inflow of eroded soils from ground-disturbing activities in the Planning Area would represent a proportionately much small incremental increase for streams below the rim than for those above.

An indirect impact of particular importance for this RMPA/EIS is the potential transport of eroded soil material to streams, where it may adversely affect water quality, riparian vegetation, and aquatic

organisms, including genetically pure populations of the Colorado River cutthroat trout and other sensitive plant and animal species.

Areas of bare soil are also a source of suspended (windblown) particulates in the form of fugitive dust that may be transported into aquatic habitats and deposited on plant foliage, reducing plant vigor and affecting local air quality.

The management and expected impacts to the soil resources of the Planning Area associated with each alternative are described below. The general management of the soil resources is based on Land Health Standards. All of the alternatives would manage soils to meet or exceed Land Health Standard 1. Areas with wilderness character and areas eligible for designation as WSRs are discussed in Sections 4.5.8 and 4.5.9.

Some of the soil impacts described in the following subsections may represent an irreversible and irretrievable commitment of natural resources.

#### **4.2.3.2 Impacts of Proposed Plan**

##### ***Direct and Indirect Onsite Impacts***

The Proposed Plan would have less direct impact on soils than any of the alternatives in the Draft RMPA/EIS except for Alternative I (No Action). This is due to the requirement for phased and clustered oil and gas development atop the plateau and the goal of clustering below the rim. Additionally, the Proposed Plan would have more area protected by NGD/NSO and SSR/CSU restrictions than any alternative except Alternative II. These include the specific soils-related protections of an NGD/NSO for slopes steeper than 50 percent and an SSR/CSU for slopes steeper than 30 percent on erosive soils. In this context, erosive (highly erodible) soils are those map units identified in the soil survey of the Rifle Area as having a high erosion hazard (SCS [NRCS] 1985).

The estimated 193 new oil and gas pads and 124 miles of new or upgraded access roads under the Proposed Plan would result in total long-term disturbance of 812 acres and temporary disturbance of 318 acres. However, these totals are less than 50 percent of the long-term impact acres, and less than 25 percent of the temporary impact acres, under Alternative II—the environmentally most protective alternative of the Draft. The total long-term ground disturbance under the Proposed Plan represents 1.1 percent of the Federal lands on the Planning Area. In comparison, the analogous figure for the five previous alternatives ranged from 1.6 percent to 3.4 percent.

For the area atop the plateau, the reduction in ground-disturbing impacts is accomplished not only by clustered development (with a minimum of 0.5 mile between pads), but also by focusing development on ridgetops with slopes of 20 percent or less. The latter measure avoids most of the valley sideslopes. In addition to causing less physical disturbance and increased erosion loss of soils, it also provides greater distances of well pads from streams, as well as fewer new road crossings of streams.

Although the oil and gas impacts under this alternative would have negligible soil impacts overall, impacts would continue to be more severe at a localized scale due to long-term changes in soil fertility or structure, loss of topsoil, compaction, loss of plant cover, and other changes. These areas of localized impact may create ecological and visual scars extending well beyond the end of the 20-year analysis period. BMPs to minimize these impacts include requirements for salvaging and replacing topsoil. A related component of the Proposed Plan that was not contained in any of the previous alternatives is the requirement that no more than 350 acres (approximately 1 percent of the Federal lands atop the plateau) be in a disturbed condition at any one time. In this regard, “disturbed condition” means areas from which plant cover has been removed, but excluding areas in at least their second year of revegetation and showing satisfactory progress toward revegetation success (Appendix J).

Examples of BMPs (see Appendix I for a comprehensive list) that may be required to reduce the potential for soil damage or loss in specific locations include:

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- use of erosion-control fabric to stabilize development-related bare slopes steeper than 2 to 1 (horizontal to vertical)
- construction of water bars or other erosion-control features on vehicle routes constructed or used to access oil and gas pads or roads used for grazing access and recreational travel
- testing of soil for agronomic (growth) characteristics prior to reclamation of long-term disturbances and adding organic matter, applying nutrients, or undertaking other measures to improve quality as a growth medium (not an issue for temporary impacts)
- requirements for enhanced revegetation, including use of woody plants as containerized stock to hasten soil stabilization

The Proposed Plan would share with Alternatives II through V the restriction of motorized and mechanized travel to designated routes, except that it would allow cross-country travel by snowmobiles with at least 12 inches of snow cover and would designate the Hubbard Mesa OHV Riding Area as open for cross-country travel. Based on current and anticipated growing levels of OHV use in the Hubbard Mesa area, the open designation in this area is likely to result in potentially major localized impacts to soils from physical disturbance, compaction, and damage to vegetation. The resultant increase in soil erosion and sediment transport would be likely to affect water quality in Government Creek, which receives runoff from the Hubbard Mesa area. However, the increased suspended load in Government Creek would be unlikely to affect water quality in the Colorado River, to which Government Creek is a minor tributary. Outside the Hubbard Mesa OHV Riding Area, the Proposed Plan would also be unlikely to substantially increase sediment loads in perennial streams supporting aquatic life, based on the various protections provided.

Vegetation goals would focus on improving the diversity, production, and native species composition of upland and riparian/wetland areas. Livestock grazing would be managed to conform to BLM grazing regulations and meet Land Health Standards as well as vegetation community objectives. Because the Proposed Plan makes greater use of active management than Alternatives I and II, which relied primarily on natural processes, the rate of range improvement is expected to be more rapid. Over time, the Proposed Plan is expected to have moderate to major positive benefits on vegetation condition, which in turn would benefit the soil resource.

Fires can affect soil by removing plant cover, destroying surficial organic matter, altering the temperature and moisture regimes (by altering the amount and type of plant overstory), altering patterns of snow accumulation and snowmelt, and (if sufficiently hot) modifying soil infiltration rates by creating a hydrophobic or “water-repellent” surface. Because of higher temperatures and occurrence during less favorable seasons (during summer when vegetation may be drought-stressed), uncontrolled wildland fires typically have a greater impact than lower intensity prescribed fires. However, wildland fire management under any of the alternatives is related primarily to other factors, such as management of forest and range health and risks of damage to private property, crucial habitats, watershed processes, and oil and gas facilities.

Overall, soil impacts under the Proposed Plan would be minor due to the combination of road closures, prohibition against cross-country OHV travel except for Hubbard Mesa and snowmobiles, and rangeland improvements combining to offset much of the adverse impact associated with oil and gas development. The phased and clustered development atop the plateau, and to a lesser degree the assumed level of clustering below the rim, would also reduce the severity of soil impacts from oil and gas development.

Indirect impacts to soils associated with soil erosion have been described above and include both direct disturbance during construction of roads and drill pads or potentially from cross-country OHV use and indirect impacts from loss or reduced vigor of plant cover that stabilizes the soil. Impacts of reduced soil quality include greater erosion potential and resultant sediment transport to streams, potential entrainment

as fugitive dust, visual degradation, and reduced vegetation cover due to soil instability, lower fertility, and compaction.

Especially because of the slow recovery rate of natural plant communities in semi-arid regions, the loss of vegetation associated with soil impacts would indirectly reduce wildlife carrying capacity in proportion to the amount of land taken out of forage production and no longer providing cover or, for small ground-dwelling species, habitable land.

Under any of the alternatives, including current conditions, sediment transport to streams could affect water quality for the Colorado River cutthroat trout, as well as other aquatic species and terrestrial species that rely on water. However, the clustered development requirement and the restriction of development to ridgetops in the area on top of the plateau, combined with the restriction of motorized and mechanized travel to designated routes and planned range improvement measures, would minimize this risk compared to Alternatives II through V. Alternative I would not allow oil and gas development atop the plateau, but would allow cross-country OHV travel and implement less aggressive range improvement measures.

#### **Offsite and Cumulative Impacts**

Offsite impacts of soil erosion within the Planning Area would mostly be limited to offsite transport of sediments and, to a lesser degree, offsite impacts on air quality. Considering the currently sparse vegetation across much of the lower portion of the Planning Area, naturally high rates of soil erosion would continue in this area. However, due to the naturally high sediment loads in area streams and the measures described above for reducing soil erosion, these offsite impacts are expected to be negligible under all of the alternatives, including the Proposed Plan.

Cumulative onsite impacts would be minor, since the proportion of the area disturbed would remain a small percentage of the total area. In general, cumulative impacts of land uses on Federal lands are likely to be substantially less than those on private lands due to generally fewer and less stringent protections. Even on private lands, development on areas with slopes steeper than 50 percent is not anticipated, lessening the potential impacts on private lands. However, avoidance of slopes steeper than 30 percent with erosive soils, and BLM measures related to revegetation and range improvement, are not as likely to accompany development on private lands.

Assessing the potential for cumulative offsite impacts of soil erosion assumes that urbanization of private lands both inside and outside the Planning Area is likely to continue at current or accelerated rates. This has the potential to disturb much larger areas than those on BLM lands. Nonetheless, the combination of increased roads and access to the Planning Area, continued population growth and resultant increase in OHV travel, and increasing amounts of long-term disturbance associated with oil and gas development could result in observable adverse impacts from erosion and sediment transport to streams.

### **4.2.4 Water Resources**

#### **4.2.4.1 Types of Impacts**

Water quality impacts can result from a number of causes, including transport of eroded soils into streams due to livestock grazing, introduction of waste matter into streams from domestic livestock, and “low-water” crossing points of roads, routes, and ways used by motorized vehicles. While these potential impact sources exist and would continue under any of the alternatives, a potentially greater source of potential impacts to water quality would result from additional oil and gas development. Potential oil and gas impacts relate to both the transport of soil eroded from roads and drill pads and the potential for release of chemical pollutants into area ponds, streams, or tributary ephemeral drainage swales.

**Sedimentation**

Sedimentation is the buildup of eroded soil particles in surface water channels. Erosion is a natural process; however, certain land-use activities may accelerate the process. Erosion and sedimentation can be increased by activities that move soil/sediment particles and/or activities that reduce the density or quality of vegetative cover, including livestock grazing and range manipulation, grading and clearing for roads or well pads, on- and off-road OHV use, and fire or fire management. Additionally, activities or management prescriptions that reduce the quantity or quality of ground cover can increase surface water runoff, thereby potentially increasing sedimentation of water channels.

Once soil particles have been detached and suspended in surface runoff, they can contribute to degradation of surface water quality and aquatic habitats. Impacts to water quality due to sedimentation are highly variable. Generally, sedimentation can degrade water quality by increasing turbidity and salinity, and introduce contaminants held in the soil particles. Sediments can also bury plants and rocks and accumulate in streambeds.

In the Planning Area, streams would be protected by setback restrictions and by BMPs and reclamation standards for ground-disturbing activities within the watershed. Nonetheless, construction of well pads, roads, pipelines, and related facilities would result in large amounts of soil being moved locally in the short term, potentially resulting in temporary decreases in water quality in nearby streams. In the Planning Area, which includes large areas of soils with naturally severe or very severe erosion rates (5 to 30 tons/acre/year), it is possible that any increase in sedimentation from oil and gas development during the 20-year period of analysis, or from other land-use or management activities, would not be distinguishable from natural erosion rates in the area.

The portion of a given source of sedimentation that actually reaches a stream can be near zero where an eroding slope deposits most of the soil particles at the base of a hill, to 100 percent where an eroding slope leads directly to a stream.

**Chemical Pollution**

Each phase of oil and gas extraction can create wastestreams that, if not handled correctly, could degrade surface and ground water quality. Table 4-4 describes typical wastestreams. The severity of the effects may be highly variable, depending on the content of the waste-stream, amount and location of discharge, geologic formation and permeability of soils, and climatic conditions.

**Table 4-4. Potential Wastestream Outputs from Oil and Gas Extraction Processes**

<b>Stage</b>	<b>Wastestreams</b>
Well Development	Drilling muds, organic acids, diesel oil, crankcase oils, and acidic stimulation fluids (hydrochloric and hydrofluoric acids)
Production	Heavy metals, dissolved solids, organic compounds, and high levels of salt. May also contain additives including biocides, lubricants, and corrosion inhibitors.
Maintenance	Completion fluid, well-cleaning solvents, paint, and stimulation agents. The volume of associated wastes (wastes related to maintenance) is typically very small, about one barrel per well per year.

*Source: Profile of the Oil and Gas Extraction Industry (EPA 2000)*

The primary wastestreams from oil and gas extraction are associated with drilling wastes and produced water. During drilling, as much as 0.06 to 0.14 barrels of drill cuttings are produced for each vertical foot drilled, based on a 7.875-inch gauge bore and 12-inch washout. The drilling mud may contain bentonite clay and various contaminants (Section 3.5.12).

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Drill cuttings, including rock fragments and unsalvaged mud, typically are not removed from the site. Up to 100 cubic yards of cuttings (for an 8,000-foot deep well and a 7.875-inch gauge bore) may be left at each drill pad per well drilled. The mud pits are typically unlined, 8 to 10 feet deep, and backfilled with the excavated soil and subsoil material after drilling is completed. Drilling mud may be reconditioned and reused. Drilling mud is typically monitored continuously (24 hours a day) during drilling operations to avoid accidental release from a site. In the event of an inadvertent discharge, its high viscosity would limit the rate of overland flow, allowing it to be contained before reaching a stream (in combination with the setback distances from streams of at least 200 meters).

According to a recent study by the EPA (2000), the primary byproduct of the production phase, and of the industry, is produced water. While disposal of produced water by underground injection is common in some regions, it is not common in the Roan Plateau area, and BLM has not approved any injection wells in the Planning Area. Use of pits or ponds to dispose of produced water by evaporation (and to a lesser extent infiltration into the soil) is also common in some areas but less so in the Planning Area. Alternative I (and the other alternatives) would specify that any drilling atop the plateau be a self-contained operation in which produced water is trucked offsite for disposal.

Table 3-35 (Section 3.5.12) summarizes the chemistry of produced water from the Black Mountain brine disposal facility in Colorado. While the data from this facility may differ slightly from the chemistry of evaporation ponds at oil and gas development sites in the Planning Area, they provide a basis for analyzing the potential impacts of disposal of contaminated produced water. At this facility, sodium, chloride, dissolved solids, iron, manganese, benzene, and toluene exceeded Colorado's MCLs for drinking water and groundwater by a factor of 10 or more. The reported analyte concentrations presented in Table 3-35 are conservative (more likely to overestimate than underestimate) produced waters at the well sites because of concentration associated with evaporation. According to Williams Production, the largest producer of oil and gas in the Planning Area, approximately 4 barrels of water are produced per well each day (Cesark 2003).

Potential regulated releases could occur from tanker trucks, onsite tanks, or evaporation ponds. The size of potential spills can vary. The average condensate tank capacity is typically 300 barrels per wellhead, and produced-water storage tanks are generally between 200 and 300 barrels per wellhead. Transport trucks range in capacity from 60 to 120 barrels. Produced water typically contains about 10 percent condensate. The tankers and/or ponds can contain more than 25 gallons of natural gas condensate at any given time. BLM requires reporting of brine releases that exceed 100 barrels.

Discharge or seepage of drilling mud or produced water, if not handled correctly, could have localized major direct impacts to surface water. The effects are highly dependent on the level of contamination, the method of disposal, and the amount disposed. However, drilling permits require operators to ensure that exploration and production waste is properly stored, handled, transported, treated, recycled, or disposed to prevent significant environmental impacts to water resources. These requirements aim to minimize or eliminate adverse impacts associated with oil and gas extraction processes.

Adverse impacts to water quality could occur as a result of accidental discharges, leaks, or spills at development sites. In the case of small or one-time discharges of contaminated drilling mud or produced water, direct impacts to water quality are considered minor because effects are temporary and limited to the immediate area. However, the impacts could be major for a specific resource in a specific area. For example, a sudden accidental release from a tanker truck—e.g., from tipping over and rupturing at a stream crossing—would cause major impacts to water quality at the site and for some distance downstream. In the small streams that characterize most of the Planning Area, a spill of up to 120 barrels of brine or other pollutant (e.g., fuel) could kill most or all of the aquatic biota, and some of the adjacent riparian vegetation, along whatever downstream distance would be required for dilution below toxic levels. A requirement for culverted road crossings of streams, as specified for reducing stream erosion and protecting aquatic and riparian vegetation and wildlife, would probably reduce the potential for truck

accidents at stream crossings, which often require a relatively steep descent to, and departure from, the crossing point. Standard operating procedures for these incidents are summarized in Section 3.5.12.

### **Reduced Water Quantity**

Water yield is dependent on both natural factors and land management. Natural factors include climate, geology and soils, slope, channel conditions, and vegetation type and density. Land use or management activities that result in alteration of these natural factors plays a role in altering water yield, including grading or compaction of soils for new roads or well pads, and management prescriptions that alter the type or density of vegetation.

Reductions in water flow can have adverse impacts on the ecology of a watershed, its recreational potential, the availability of drinking water and water for other uses, and groundwater quality and quantity (EPA 1999). Such reductions could result from consumptive uses of surface water or tributary groundwater sources that do not result in return of the water to the basin. Examples include evaporative loss from new surface water features, evapotranspiration from irrigation of vegetation, injection into deep wells, or use in drilling fluids that are later disposed outside the basin.

#### **4.2.4.2 Impacts of Proposed Plan**

This section evaluates the changes to water resources in the Planning Area from implementation of management actions for the Proposed Plan, with selected comparisons to the five previous alternatives. To evaluate effects on water quality and water rights, threshold criteria were developed to differentiate the extent and intensity of impacts under each alternative. Categories of adverse impacts on water quality used in this RMPA/EIS include:

- **None** – Not likely to affect the resource.
- **Negligible** – Changes in water quality may be detectable and measurable in analytical samples but not upon observation in the field. No regulatory standards would be exceeded. Changes in water quality or quantity would not affect current uses or have discernible impacts on water-dependent resources.
- **Minor** – Degradation of water quality could result in exceedances of regulatory standards, but these would be transitory (e.g., in response to a pulsatile event) and limited to the vicinity of the causal sources. Changes in water quality may be discernible in the field as well as in analytical samples. Changes in water quality or quantity could temporarily impair some current uses or water-dependent resources in localized areas.
- **Moderate** – Degradation of water quality could result in more widespread, but transitory, exceedances of regulatory standards. Changes in water quality may be discernible in the field. Changes in water quality or quantity would temporarily impair some current uses water-dependent resources beyond the vicinity of the source, or the most sensitive current uses and water-dependent resources in localized areas.
- **Major** – Water quality would be degraded to a degree that causes ongoing and/or widespread exceedances of regulatory standards. Changes in water quality and/or quantity would be discernible in the field and cause long-term impairment of all current uses and water-dependent resources.

The same terms are applied in a more relative sense to describe beneficial impacts. The following subsections summarize impacts to water quality and quantity under the Proposed Plan. Because surface water is a renewable resource (i.e., continually replenished by natural processes), and because no aspect of the proposed alternatives would represent a permanent consumptive use or depletion of surface water, none of the impacts discussed below would represent an irreversible and irretrievable commitment of natural resources. Impacts to groundwater could be considered an irreversible and irretrievable commitment of a natural resource due to the much slower rate at which changes in water quality or quantity would be reversed by natural processes (Section 4.6). However, the potential for contamination

of usable water zones and domestic groundwater, or adverse impacts on groundwater quantity, from oil and gas drilling on BLM lands is considered negligible under all alternatives. This is due to the requirement that operators isolate and protect usable water zones, the relatively few domestic water wells on or near public lands, and the limited water-bearing zones below the rim (TRW 1982, BLM 1998c). Atop the plateau, groundwater is more abundant but has not been significantly developed for domestic uses due to its depth and the lack of permanent residents. However, more than 40 springs have been developed by BLM for use by livestock or wildlife.

#### ***Direct and Indirect Onsite Impacts***

**Sedimentation** — The Proposed Plan is assumed to result in a smaller number of oil and gas pads and fewer miles of new access roads than any of the alternatives analyzed. This is the result of required phased and clustered development atop the plateau and a management emphasis on clustered development below the rim. Although 14,000 acres of additional lands would be available for oil and gas surface facilities than under Alternative II, some 17,000+ acres of additional SSR/CSU restrictions would be established. Importantly for water quality considerations, the greatest benefit of these measures would be seen atop the plateau, where numbers of well pads would exceed Alternative I (No Action) by only 6 (13 versus 7), while the numbers of wells would exceed Alternative I by 200 (210 versus 10). Besides fewer acres of long-term disturbance atop the plateau than Alternatives II through V, the Proposed Plan would also focus development onto ridgetops. Due to the more gentle slopes and greater distances from streams associated with ridgetop development, transport of eroded soils and road materials to surface waters would also be reduced.

WSR-eligible streams would continue to have NGD/NSO restrictions, as would streams and adjacent slopes or tributaries with high quality or moderate quality for Colorado River cutthroat trout. NGD/NSO restrictions would also apply to riparian and wetland corridors. All of area atop the plateau not protected by one of these NGD/NSO restrictions would be protected with an SSR/CSU, including the Parachute Creek WMA and two drainage-based ACECs (East Fork Parachute Creek and Trapper/Northwater Creek). All of these areas would be subject to the BMPs described above for soils (Section 4.2.3).

Restriction of motorized and mechanized travel to designated routes, except for over-snow travel by snowmobiles and open travel in the Hubbard Mesa OHV Riding Area, would also reduce the risk of sediment-impacts on area streams atop the plateau. Below the rim, some increased sediment transport associated with open travel designations in Hubbard Mesa could increase sediment loads in receiving waters of the Government Creek drainage. However, currently high erosion rates in this area, combined with the ephemeral nature of the drainages, reduces the potential for detectable impacts to aquatic or riparian/wetland resources. Throughout the Planning Area, the combination of active range management and administrative solutions to reduce grazing impacts and help meet Land Health Standards would tend to reduce the risk of water quality impacts from sedimentation of area streams.

Vegetation goals would focus on improving the diversity, production, and native species composition of upland and riparian/wetland areas. Livestock grazing would be managed to conform to BLM grazing regulations and meet Land Health Standards as well as vegetation community objectives. Because the Proposed Plan makes greater use of active management than Alternatives I and II, which relied primarily on natural processes, the rate of range improvement is expected to be more rapid. Over time, the Proposed Plan is expected to have moderate to major positive benefits on vegetation condition, which in turn would benefit surface water quality.

**Chemical Pollution** — Additional oil and gas development would increase the potential for accidental spills or other discharges of contaminated drilling mud or produced waters over time. With 83 percent more wells than the No Action Alternative and 66 percent more wells than the Preferred Alternative, the potential for a pollutant spill would increase proportionately but remain low. Additionally, the phased and clustered development atop the plateau, and the focus on ridgetop development, under the Proposed

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Plan would substantially reduce the risk of direct spills into streams from trucks and overland flow of well-site pollutants than any alternative except the No Action.

In the case of small or one-time discharges of contaminated drilling mud, produced water, or other pollutants, the potential for direct adverse impacts is considered minor overall. However, impacts of a catastrophic release such as spillage of a tanker truckload into a sensitive stream segment could be major for localized resources. Potentially affected resources could include the Colorado River cutthroat trout and other sensitive aquatic or terrestrial receptors exposed to the water. Impacts could extend a considerable distance downstream, depending on the volume and rate of pollutant release, the volume and flow velocity of the receiving water, and the toxicity and dispersal behavior of the specific pollutant (highly viscous mud versus soluble contaminants versus an immiscible surface sheen resulting from the inability of oil and water to mix).

The potential for contamination of usable groundwater from oil and gas operations is considered negligible, based on the requirement that operators isolate and protect usable water-bearing zones and the limited amount of water-bearing zones on public lands below the rim (TRW 1982, BLM 1998c). Although four significant aquifers occur on top of the plateau, the only known well is associated with a BLM cabin near the center of the upper plateau. The limited number of water wells is related to the depth to usable groundwater and the lack of permanent residents. While many of the springs, both developed and undeveloped, are used for livestock watering and sustain wetlands or streams, the risk of damage to these resources from drilling-related contamination of groundwater is also low due to the requirements placed on drilling operations and, for the hydrologic resources atop the plateau, the small number of oil and gas wells during 20 years.

**Water Quantity** — Under the Proposed Plan, no areas would be closed to oil and gas leasing. However, the protective stipulations (NGD/NSO and SSR/CSU) and BMPs described above would specifically address protection of aquatic and riparian resources, including large portions of watersheds. These measures would reduce impacts to water quantity as well as to water quality.

Although road and well pad construction under this alternative would tend to increase runoff and hence water yield, any increases would be minor due to the small amount of increase in barren area involved (e.g., 1.1 percent of the BLM lands in the Planning Area under the Proposed Plan) and required setback distances from streams. Therefore, impacts to water quantity from increased runoff are considered negligible.

An additional consideration affecting water quantity involves the source and disposition of waters used for oil and gas activities. The Proposed Plan (and other alternatives) would establish an LN requiring that water used for drilling be either trucked into the area from an offsite source (i.e., not pumped from area streams) or piped into the area from an offsite source. This is especially important for the small streams atop the plateau, where the aquatic habitat value is substantially limited by existing flow volumes characteristic of streams in headwaters regions. For the Colorado River Basin as a whole, BLM has estimated future depletions from oil and gas drilling activities on BLM lands in the Planning Area at 0.55 acre-feet per well per year. This computes to 43 cfs per year under the Proposed Plan, using assumptions of 200 barrels per well per day, 78.5 wells per year, and a weighted average of 22 days per well (20 below the rim, 30 atop the plateau). If the depletion were distributed uniformly throughout the year, it would represent an average decrease of 0.06 cfs, or less than 0.002 percent of the average flow in the Colorado River near the Planning Area.

Additional depletions could result from use of Colorado River Basin waters in dust suppression of roadways used for oil and gas access. Because dust suppression would be required only on roadways actively used for oil and gas access, and only during portions of the year, the exact number of miles or acres of roads requiring dust suppression per year is not known. Methods to reduce depletions related to dust suppression include surface treatments such as magnesium chloride or gravel. Surface treatments would not be allowed in areas where they could adversely affect surface waters. Other water

conservation measures could include onsite treatment and reuse of imported or produced waters for dust suppression or other applications.

Some minor water development for grazing or wildlife enhancement is possible, but the amount of any related depletions due to increased evaporative loss from stockponds or “guzzlers” would be negligible at the scale of the Planning Area. Additionally, successful enhancement of areas not meeting Land Health Standards due to livestock use could decrease runoff due to increased vegetation cover. However, the result of this impact is generally beneficial, because contributions to runoff as shallow subsurface flow following infiltration into a vegetated hillside are less “flashy” and more protracted than in poorly vegetated situations, even if actual flow to the stream is reduced. The 1984 GSRA RMP allows for enhancing water yield by vegetation manipulation, which alters the timing, duration, and intensity of runoff. Treatments could include thinning of brush, prescribed fires, and timber harvests.

Based on these considerations, the Proposed Plan is not expected to result in substantial depletions of surface water or groundwater during the 20-year planning period. Potentially, flow volumes in localized areas could increase slightly if water piped or trucked from other basins or sub-basins is treated and disposed or reused onsite.

**Channel Morphology and Stability** – Indirect impacts on surface water resources include changes in channel morphology and stability. Land-use changes may increase runoff by decreasing infiltration and evapotranspiration (e.g., due to reduction in vegetation cover) and increasing the amount of impermeable surface (roads, structures, compacted soil). Generally, channel area increases to accommodate the increased discharge, including channel deepening, widening, or both. Large quantities of sediment introduced directly to the channel or riparian zone can aggrade channels, fill pools, and choke channel substrates with fine sediment.

Under the Proposed Plan and Alternatives II through V, surface runoff and sediment delivery to streams would be addressed by combinations of NGD/NSO and SSR/CSU restrictions, limiting cross-country recreational travel in most of the Planning Area, and various BMPs, reclamation standards, and range improvement measures. Proper placement of well pads, roads, and pipelines and satisfactory implementation of measures to stabilize and revegetate areas of temporary disturbance would further contribute to reducing potential impacts to streams.

Because of the combination of measures to reduce the risk of increased sediment loads and the anticipated negligible effect on flow volumes, the morphology and stability of streams within the Planning Area are also not expected to be affected by any of the alternatives. Potentially, the introduction of water into the system by treating and discharging imported waters used for drilling could increase surface flows at and below the discharge point. However, proper methods and locations for these discharges (e.g., into ponds to be used for stock watering) would minimize the potential for increased channel erosion. Also, because of the requirement for phased and clustered development atop the plateau, localized additions to the water balance in any one area would be temporary as well as minor.

Another possible source of more extensive impacts to channel morphology and stability, as well as water quality and surface water yield, is the abrupt reduction in vegetation cover as a result of either a prescribed fire or wildland fire in the currently forested watersheds atop the plateau. To a lesser extent, this risk also applies to some forested lands below the rim. By removing vegetation cover, including the tree canopy, and altering the surficial soil (see Section 4.2.3.2), intense fire events can result in greater volume, velocity, and sediment load of runoff entering directly into a stream from upslope areas or carried in along tributary channels.

In light of the constraints associated with oil and gas development, combined with the sensitive wildlife and fisheries values related to the current forest habitat, the top of the plateau has recently been reclassified from FMZ D to C (see Section 4.5.11). This change reflects recognition that, while fire can be an effective tool for some aspects of forest management, the adverse consequences of fire reduce its

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desirability atop the plateau. Areas along and below the cliffs would continue to be rated as FMZ B, with a greater constraint on prescribed or wildland fire.

### ***Offsite and Cumulative Impacts***

Offsite impacts to water resources include transport of sediments or contaminants through surface runoff or streamflow to downgradient receptors, including Parachute Creek, Government Creek, and the Colorado River. The impact of sediments and chemical pollutants in offsite streams, lakes, or ponds from land use and management activities on BLM lands in the Planning Area is expected to be much less than for private lands in the Planning Area due to additional various land uses and management actions in other portions of these watersheds. An exception to this generalization would be if a chemical pollutant were discharged into waters on BLM lands in sufficient quantities to be transported to offsite waters at concentrations that adversely affect water quality for aquatic life, livestock watering, recreation, or other uses.

A quantitative assessment of cumulative impacts on surface water is not possible, due to unavoidable uncertainties about (1) the location, scale, and rate of oil and gas development on BLM lands, private lands, and other lands both inside and outside the Planning Area; (2) impacts from other types of land uses associated with the regional population growth; and (3) the application and effectiveness of environmental protections associated with non-BLM lands. However, the long-term surface disturbance from new wells on BLM lands in 20 years (812 acres) represents about 29 percent of the cumulative total for the Planning Area (compare Tables 4-2 and 4-3). Also, the total number of BLM and private wells in the Planning Area at the end of 20 years (approximately 3,700) is in comparison to a projected total of 10,000 to 20,000 in Garfield County for the same time-frame (Section 3.4.3).

Also, oil and gas development is in addition to ongoing industrial, commercial, and residential development associated with the current annual population growth of 3.9 percent in Garfield County and 4.5 percent in the area west of Rifle (Section 3.4.3). Urbanization increases impervious surfaces, thereby increasing surface runoff and potentially increasing sediments and contaminants in local surface waters. These potential impacts may be minimized in urbanizing areas due to local and county requirements for detention of surface runoff (and especially storm flows), with the effect of delaying or reducing the amplitude of discharge from storm events and achieving some water treatment by allowing sediments and associated contaminants to settle out. If not managed properly, however, urban runoff can cause serious erosion of receiving streams by increasing the magnitude of storm runoff. The resultant channel erosion can damage both the aquatic habitat and adjacent riparian habitat—a common situation in urban areas prior to the implementation of local and county requirements for drainage improvements in conjunction with development.

Urbanization also typically includes irrigation of landscaping. However, this may be less than the amount of irrigation associated with the agricultural lands used for development. Increased runoff from urbanization may benefit receiving waters by reducing the flashiness of storm events and adding irrigation returns to the base flows, thereby increasing the volume and persistence of surface flows.

Another issue associated with both oil and gas development and urbanization in the region is potential for increased salinity of the Colorado River and other streams. Current sources of salinity include naturally high levels contributed by saline springs and runoff from areas of saline soils. Existing oil and gas development and runoff from highways, roads, and parking lots may contribute substantial additional salinity. Within the Planning Area, BLM requires measures to reduce or avoid discharge of saline waters to streams (e.g., see Section 4.5.5).

## 4.2.5 Climate and Air Quality

### 4.2.5.1 Introduction

The burning of fossil fuels (natural gas, crude oil, coal, etc.) produces various emissions, including so-called greenhouse gases (GHGs). These GHGs (primarily carbon dioxide [CO<sub>2</sub>]) are widely believed to cause global warming but, at a minimum, contribute to air pollution. The continued or increased production and combustion of natural gas from resources underlying the Planning Area, which would occur under any of the alternatives, would produce GHGs. However, the amount of GHGs potentially produced from Planning Area resources is an extremely small fraction of global emissions and lower than it would be if other fuels (coal, oil, etc.) were being used instead. Therefore, no significant adverse impacts to climate are anticipated from implementation of any of the alternatives, because they would not add to the demand or consumption of fossil fuels.

Potential air quality impacts were analyzed to determine maximum “near-field” (local) ambient air pollutant concentrations and hazardous air pollutant impacts, as well as to determine maximum “far-field” (regional) impacts on ambient air pollutant concentrations, visibility, and atmospheric deposition (“acid rain”).

Air pollution impacts are limited by State and Federal regulations, standards, and implementation plans established under the Clean Air Act and administered by CDPHE-APCD. Colorado regulations require that proposed air pollutant emission sources—including dehydrators, separators, and natural gas compressors—undergo a permitting review. Therefore, CDPHE-APCD has the authority to review emission permit applications and to require emission permits, fees, and control devices prior to construction and/or operation. In addition, Section 116 of the Clean Air Act authorizes Tribal, State, and local air quality regulatory agencies to establish air pollution control requirements more (but not less) stringent than Federal requirements. Additional site-specific air quality analysis would be performed, and additional emission control measures, including Best Available Control Technology (BACT), may be required to protect air quality resources.

Under FLPMA and the Clean Air Act, BLM cannot conduct or authorize any activity that does not conform to all applicable Federal, Tribal, State, and local air quality laws, statutes, regulations, standards, and implementation plans. An extensive Air Quality Impact Assessment was prepared to analyze the potential impacts and is available for review (Trinity 2006).

Finally, a word regarding dispersion modeling analyses and their use in planning and decision-making: All dispersion models, regardless of their level of complexity, are mathematical approximations (based largely on fluid dynamics) of the behavior of the atmosphere. Therefore, particularly given the uncertain nature of the number and placement of sources under the alternatives in this analysis, the results need to be viewed appropriately as estimates of possible future concentrations and not exact predictions in time and space.

Because of this, dispersion modeling is generally conducted using assumptions which ensure that the modeled results do not underestimate actual future impacts so that appropriate planning decisions can be made. For example, sources may be assumed to operate for longer periods or emit more pollutants than actual conditions to ensure that health-based standards are protected. On the other hand, analyses are not conducted assuming “worst-case” conditions across the board, because this typically leads to results that are unreasonable and unrealistic. Hence, dispersion modeling uses the best available information and methods (EPA-approved models, emission factors, etc.) when possible, and the best scientific and professional judgment in attempting to ensure that projections of future air quality are neither under predicted nor unrealistically over predicted.

The remainder of this section describes the methodologies and results for modeling of near-field and far-field air quality in the Planning Area during the 20-year period of analysis. Note that the air quality

analyses and impacts presented in the Draft RMPA/EIS were limited to Alternatives I, II, IV, and V, since the Preferred Alternative (Alternative III) had not yet been formulated. However, as described in the Draft, impacts under Alternative III were assumed to be less than the “upper bound” or “worst case” alternative (Alternative V) due to a smaller number of wells and fewer acres of surface disturbance. Additionally, it should be recognized that, while activities may have some impacts on air quality, these are likely to be minor in comparison to oil and gas drilling and production.

The near-field analysis (Section 4.2.5.2) uses 25 well pads arranged in a 5 x 5 matrix. The far-field analysis (Section 4.2.5.3) uses the upper bound assumptions of Planning Area and regional oil and gas development incorporated into Alternative V of the Draft RMPA/EIS. Those included an assumed 3,055 new wells for BLM and private lands, combined with reasonable but conservative assumptions (i.e., more likely to overestimate than to underestimate impacts) regarding sources such as vehicle emissions, compressor emissions, fugitive dust from well pads and unpaved roads, etc.

### 4.2.5.2 Modeling Methodology

#### Near-Field Analysis

Methods and results of the near-field air quality analysis are presented below. A more detailed description of the near-field modeling methodology and results is presented in the Air Quality Technical Support Document (TSD)(Trinity 2006), which served as the basis for the Draft RMPA/EIS and the current document. Individual tables showing results for each year and pollutant, including the location of each maximum impact, are provided in Appendix E of the TSD (Trinity 2006). Plots showing the location of each maximum impact and the wind roses for each year of meteorological data for both stations are provided in Figures A-34 through A-85 of Appendix A of the TSD (Trinity 2006). The input and output files for the post-processing are provided on CD in Appendix F of the TSD (Trinity 2006).

A separate screening model analysis was conducted to estimate potential impacts from flaring associated with natural gas production. This is presented at the end of this section.

The near-field modeling methodology generally follows that used in a previous modeling analysis for the Glenwood Springs area performed by the National Park Service (NPS 1998). Trinity Consultants, the primary modeling contractor for the far-field analysis, was also consulted to ensure that, where applicable, the two methodologies (near-field and far-field) were consistent. Finally, further details were developed in response to comments from EPA Region 8 (EPA 2003b) on Trinity’s protocol for far-field modeling (Trinity 2003b) and subsequent meetings with EPA’s NEPA and Air Quality staffs.

The ISCST3 model, as contained in Lakes Environmental ISC-AERMOD View software (Lakes 2002) package, was used for all near-field modeling. Unless stated otherwise, the regulatory default options built into the model were used. All modeling assumed flat terrain, rural dispersion conditions, and building down-wash effects for a hypothetical compressor building.

The near-field modeling was performed in flat terrain because the exact location of any group of wells, as modeled here, is unknown. It would not be possible to conduct this type of modeling exercise with a hypothetical arrangement of sources in complex (mountainous) terrain, because the choice of terrain features would be completely arbitrary. While placing the arrangement of modeled sources in a complex terrain environment might produce higher resultant concentrations, the results of such an effort would be of little value due to the sensitivity of the model to the location and orientation of the terrain selected.

A hypothetical grouping of sources was used that provides an estimate of potential near-field pollutant impacts. These sources include well pads, glycol dehydrators, natural gas compressors, and an unpaved road traversing the source area. Details of the source types and configurations are discussed in Section 3.11 of the TSD (Trinity 2006). Appropriate operating parameters were used for each source, and were in all cases, unless otherwise stated, the same as those used in the modeling by Trinity.

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Only the following sources were included in the near-field modeling (inventory and RFD sources were not included):

- 25 well pads arranged in a 5 x 5 matrix, with 300-meter spacing between the centers of adjacent pads, which is approximately equivalent to a 20-acre well spacing with 1.9 acres disturbed per pad.
- A glycol dehydrator collocated at the center of each well pad.
- Six natural gas compressors, modeled as point sources, equally spaced within the 5 x 5 well matrix.
- An unpaved road (approximately 1,700 meters long) diagonally traversing the source area.

Meteorological data for the period 1987-1991 from Grand Junction, Colorado, were used in the modeling. The raw surface and upper air data were processed using the EPA-approved PCRAMMET meteorological processing software to combine the surface and upper air data into a model-ready format.

Wind roses for the 5-year period from each location are presented in the TSD. Individual wind roses for each year can be seen in Appendix A of the TSD (Trinity 2006).

Model receptors (points at which the model estimates concentrations) were placed according to the scheme outlined in Table 4-5. This receptor spacing differs somewhat from that used in the 1998 Glenwood Springs analysis, but in all cases the changes meant including more receptors and/or closer spacing to ensure that the maximum modeled concentration was captured and occurred within the receptor domain. A graphic representation of the source configurations and model receptors is presented in Figures 3-1 and 3-2 of the TSD.

**Table 4-5. Receptor Distances and Spacing for Near-Field Modeling**

<i>Pollutant(s)</i>	<i>Source Type(s)</i>	<i>Receptor Distances (meters)</i>	<i>Receptor Spacing (m)<sup>1</sup></i>
PM <sub>10</sub> , PM <sub>2.5</sub>	Roads	50 – 1, 500	50
	Pad Construction	50 – 1,700	50
All other Criteria Pollutants	Pad Construction	100 – 4,000	100
	Compressors and Glycol Dehydrators	4,000 – 10,000	2,000
Hazardous Air Pollutants (HAPs)	Compressors	100 – 4,000	100
	Glycol Dehydrators	4,000 – 10,000	2,000

**Criteria Pollutants**

**Carbon Monoxide (CO)** — Maximum potential CO emissions from natural gas-fired compressors (units were assumed to run 8,760 hours without stopping) were used to determine the maximum potential 1-hour and 8-hour average CO concentrations. The maximum modeled concentrations were 220.0 micrograms (µg) per cubic meter (m<sup>3</sup>)(1-hour) and 77.2 µg/m<sup>3</sup> (8-hour).

When background concentrations were added (8,000 µg/m<sup>3</sup> [1-hour]; 4,444 µg/m<sup>3</sup> [1-hour]), the total concentrations were 8,229 µg/m<sup>3</sup> (1-hour) and 4,521 µg/m<sup>3</sup> (8-hour). These concentrations are well below the applicable Colorado and National AAQS for CO of 40,000 µg/m<sup>3</sup> (1-hour) and 10,000 µg/m<sup>3</sup> (8-hour).

**Particulate Matter** — Particulate matter in relation to air quality modeling is expressed in terms of PM<sub>10</sub> (particles less than 10 microns [µm = micrometers; 0.00001 meters] in diameter) and PM<sub>2.5</sub> (particles less 2.5 µm in diameter), because these small sizes represent particulates capable of entering the lungs and of being transported over long distances. To address the concerns of some stakeholders and Cooperating

Agencies, modeling of PM<sub>10</sub> and PM<sub>2.5</sub> was divided into two parts: (1) analysis of a hypothetical road diagonally crossing the area of the well pads by itself; and (2) analysis of all particulate matter sources grouped together. It should be noted that different receptor configurations were used for the two analyses (Trinity 2006) and that all particulate matter sources were modeled with emissions limited to the hours from 0700 to 1900, the period when these sources are generally active. Also, since most of these sources are temporary in nature, PSD increments would not apply.

- **PM<sub>10</sub>** – For the road-only analysis, the maximum modeled potential PM<sub>10</sub> concentrations were 6.6 µg/m<sup>3</sup> (24-hour) and 1.0 µg/m<sup>3</sup> (annual). When background concentrations were added (54 µg/m<sup>3</sup> [24-hour]; 24 µg/m<sup>3</sup> [annual]), the total concentrations were 60.6 µg/m<sup>3</sup> for the 24-hour average and 25 µg/m<sup>3</sup> for the annual average. These concentrations are well below the applicable Colorado and National AAQS of 150 µg/m<sup>3</sup> (24-hour) and 50 µg/m<sup>3</sup> (annual).

For all sources (well pads [construction, traffic], compressors, roads), the maximum modeled potential PM<sub>10</sub> concentrations were 57.7 µg/m<sup>3</sup> (24-hour) and 13.6 µg/m<sup>3</sup> (annual). When background concentrations were added (54 µg/m<sup>3</sup> [24-hour]; 24 µg/m<sup>3</sup> [annual]), the total concentrations were 112 µg/m<sup>3</sup> for the 24-hour average and 37.6 µg/m<sup>3</sup> for the annual average. These concentrations are well below the applicable Colorado and National AAQS of 150 µg/m<sup>3</sup> (24-hour) and 50 µg/m<sup>3</sup> (annual).

- **PM<sub>2.5</sub>** – For the road-only analysis, the maximum modeled potential PM<sub>2.5</sub> concentrations were 0.96 µg/m<sup>3</sup> (24-hour) and 0.15 µg/m<sup>3</sup> (annual). When background concentrations were added (19 µg/m<sup>3</sup> [24-hour]; 7 µg/m<sup>3</sup> [annual]), the total concentrations were 20 µg/m<sup>3</sup> for the 24-hour average and 7.2 µg/m<sup>3</sup> for the annual average. These concentrations are well below the proposed National AAQS for PM<sub>2.5</sub> of 65 µg/m<sup>3</sup> (24-hour) and 15 µg/m<sup>3</sup> (annual).

For all sources (compressors, wells pads, roads, vehicles), the maximum modeled potential PM<sub>2.5</sub> concentrations were 8.4 µg/m<sup>3</sup> (24-hour) and 1.9 µg/m<sup>3</sup> (annual). When background concentrations were added (19 µg/m<sup>3</sup> [24-hour]; 7 µg/m<sup>3</sup> [annual]), the total concentrations were 27.4 µg/m<sup>3</sup> for the 24-hour average and 8.9 µg/m<sup>3</sup> for the annual average. These concentrations are well below the proposed National AAQS of 65 µg/m<sup>3</sup> (24-hour) and 15 µg/m<sup>3</sup> (annual).

Again, it should be noted that the two particulate matter analyses used different receptor configurations due to the arrangement of sources; therefore, the all-sources analysis does not automatically show higher modeled concentrations.

**Sulfur Dioxide (SO<sub>2</sub>)** — The maximum short-term (3-hour and 24-hour) and long-term (annual average) SO<sub>2</sub> emissions would occur from compressors used to move the gas through the pipelines (well drilling engines were screened out of the analysis as insignificant). The maximum modeled concentrations (including representative background values) would be 110 µg/m<sup>3</sup> (3-hour), 39 µg/m<sup>3</sup> (24-hour), and 11 µg/m<sup>3</sup> (annual). Therefore, all predicted short-term and long-term SO<sub>2</sub> concentrations comply with the Colorado SO<sub>2</sub> Ambient Air Quality Standards (3-hour) of 700 µg/m<sup>3</sup>, as well as the NAAQS of 365 µg/m<sup>3</sup> and 80 µg/m<sup>3</sup> (24-hour and annual average), respectively. The 3-hour State standard is more stringent than the National AAQS.

**Nitrogen Oxides (NO<sub>2</sub>)** — Maximum NO<sub>2</sub> impacts during operations were predicted using “reasonably foreseeable” compressor NO<sub>x</sub> emission rates. The maximum potential near-field NO<sub>2</sub> concentrations were determined by multiplying maximum NO<sub>x</sub> concentrations by 0.75, in accordance with standard EPA methodology (EPA 1995a). The maximum predicted annual potential NO<sub>2</sub> concentration was 2.2 µg/m<sup>3</sup>. When this value is added to the assumed representative background concentration (34 µg/m<sup>3</sup>), the resulting predicted maximum total impact is 36.2 µg/m<sup>3</sup>, which is also below the applicable Colorado and National AAQS of 100 µg/m<sup>3</sup> (annual).

**Hazardous Air Pollutants (HAPs)**

Maximum HAPs impacts during operations were predicted for the hypothetical arrangement of sources as described above. The emissions sources include six compressors (benzene, ethylbenzene, formaldehyde, toluene, and xylene) and 25 individual glycol dehydrators (benzene, toluene, ethyl benzene, hydrogen sulfide, and xylene). Since neither Colorado nor EPA has established HAP standards, 24-hour and annual HAP concentrations were predicted using the ISCST3 model and compared to a range of State Acceptable Ambient Concentration Levels (AACLs) and/or EPA Reference Concentrations (RfCs). These thresholds are presented in Table 4-6.

Results of the near-field HAPs modeling shows that the annual benzene concentration (1.12 µg/m<sup>3</sup>) and annual formaldehyde concentration (0.30 µg/m<sup>3</sup>) exceed the low end of the range of AACLs presented in the table. Therefore, an incremental cancer risk analysis was performed for these two carcinogenic compounds, which are emitted from sources such as those modeled.

**Table 4-6. Summary of Acceptable Ambient Levels for Hazardous Air Pollutants (HAPs)**

<b>Benzene (µg/m<sup>3</sup>)</b>	<b>Ethylbenzene (µg/m<sup>3</sup>)</b>	<b>Formaldehyde (µg/m<sup>3</sup>)</b>	<b>Hydrogen Sulfide (µg/m<sup>3</sup>)</b>	<b>Toluene (µg/m<sup>3</sup>)</b>	<b>Xylenes (µg/m<sup>3</sup>)</b>	<b>Agency</b>
0.12 (annual)	1,000 (24-hour)	0.077 (annual)	0.9 (24-hour)	400 (24-hour)	1,500 (24-hour)	Washington Department of Ecology ( WAC) 176-460-150
53 (24-hour)	14,467 (24-hour)	-	467 (24-hour)	6,267 (24-hour)	14,467 (24-hour)	Utah Department of Environmental Quality (UDEQ) Toxic Screening Level <sup>1</sup>
-	-	-	140 (24-hour)	-	-	North Dakota Department of Health, Division of Environmental Engineering, 33-15-02 or Air Toxics Policy
13 - 45 <sup>2</sup> (annual)	-	8 <sup>3</sup> (annual)	-	-	-	EPA IRIS Database 1/10,000 (1 x 10 <sup>-4</sup> ) Risk Level
-	1,000 (24-hour)	-	1.0 (24-hour)	400 (24-hour)	100 (24-hour)	EPA Integrated Risk Information System (IRIS) Database RfC <sup>3</sup>

<sup>1</sup> The Toxic Screening Level (TSL) for Utah can be found in Utah Administrative Code R307-401(1)(d).

<sup>2</sup> The range of values shown here represents the air unit risk of 1 in 10,000 (1 x 10<sup>-4</sup>) excess cancers, taken from EPA's Integrated Risk Information System (IRIS) database.

<sup>3</sup> EPA's IRIS database contains information on reference concentration for chronic inhalation exposure (RfC)(EPA 1997, per Trinity 2003a).

Two estimates of incremental cancer risk were made: one that corresponds to a most likely exposure (MLE) condition and one that corresponds to a maximally exposed individual (MEI). The MLE consists of a residential dwelling occupied by the same family for 20 years, while the MEI consists of a full-time worker with occupational exposure for 20 years. These receptors were assumed to be located at the exposure distances shown in Table 4-5. Exposures to known carcinogens were assumed to be at the maximum predicted annual concentrations for BLM sources only. The assumed 20-year residential duration greatly exceeds the average of 9 years for occupancy of a home by the same family (EPA 1993). The 20-year occupational duration is for an onsite worker.

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Because the EPA unit risk factors reported in Table 4-6 are based on a 70-year (lifetime) exposure, the modeled 20-year duration was adjusted to represent 20/70 (0.286) of a lifetime. For the MLE (residential), a second adjustment was made to compensate for the average amount of time spent at home. The onsite fraction used was 0.64 (i.e., slightly less than two-thirds of a resident's time being spent at home), based on EPA (1993). For the remainder of each day, the MLE calculation assumes that the resident would be exposed to HAPs at 25 percent of the maximum annual average concentration. Therefore, the MLE adjustment factor is  $(0.286) \times [(0.64 \times 1.0) + (0.36 \times 0.25)] = 0.209$ . Because the MEI (occupational) scenario assumed an onsite worker, no second adjustment was made to account for time spent away from home.

Under the MLE scenario, the estimated individual cancer risks associated with long-term exposure to benzene (compressors, dehydrators) and formaldehyde (dehydrators) are below  $1.0 \times 10^{-4}$  ( $1.8 \times 10^{-6}$  to  $5.1 \times 10^{-7}$  and  $8.1 \times 10^{-7}$ , respectively). Under the MEI analysis, the individual cancer risks for benzene ( $2.5 \times 10^{-6}$  to  $7.0 \times 10^{-7}$  and formaldehyde ( $1.1 \times 10^{-6}$ ) and the total cancer risk for the inhalation pathway ( $3.2 \times 10^{-6}$  to  $3.8 \times 10^{-6}$ ) fall toward the lower end of the threshold range of presumptively acceptable risks of  $1.0 \times 10^{-6}$  to  $1.0 \times 10^{-4}$  (one excess cancer per 1 million people to one excess cancer per 10,000 people, respectively)(EPA 1998). Therefore, the long-term cancer risk analyses indicate no basis for concern.

It should be noted that the risk calculations are based on the maximum modeled concentration found anywhere in the vicinity of the hypothetical arrangement of sources. These maximum concentrations occurred within a few hundred meters of the edge of the sources and dropped off quickly with increasing distance from the sources. It is unlikely that any individual would be living this close to the sources. Therefore, the risk values calculated above should be viewed as an upper bound on the range of possible risks associated with near-field impacts, with risks to actual residents likely being lower.

### **Natural Gas Flare**

As mentioned above, a separate modeling exercise was conducted for potential natural gas flaring emissions. As suggested at a meeting of the air quality stakeholders for this project (BLM 2003c), the flare modeling was performed with the SCREEN3 model (EPA 1995c). The SCREEN3 model is a simple single-source screening model that assumes a constant wind direction for an entire hour, and reports a 1-hour concentration. A predetermined matrix of wind speeds and atmospheric stabilities are processed to find the maximum concentration. These results show that all modeled concentrations are well below the NAAQS. Detailed results are presented in the TSD.

### **Far-Field Analysis**

Methods and results of far-field air quality modeling for each alternative are presented below. Detailed modeling results, including the location and date of each maximum impact, are provided in the TSD (Trinity 2006). Plots showing the receptor grid, terrain, and location of each maximum impact are provided in Figures A-8 through A-29 of Appendix A of the TSD. Output, input, and list files are provided on CD in Appendix F of the TSD.

The modeling analysis performed by Trinity Consultants and BLM's National Science and Technology Air Quality (NSTC-AQ) staff followed a general modeling procedure used in previous NEPA assessments and Clean Air Act New Source Review (NSR) permit applications. The CALPUFF model was used to estimate potential impacts on air quality and AQRVs from proposed and other "reasonably foreseeable" sources in the modeling domain. The CALPUFF modeling domain included the entire Vernal Field Office (VFO) and GSFO areas, several mandatory Federal Class I areas, and other sensitive Class II areas specified by BLM and the States. This modeling domain covers most of northeastern Utah and western Colorado and portions of southwestern Wyoming. The CALPUFF modeling system consists of three main component models:

- CALMET – A meteorological model that develops hourly wind, temperature fields, and other meteorological fields on a three-dimensional modeling domain. Associated two-dimensional fields

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such as mixing height, surface characteristics, and dispersion properties are also include in the CALMET output.

- CALPUFF – A transport and dispersion model that moves puffs of emitted material from modeled sources, simulating dispersion and transformation processes along the way. The movement of these puffs is dictated by the meteorological fields generated by CALMET.
- CALPOST – Processes the CALPUFF output files to produce tables that summarize the results. Separate CALPOST runs are needed for individual pollutants and for each AQRV scenario

Outputs from the air quality modeling are used to assess potential impacts on near- and far-field air quality and AQRVs. The following assessments were conducted:

- Prediction of the potential direct and cumulative air quality impacts of emissions from existing and foreseeable oil, gas, and mineral development scenarios (five alternative scenarios).
- Comparison of potential direct and cumulative air quality impacts plus the existing background concentration to the applicable NAAQS and to any State AAQS that are more stringent.
- Visibility assessment impacts within mandatory Federal Class I areas and specific Class II areas of concern.
- Atmospheric deposition of total sulfur and nitrogen within mandatory Federal Class I areas and specific Class II areas of concern.

For the CALMET inputs, a search of meteorological stations using Trinity's proprietary database showed that 28 surface and 68 precipitation meteorological stations were within the modeling domain or near the domain boundary. From these stations, 14 surface stations and 38 precipitation stations were selected based on data counts of at least 6,000 and their distance from the RMP areas. Data from four upper air stations were used. These data, combined with MM5 data for 1996, were processed to produce a single year of meteorological data for input to CALPUFF.

To develop the sources to be included in the CALPUFF modeling, Trinity conducted a review of all sources provided in the Utah and Colorado source inventory and all Title V permits available on the UDEQ and CDPHE websites. The review was conducted on a per-pollutant basis since each pollutant had a different monitoring baseline date.

Subsequent to Trinity's review of Colorado State permits, BLM NSTC-AQ staff undertook a review of a small portion (based on a screening procedure developed by NSTC-AQ staff; see Section 3.3.1.3 of the TSD for details) of the approximately 250 inventory sources to determine if all the information provided by the States was correct.

Approximately 10 facilities (26 sources) were selected for detailed review. Approximately 20 sources were removed or had some of their source parameters changed. At the request of CDPHE, the American Soda facility (17 sources) was added. As discussed in Section 3.4 of the TSD (Trinity 2006), the modeling domain was set such that it extends 50 km beyond all sources and Class I receptors. Therefore, only sources inside 50 km of the modeling domain boundary are modeled. Figure A-1 in the TSD shows the modeling domain boundary.

Receptor locations were placed at 3-km intervals within the two BLM resource areas. No receptors were placed within 4 km of a source (see near-field analysis). For each Class I and Class II area, a grid of receptors was placed at 2-km spacing within the area. Figures A-4 through A-27 in Appendix A of the TSD (Trinity 2006) show the receptor grid for each sensitive area and the RMP areas.

For the criteria pollutant (NAAQS) and HAPs results, background concentrations were added to produce the total modeled concentrations (Tables 4-7 and 4-8). For the HAPs analysis, CDPHE recommended using the data from EPA Urban Air Toxics Pilot Project as the background concentration (Chick 2002).

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These concentrations were collected in the City of Grand Junction, Colorado, between May 2001 and April 2002. Recommended concentration estimates are summarized in Table 4-8, below.

**Table 4-7. Background Concentrations Used for Modeling of Criteria Air Pollutants**

<b>Pollutant</b>	<b>Annual (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>24-Hour (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>8-Hour (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>3-Hour (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>1-Hour (<math>\mu\text{g}/\text{m}^3</math>)</b>	<b>Monitoring Station Location Description</b>
PM <sub>10</sub>	24	54	-	-	-	Rifle, Garfield County (1998-2000 data collected by CDPHE) <sup>1</sup>
PM <sub>2.5</sub>	7	19	-	-	-	Grand Junction, Mesa County (1999-2001 data collected by CPHE) <sup>1</sup>
NO <sub>2</sub> <sup>2</sup>	34	-	-	-	-	Woodmen and Colorado College stations, Colorado Springs, El Paso County (1998-2000 data) <sup>1</sup>
CO <sup>3</sup>	-	-	4,444	-	8,000	Grand Junction, Mesa County (Average of 1999-2001) <sup>1</sup>
SO <sub>2</sub> <sup>4</sup>	11	39	-	110	-	Colorado College, Colorado Springs, El Paso County (1998-2000) <sup>1</sup>

<sup>1</sup> Background concentration recommended by CDPHE in the review comments provided by Nancy Chick, dated on December 20, 2002 (Chick 2002, per Trinity 2003a).

<sup>2</sup> NO<sub>2</sub> concentration recommended by CDPHE is originally stated in 0.018 ppm, annual average (Chick 2002, per Trinity 2003a).

<sup>3</sup> CO concentrations recommended by CDPHE are based on 3 years average and are originally stated in ppm, as follows: 8-hr, 3.74 ppm; 1-hr, 6.1 ppm.7 ppm (Chick 2002, per Trinity 2003a).

<sup>4</sup> SO<sub>2</sub> concentrations recommended by CDPHE are originally stated in ppm: annual, 0.004 ppm; 3-hour, 0.042 ppm; 24-hour, 0.015 ppm (Chick 2002, per Trinity 2003a).

**Table 4-8. Background Concentrations Used for Modeling of Hazardous Air Pollutants<sup>1</sup>**

<b>Agency</b>	<b>Benzene</b>	<b>Ethylbenzene</b>	<b>Formaldehyde</b>	<b>Toluene</b>	<b>Xylenes</b>
Annual Mean (ppbv) <sup>2</sup>	0.90	0.84	5.78	3.70	3.63
24-hour Maximum (ppbv) <sup>2</sup>	2.72	10.68	14.00	33.26	43.66
Annual Mean ( $\mu\text{g}/\text{m}^3$ )	2.87	3.65	7.11	13.95	15.75
24-hour Maximum ( $\mu\text{g}/\text{m}^3$ )	8.68	46.35	17.22	125.39	189.48

<sup>1</sup> Values from Chick (2002).

<sup>2</sup> ppbv = parts per billion, by volume

**4.2.5.3 Results of Modeling for Alternative V (Bounding the Proposed Plan)**

The following subsections present the CALPUFF modeling results for Alternative V for criteria pollutants (NAAQS and PSD increments), HAPs, visibility, deposition, and Acid Neutralizing Capacity (ANC) from BLM sources only. As described previously, no separate model runs were made for the Proposed Plan, because the sources of all pollutants would be no greater than for Alternative V, analyzed in the Draft RMPA/EIS. Therefore, Alternative V (the most development-intensive of the alternatives analyzed in the Draft) would bound the expected air quality impacts under the Proposed Plan.

**Criteria Pollutants**

Modeling shows no exceedances of the NAAQS for any pollutant, nor were any predicted potential concentrations found that could exceed the Class I or Class II increments for emissions from BLM sources.

**Hazardous Air Pollutants**

The results of the near-field HAPs modeling show no concentration values (excluding background concentrations) that exceeded any of the AACLs/RfCs for BLM sources only. However, when background concentrations are included, the annual concentrations for benzene ( $2.87 \mu\text{g}/\text{m}^3$ ) and formaldehyde ( $7.15 \mu\text{g}/\text{m}^3$ ) as well as the 24-hour concentration for xylenes ( $189.5 \mu\text{g}/\text{m}^3$ ) exceed their respective AACLs. As with previous Alternatives, BLM sources contribute less than 1% to the total modeled concentrations.

An incremental cancer risk analysis (excluding background concentrations) for benzene under the MLE scenario yielded individual risks of  $1.8 \times 10^{-10}$  to  $6.5 \times 10^{-10}$  for long-term exposure to benzene, while the results for formaldehyde showed a risk value of  $1.1 \times 10^{-7}$ . All MLE risks are well below the lower end of the range of presumptively acceptable risks ( $1 \times 10^{-6}$ ; EPA 1998).

Under the MEI analysis, the individual cancer risk for benzene was  $2.5 \times 10^{-10}$  to  $8.9 \times 10^{-10}$ , while formaldehyde showed a maximum individual risk of  $1.5 \times 10^{-7}$ . These risks values are also below the range of presumptively acceptable risks.

Because risk calculations are based on the maximum modeled concentration found anywhere in the modeling domain, the calculated risk levels are an upper bound on the range of possible risks associated with far-field impacts, with risks to actual residents likely being lower.

**Visibility Screening Analysis**

Results of the visibility screening analysis for Alternative V are the same as for Alternatives I through IV; there were no modeled impacts that exceeded the 1.0 deciview (dv) threshold for any of the Class I areas. Results of an analysis using the USFS threshold of 0.5-dv change are available in the TSD (Trinity 2006).

Although Class II areas have no visibility protection under State or Federal law at this time, they were included in the analysis to provide decision-makers with a more complete picture of potential regional impacts.

**Deposition**

All calculated potential values of sulfur and nitrogen deposition for BLM sources were well below the applicable thresholds of 3 kilograms per hectare per year (kg/ha/yr) for total sulfur and 5 kg/ha/yr for total nitrogen. One kg/ha/yr is approximately 0.9 pounds per acre per year.

**Acid Neutralizing Capacity (ANC)**

Results of this analysis indicate that impacts to all lakes considered in the modeling would be well below the thresholds of 10-percent change level for lakes with background ANC values equal to or above 25 micro-equivalents per liter ( $\mu\text{eq}/\text{L}$ ), or a total change of less than  $1.0 \mu\text{eq}/\text{L}$  for lakes below  $25 \mu\text{eq}/\text{L}$ .

**4.2.5.4 Cumulative Impacts**

The CALMET/CALPUFF dispersion model was used with MM5 meteorological data from 1996 plus numerous surface, precipitation, and upper air data to predict maximum potential far-field cumulative air quality impacts at downwind PSD Class I Wilderness Areas. The results were used to (1) determine if PSD Class I increments and NAAQS might be exceeded, (2) calculate potential nitrate and sulfate deposition (and their related impacts) in sensitive lakes, and (3) predict potential impacts to regional visibility. Concentrations were also predicted in the impact analysis area to determine compliance with the NAAQS and Class II increments.

Potential emissions from other reasonably foreseeable facilities not represented by the measured background values were combined with those resulting from implementation of Alternative V (representing the greatest degree of oil and gas development, and used as a surrogate for the Proposed Plan) to determine potential cumulative air quality impacts. The results discussed below therefore

represent the highest cumulative impact from the alternatives analyzed. Detailed information on the sources outside the Planning Area is presented in the TSD (Trinity 2006).

Estimates of compression requirements in the Draft RMPA/EIS were made based on the projected number of wells and a rule of thumb for the horsepower (hp) requirement per unit of gas (1,100 hp per 10 MMCF of gas). Assuming that this remains valid, a simple comparison of projected well numbers can be used to project increases and/or decreases in potential impacts from compressor emissions.

#### **Criteria Pollutants**

The modeling results show no exceedances of the NAAQS for any pollutant. Predicted potential concentrations were also compared to the applicable Class I and Class II PSD increments. No modeled concentrations exceeded any PSD increment for any criteria pollutant.

#### **Hazardous Air Pollutants**

The results of the far-field HAPs modeling show that the annual benzene and formaldehyde concentrations ( $2.93 \mu\text{g}/\text{m}^3$  and  $7.18 \mu\text{g}/\text{m}^3$  respectively, including background concentrations) and the 24-hour concentration of xylenes ( $191 \mu\text{g}/\text{m}^3$ , including background) were the only values that exceeded any of the AACLs. An incremental cancer risk analysis was performed for benzene and formaldehyde emitted from the proposed sources modeled (xylenes are not considered carcinogenic).

Under the MLE scenario, estimated individual cancer risks associated with long-term exposure to benzene range from  $1.4 \times 10^{-6}$  to  $4.8 \times 10^{-6}$ , while the formaldehyde risk was estimated to be  $2.0 \times 10^{-5}$ . These values are within the EPA (1998) range of presumptively acceptable risks of  $1.0 \times 10^{-4}$  to  $1.0 \times 10^{-6}$ .

Under the MEI analysis, individual cancer risks for benzene were  $1.8 \times 10^{-6}$  to  $6.5 \times 10^{-6}$ , while the risk for formaldehyde was  $2.8 \times 10^{-5}$ . Again, the values are within the range of presumptively acceptable risks.

Because risk calculations are based on the maximum modeled concentration found anywhere in the vicinity of the hypothetical arrangement of sources, the calculated risk levels are an upper bound on the range of possible risks associated with far-field impacts, with risks to actual residents likely being lower.

#### **Visibility Screening Analysis**

Results of the visibility analysis performed by Trinity (2004) for BLM sources and all sources are presented in Table 4-9. The results indicate that potential BLM sources, along with existing inventory sources, could result in a perceptible or “just noticeable” impact (1.0-dv reduction) on visibility at several of the PSD Class I areas in the study domain. Results of an analysis using the USFS threshold of 0.5-dv change may be found in the TSD (Trinity 2006). As with the alternatives analyzed, the Class II areas have no visibility protection under existing State or Federal laws but are included to provide decision-makers with a more complete picture of potential impacts throughout the region.

#### **Refined Visibility Analysis**

Because the screening visibility showed potential impacts at one or more Class I areas, a daily refined analysis was conducted based on hourly IMPROVE (2002) optical monitoring data measured at Canyonlands National Park for the years 1986-2002. Daily optical values were calculated based on at least 6 hours of valid data each day (Archer 2002, per Trinity 2006). Also, the maximum relative humidity was limited to no more than 90 percent. The basis for limiting aerosol growth at 90 percent relative humidity is that direct optical monitoring devices are not reliable at humidity values above this level, and measurements above 90 percent were not reported as “valid” by the IMPROVE data contractor.

**Table 4-9. Results of Screening-Level and Refined Modeling of Cumulative Visibility Impacts <sup>1</sup>**

PSD Class	Name of Class I or Class II Area	Days >1.0 Deciview Change		
		Screening-Level Modeling	Refined Modeling	
			Minimum	Maximum
I	Black Canyon of the Gunnison National Park	2 (0)	0	1(0)
I	Eagle's Nest Wilderness	0	--	--
I	Flat Tops Wilderness	1 (0)	0	0
I	La Garita Wilderness	0	--	--
I	Maroon Bells-Snowmass Wilderness	0	--	--
I	Mt. Zirkel Wilderness	1 (0)	0	1(0)
I	Rawah Wilderness	0	--	--
I	Weminuche Wilderness	0	--	--
I	West Elk Wilderness	1 (0)	0	0
II	Colorado National Monument	3 (0)	--	--
II	Dinosaur National Monument	3 (0)	--	--
II	Holy Cross Wilderness	0	--	--
II	Hunter-Frying Pan Wilderness	0	--	--
II	Raggeds Wilderness	0	--	--

<sup>1</sup> All sources for Vernal, UT, and Glenwood Springs, CO, Resource Areas. BLM sources show in parentheses. Class II areas and Class I areas with no impact in screening analysis did not have a refined analysis conducted.

Air Resource Specialists, Inc. (2002, per Trinity 2006) states that these data are not labeled as valid because "...small random temperature or absolute humidity fluctuations along the path can lead to condensation of water vapor causing meteorological interferences. Thus, in accordance with the philosophy expressed above [viz., of ensuring that impacts are not underestimated], the 90 [percent] relative humidity limit was selected for this test." Therefore, the maximum relative humidity was limited at 90 percent for optical data comparison. Again, the Federal Land manager's AQRV Workgroup (FLAG) 1.0-dv (10 percent change in extinction) "just noticeable change" cumulative source threshold was used to assess the significance of potential impacts. The results of the refined modeling analysis are also presented in Table 4-9.

Note that the refined visibility results show that operations of proposed BLM and Inventory sources could result in a "just noticeable" (1.0-dv reduction) impact on visibility at only two Class I areas (the Black Canyon of the Gunnison and Mt. Zirkel), with maximum potential impact of 1 day per year at each site. No BLM sources (Vernal or Glenwood Springs) cause significant impacts to this, or any, Class I area.

**Acid Neutralizing Capacity**

Where background lake chemistry data were available, an analysis of potential changes to ANC was performed using the procedure recommended by the USFS (2000). This screening methodology takes deposition values of sulfur and nitrogen estimated by CALPUFF and converts these values into a potential change in the ability of a given lake to neutralize acid precipitation. These values were compared to a 10-percent change in ANC for lakes with background ANC values equal to or greater than 25 micro equivalents per liter (µeq/L). For lakes with background ANC values less than 25 µeq/L, the threshold is no more than 1.0 µeq/L total change in ANC.

The results indicate that none of the lakes analyzed would be adversely affected by modeled sources.

#### 4.2.5.5 Discussion of Air Quality Impacts under the Proposed Plan

The multiple conservative assumptions used throughout the modeling underscore that actual air quality impacts are likely to be less than the modeled values. For example, some pollutant sources were assumed to operate 100 percent of the time throughout the modeled period. The maximum modeled concentration was used for health risk calculations, although it is unlikely that anyone resides at the maximum location. Fugitive dust sources were conglomerated into area sources, likely increasing local PM<sub>2.5</sub> and PM<sub>10</sub> concentrations. Roads were assumed to emit dust equally throughout the year; in actuality, dust emissions are reduced or eliminated when roads are frozen or wet. After considering these factors, it is reasonable to conclude that impacts on air quality of implementation of any the alternatives would be as follows compared to existing conditions (terms are defined in the introduction to Chapter 4):

- Hazardous Air Pollutants – none to negligible (benzene, formaldehyde)
- Priority Pollutants – none
- Visibility – none to negligible
- Deposition of Sulfur and Nitrogen – none
- Acid Neutralizing Capacity – none

As described above, these qualitative impact level values recognize that the calculated values are likely higher than actual conditions.

Regulation of oil and gas development activities by State and Federal authorities would be expected to avoid or minimize the potential for violations of applicable standards. For example, if monitoring indicates that fugitive dust emissions are leading to exceedances of the NAAQS standards, more restrictive operational constraints or more stringent BMPs would be required.

In summary, based on the information summarized in Table 4-2 and the assumptions used in the near-field and far-field air quality modeling, it can be concluded that:

1. Assumed levels of oil and gas development within the Planning Area during the 20-year period of analysis are not projected to cause an exceedance of any applicable standard or threshold affecting human health and the environment.
2. Air quality impacts related to the number of gas wells and associated facilities would be somewhat less under the Proposed Plan than predicted for Alternative V.
3. Air quality impacts related to emissions from vehicles and fugitive dust from well pads and unpaved roads would be substantially less under the Proposed Plan than predicted for Alternative V and somewhat less than for the Preferred Alternative.

### 4.3 BIOLOGICAL ENVIRONMENT

#### 4.3.1 Upland Vegetation and Riparian/Wetland Areas

##### 4.3.1.1 Introduction

Vegetation in the Planning Area is conceptually subdivided into the general community types described and quantified by area in Section 3.3.1. A distinction is made between upland vegetation and those areas classified as riparian/wetland areas. Additionally, noxious weeds are considered a separate vegetation category. These distinctions are carried through the following discussion.

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The following subsections address potential impacts to Planning Area vegetation from management actions and land uses in the Proposed Plan. Selected comparisons are also made to one or more of the five alternatives analyzed in the Draft RMPA/EIS.

Impacts from two categories of management actions are analyzed and assessed. The first includes direct management of vegetation resources for its intrinsic ecological value, guided by specific objectives for the major natural plant communities in the Planning Area. The second category comprises actions directed at other resources but which impact vegetation. These include oil and gas development, livestock grazing and range management, and travel management. In addition to the above management action categories, a fifth, Special Management Designations and Restrictions, is carried through this analysis. This summarizes the impacts of special area designations as well as surface use restrictions and other protective measures on vegetation resources. Although vegetation resources would be affected to some degree by all of the future land uses and management actions associated with implementation of the final Plan arising from this RMPA/EIS process, impacts resulting from development of oil and gas are likely to be the most important (i.e., detectable, demonstrable, and deleterious) as they represent the largest potential surface disturbances.

Some impacts are direct, while others are indirect and affect vegetation through a change in another resource. Direct impacts to upland vegetation are considered to include disruption or removal of rooted vegetation resulting in a reduction in areas of native vegetation; reduction of total numbers of plant species (species richness) within an area; and/or reduction or loss of total area, diversity, structure, or function of wildlife habitat. Direct impacts to riparian/wetland areas include those expressed for upland vegetation as well as increased sedimentation due to local surface disturbance, soil and bank erosion, and changes to channel morphology.

Because the large majority of direct impacts to vegetation are the result of physical ground disturbance, these impacts are usually analyzed in terms of relative area of disturbance. For this analysis, ground-disturbing activities are assumed to be distributed among upland and riparian/wetland areas in proportion to their relative distribution in the Planning Area, unless otherwise limited by surface-use restrictions, as listed in Table 4-1. These are described in detail in Appendix C. Assumed numbers of wells and well pads and acres of surface disturbance associated with oil and gas development under the Proposed Plan and other alternatives are summarized in Table 4-2.

A number of indirect impacts to vegetation resources are also a potential result of proposed management actions. Potential indirect impacts include disruption or reduction of pollinator populations; loss of habitat suitable for colonization due to surface disturbance; introduction of noxious weeds by various vectors or conditions that enhance the spread of weeds; and general loss of habitat due to surface occupancy, surface compaction, or trampling. Upgradient physical disruption can result in sedimentation into occupied habitat and/or potential habitat. Failed reclamation or mitigation may also cause indirect impacts to these resources. Indirect impacts to riparian/wetland areas also include disruption of hydrological processes, decreased ability to trap sediments and nutrients and to moderate surface flow, decreased infiltration for groundwater recharge, increased run-off, and focused grazing pressure or wildlife use in less-impacted riparian/wetland areas. Additional indirect impacts from increased erosion and sedimentation could occur to riparian/wetland areas located downgradient from surface disturbances, even if the resource itself may be purposely avoided to reduce direct impacts. Most indirect impacts are assumed to result from direct impacts in proportion to the relative amount of surface disturbance.

Cumulative impacts are discussed in terms of past, present, and future actions in non-BLM portions of the Planning Area and the surrounding region, as well as the additive effects of multiple management actions on vegetation resources within the Planning Area. For this discussion, this region is considered to be the area comprising two large regional watersheds that define the regional vegetation map: Parachute-Roan Creek and Colorado River-Plateau Creek (Section 3.3.1).

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For this analysis, it is assumed that all BMPs listed in Appendix I would be implemented for all ground-disturbing activities. In addition, it is assumed that any entity causing a permitted ground-disturbing activity would comply with specified reclamation and revegetation practices, as well as annual monitoring and adaptive management of these sites, until BLM deems success criteria are achieved.

Standardized definitions are used to categorize impacts of specific management actions on vegetation resources. A range of estimated disruption areas is associated with each category. When quantitative analysis is not possible, categories are based upon the potential physical impacts in terms of BLM Colorado Land Health Standards (Appendix F). For riparian/wetland areas, these categories are based on the potential physical impacts in terms of Colorado Land Health Standard #2. For upland areas, these categories are based upon the potential physical impacts to this resource in terms of Colorado Land Health Standard #3.

The following general terms are used to define levels of adverse impacts to vegetation:

- **None** – No physical disruption of the resource. Effects are unlikely to be detectable. No impairment of the resource value in terms of Land Health Standards.
- **Negligible** – Physical disruption to less than 5 percent of the resource. Effects may be detectable but of short duration (would last no more than one growing season) and not of concern to the general public. Unlikely to impair the resource value in terms of Land Health Standards.
- **Minor** – Physical disruption to less than 5 percent of the resource. Effects would be detectable but temporary (would last no more than 2 years) and unlikely to be of concern to the general public. Likely to cause some impairment of the resource value in terms of Land Health Standards.
- **Moderate** – Physical disruption to 6 to 15 percent of the resource. Effects would be readily visible and maybe of concern to the general public. Effects may increase over time or be long-term to permanent. May cause substantial impairment of the resource value in terms of Land Health Standards.
- **Major** – Physical disruption to more than 15 percent of the resource. Effects would be highly visible and of concern to the general public. Effects likely to increase over time and be long-term or permanent. Likely to cause substantial impairment of the resource value in terms of Land Health Standards.

### 4.3.1.2 Impacts of Proposed Plan

Under the Proposed Plan, vegetation would be managed for its intrinsic ecological value, guided by specific management objectives for the major natural plant communities in the Planning Area as well as Land Health Standards for this resource. Vegetation management would also be impacted by aspects of other resource management, such as rangeland, travel and recreation as well as oil and gas development and special management designations and restrictions.

#### *Direct and Indirect Onsite Impacts*

**Vegetation Management** — The condition of upland vegetation communities throughout the Planning Area would be expected to continue to be generally good, moving in an upward trend due to a number of actions intended to protect and/or enhance the health and productivity of native plant communities, guided by achievement of specific community objectives as well as more general Land Health Standards. Required use of BMPs would limit direct negative impacts to vegetation during ground-disturbing activities, and reclamation standards would promote rapid reestablishment of native vegetation. The reclamation standards would include seeding with native species, planting containerized native shrubs in specific situations where woody plants are appropriate, and deferring livestock grazing for up to two growing seasons following such actions. In addition, the requirements in this Proposed Plan for annual monitoring/reporting of revegetation conditions against performance-based criteria would also contribute

to an emphasis on high-quality revegetation of disturbed areas. It is expected that this combination of management actions would result in direct moderate positive impacts to upland vegetation.

The Proposed Plan incorporates the Alternative II emphasis on noxious weed inventory, detection, and monitoring. These management actions would allow for a far more focused and effective application of the current weed management program by providing data and information upon which to base a number of important decisions such as incipient population locations, priority-to-control strategies, and the efficacy of different integrated methods for particular species and locations. Over time, this focus on noxious weed management would indirectly have a moderate positive impact on upland vegetation.

Riparian areas and river corridors are a focus of protection and management under this alternative. This includes a specific objective for maintaining proper hydrologic function and protection of vegetated areas adjacent to these resources. Management objectives for these vegetation types include achieving late-seral stage and attributes to support PFC through general resource management, as well as specific adjustments to livestock grazing systems and exclusions to promote achievement of these objectives. Due to these protections and specific management actions, a large number of riparian/wetland areas would be expected to return to PFC over time, resulting in major positive impacts within the Planning Area.

**Grazing and Rangeland Management** — Livestock grazing would be managed to conform to BLM grazing regulations and meet Land Health Standards as well as vegetation community objectives. Allotment management plans, to be developed and reviewed in collaboration with grazing permittees on a regular schedule, would provide a basis for monitoring of rangeland health and making grazing management decisions. A combination of administrative solutions (e.g., season-of-use revisions, livestock exclusions, and stocking level adjustments), range improvement projects (e.g., construction of fences and stockpounds to direct livestock use), and BMPs and reclamation standards would be applied to meet resource objectives. These include achieving a late-seral community stage as well as PFC for riparian/wetland areas. Focused management to resolve conflicts between vegetation resource conditions and livestock grazing, as well as generally improving range condition, would produce moderate positive impacts to vegetation in both upland and riparian/wetland areas over time.

**Travel and Recreation Management** — Except for the Hubbard Mesa OHV Riding Area, travel in the Planning Area would be limited to designated routes. This prohibition of cross-country travel would prevent continued expansion of unauthorized travel routes throughout most of the Planning Area, and the associated impacts of physical damage to vegetation, fragmentation of plant communities, increased soil erosion or compaction, and creation of invasion corridors for noxious weeds. When combined with the closure and revegetation of existing routes, these proposed management actions would result in moderate positive impacts to upland and riparian/wetland areas, except in the Hubbard Mesa OHV Riding Area. This 2,640 acre area would be subject to increasing loss of herbaceous vegetation and soil erosion from these activities as well as well as continual possibility of weed invasion, resulting in moderate negative impacts to this area.

**Oil and Gas Development** — Development of fluid mineral resources under the Proposed Plan would result in an estimated 193 well pads and an associated 812 acres of new long-term disturbance (1.1 percent of BLM lands in the Planning Area) during the 20-year period of analysis (Table 4-2). An additional 318 acres of temporary impacts are also estimated. The combination of long-term and temporary impacts (1,130 acres) constitutes 1.5 percent of BLM lands in the Planning Area.

Potential direct and indirect negative impacts of this development to vegetation resources, supporting ecological processes, and biological diversity above the rim would be reduced by the requirement of phased and clustered oil and gas development atop the plateau and the goal of managing toward clustered development below the rim. Atop the plateau, key components of the Proposed Plan would include a minimum separation of 0.5 mile between well pads, location of pads on ridgetops with slopes of 20 percent or less, limiting development at any one time to a single “development area,” and limiting the amount of “currently disturbed” ground at any time to 350 acres (approximately 1 percent of BLM lands

atop the plateau). In this context, “currently disturbed” means areas where vegetation has been stripped or otherwise removed or destroyed, and for which revegetation has not been initiated, has been in progress for less than two growing seasons, and/or is not showing satisfactory progress toward achieving revegetation success standards (Appendix J).

These siting components would tend to focus the 75 acres of estimated long-term disturbance resulting from oil and gas development above the rim (Table 4-2) in the mixed mountain shrubland and mountain grassland communities that occur on the ridgetops and lower angle slopes. If all of this disturbance would occur in these communities, it would represent less than one percent of the 20,744 acres they comprise within the Planning Area (Table 3-11).

If assumed BMPs, reclamation standards, and mitigation monitoring are implemented as described above, disturbances to upland plant communities and riparian/wetland areas would be minor. Impacts of oil and gas development on riparian/wetland areas would be negligible except in areas where steep slopes or other resource management concerns such as visual resources, sensitive species, and wildlife preclude shifting of an oil and gas activity within the specific SSR/CSU. This could result in negligible to minor direct impacts to vegetation of riparian/wetland areas, especially below the rim. Exceptions may include some negligible to localized minor negative impacts to upland areas, mostly below the rim, where allowed ground-disturbing activities would be cumulative to habitat degradation from ongoing ground-disturbing activities, drought effects and existing weed infestations.

**Special Management Designations and Restrictions** — In general, few special resource management actions would result in impacts to upland vegetation. Some indirect benefits may occur as a result of selected ACEC and WMA management prescriptions (Tables 2-2 and 2-3, respectively). Large and sometimes overlapping NGD/NSO polygons indirectly result in some positive impacts for other resources. These benefits result because limits on long-term ground-disturbing activities for the protection of most other resources also reduce direct loss of vegetation, fragmentation of upland habitat, and introduction of weeds along routes and the edges of disturbance zones. Under the Proposed Plan, negligible to minor positive impacts to upland vegetation would result from special resource management actions.

The Proposed Plan would also result in a number of direct and indirect positive impacts to riparian/wetland areas above the rim due to the ACEC and WMA management prescriptions (Tables 2-2 and 2-3, respectively). Prohibitions on long-term ground-disturbing activities within WSR-eligible stream corridors would protect an area of 0.25 mile on either side of stream centerlines from ground-disturbing activities that might impair ORVs until a suitability analysis has been completed.

Also above the rim, a broad protection zone would be afforded riparian/wetland areas due to a NGD/NSO restriction specific to protection of high value habitat for genetically pure populations of Colorado River cutthroat trout. An overlapping, but much narrower zone of protection is afforded from an NGD/NSO restriction for riparian/wetland vegetation. In addition, an SSR/CSU restriction would provide controls on the specific location of proposed surface uses within a 500-foot buffer outside the edge of riparian or wetland plant communities.

It is anticipated that as a result of special resource management, riparian/wetland vegetation above the rim would generally experience local and widespread moderate positive impacts under the Proposed Plan. Below the rim, protections and benefits for the fewer and smaller riparian/wetland areas would be limited to the NGD/NSO and SSR/CSU restrictions specifically for the vegetation.

#### ***Offsite and Cumulative Impacts***

Offsite impacts under the Proposed Plan would be the same for all alternatives; activities in these areas are generally expected to follow current trends, regardless of management within the Planning Area. In terms of impacts from oil and gas development, comparing assumed cumulative impacts to those for only Federal lands (Tables 4-2 and 4-3) shows that the offsite impacts (i.e., on private lands within and

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surrounding the Planning Area) would be proportionately greater than for the Federal lands. This reflects the greater proportion of available surface on private lands, where only areas steeper than 50 percent are assumed to be unavailable (versus other NGD/NSO restrictions on Federal lands). In terms of cumulative impacts to vegetation it is important to note that a higher proportion of private lands within the Planning Area are below the rim, where upland habitat is already more degraded than above the rim.

Based on assumptions used in the RFD (Appendix H), approximately 2,904 wells could be developed on Federal and private lands in 20 years, assuming comparable development rates in proportion to the acres available for drilling operations (Table 4-3). This estimate includes the assumed 1,570 wells on Federal lands. Because more of the private lands are located below the rim than are Federal lands—64 percent versus 53 percent—the relative impacts on upland and riparian/wetland areas on private lands would be greater. This is compounded by an assumed lesser emphasis on clustering (e.g., with an assumed 40-acre surface density throughout, versus a goal of 160-acre surface density on new Federal leases) and the fact that private landowners negotiate their own agreements with oil and gas companies regarding reclamation standards, road designs, and other environmentally protective aspects of development. Failure to perform adequate reclamation or avoid riparian/wetland vegetation during offsite development could in turn potentially result in indirect impacts to BLM lands through the increased incidence of noxious weed and other undesirable plant introductions or transport of eroded soils and sediments. Degradation of these areas would also cause a decrease in the areal extent of natural vegetation communities throughout the larger area.

Although management of livestock grazing under the Proposed Plan is expected to result in improvements to vegetation resources, the same management on private lands cannot be assumed. Therefore, any potential negative impacts from livestock use in offsite areas—including erosion, siltation, and other impacts to streams as well as general vegetation degradation and noxious weed infestations—could negatively affect lands within the Planning Area.

Cumulative impacts on vegetation would also result from public travel on public lands within and surrounding the Planning Area. In general, public lands receive much greater use than private lands. Therefore, the beneficial road closures and cross-country travel restrictions for motorized and mechanized uses (except for Hubbard Mesa and over-snow travel by snowmobiles) under the Proposed Plan would help offset an anticipated increase in use of both public and private lands and the indirect and direct negative impacts these activities have on vegetation resources.

Noxious weeds and other populations of other undesirable vegetation are assumed to occur at approximately the same densities offsite as within the Planning Area. If unmanaged, the presence of these populations offsite would serve as a constant infestation source for the Planning Area, especially in areas where human traffic and livestock or wildlife movement can serve to spread weed seeds into new sites, counteracting active and coordinated management under the Proposed Plan.

The minor potential negative impacts discussed for riparian/wetland areas below the rim within the Planning Area would be cumulative to prior degradation of these areas due to livestock grazing, unregulated stream crossings, noxious weed proliferation, and drought effects (Section 3.3.1). These negative factors are assumed to be present and unmitigated in many riparian/wetland areas in the greater region as well. Therefore, negative impacts due to management actions being considered for incorporation into the RMPA have the potential to be cumulatively greater than when assessed in isolation.

A quantitative assessment of cumulative impacts on vegetation resources is not possible, due to (1) unavoidable uncertainties about the location, scale, and rate of oil and gas development on BLM lands, private lands, and other lands both inside and outside the Planning Area; (2) impacts from other types of land uses and land developments associated with the 4.5-percent annual population growth of the surrounding area; and (3) the application and effectiveness of environmental protections on non-BLM lands. However, the long-term surface disturbance from new wells on BLM lands in 20 years (812 acres)

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represents 29 percent of the cumulative total for private plus Federal, existing plus projected development (Tables 4-2 and 4-3). Also, the total number of BLM and private wells projected for the Planning Area at the end of 20 years (approximately 3,700) is in comparison to a projected total of 10,000 to 20,000 in Garfield County for the same time-frame (Section 3.4.3).

Regardless of management actions within the Planning Area, direct and negative impacts to vegetation resources would result from ongoing human development throughout the general region, which would bring new roads, housing projects, commercial development, and increasing recreational use of wildlands. The same indirect impacts to native vegetation discussed above would also result. In many cases, the loss or fragmentation of native plant communities is highly visible. These impacts would continue on a regional scale and would be in addition to impacts expected from land uses and resource management activities in the Planning Area. If negative impacts to these resources continue to increase as expected, their condition on public lands would become even more important because of their intrinsic value, the biodiversity they represent, and the continuation of the ecological values they support.

### **Summary of Impacts to Upland and Riparian/Wetland Vegetation**

The Proposed Plan provides protection of riparian/wetland areas from surface disturbance by several, sometimes overlapping, restrictions and conditions. Additionally, several management actions proposed in this alternative would affect upland and riparian/wetland vegetation. These include direct management of the resources themselves as well as management of noxious weeds, travel, recreation, rangeland, and oil and gas development. The potential impacts of these actions to upland and riparian/wetland vegetation are discussed above and summarized in Table 4-10. The Proposed Plan and Alternative II would have the least adverse impacts to upland and riparian/wetland vegetation and the most positive impacts.

**Table 4-10. Summary of Impacts to Upland and Riparian/Wetland Vegetation<sup>1,2</sup>**

<b>Land Use or Management Action</b>	<b>Alt. I No Action</b>	<b>Alt. II</b>	<b>Alt. III Preferred</b>	<b>Alt. IV</b>	<b>Alt. V</b>	<b>Proposed Plan</b>
Upland Vegetation Management	Minor to Moderate (-)	Moderate (+)	Minor to Moderate (-)	Minor to Moderate (-)	Moderate to Major (-)	Moderate (+)
Riparian/Wetland Vegetation Management	Minor to Moderate (-)	Major (+)	Moderate (+)	Moderate (+)	Moderate to Major (-)	Major (+)
Grazing and Rangeland Management	Minor (+)	Moderate to Major (+)	Moderate (+)	Moderate (+)	Moderate (-)	Moderate (+)
Travel and Recreation Management	Localized Major (-)	Moderate (+)	Moderate (+)	Moderate (+)	Moderate (+)	Moderate (-) to Moderate (+)
Oil and Gas Development	Minor (-)	Minor (-)	Minor (-)	Minor (-)	Minor to Moderate (-)	Minor (-)
Special Management Designations and Restrictions	Negligible (+)	Moderate (+)	Minor (+)	Minor (+)	Negligible (+)	Moderate (+)

<sup>1</sup> Overall impact level after combining adverse (-) and beneficial (+) effects of land uses and management actions and after incorporating BMPs described in text and Alternative I.

<sup>2</sup> Does not include special status species; see Section 4.3.4 and Table 4-14.

## **4.3.2 Terrestrial and Aquatic Wildlife**

### **4.3.2.1 Introduction**

In general, the occurrence, abundance, and distribution of wildlife are most strongly affected by habitat type, quality, and accessibility. All of these habitat characteristics may be severely altered as a result of increased human activity and resource development, as well as by resource management activities aimed

at specific wildlife or other environmental concerns. These include (1) actions aimed at preserving or enhancing fish and wildlife resources, and (2) other actions, including oil and gas development, vegetation management, livestock management, and travel management.

Impacts to fish and wildlife resources from implementation of the Proposed Plan are summarized in the following subsections, with selected references to Alternatives I through V. These impacts can be either direct or indirect and can result from any activity involving removal or modification of vegetation and increased levels of human activity. Major impacts associated with human intrusion into an ecosystem are discussed below.

Information regarding potential impacts on special status species is presented in Section 4.3.4. These include Federally listed, proposed, or candidate threatened or endangered species; BLM and USFS sensitive species; migratory birds, including neotropical migrants; BCCs; and State-listed threatened, endangered, or special-concern species in Colorado.

### ***Impact Types***

**Direct Habitat Loss** — Direct habitat loss occurs when required life-sustaining conditions are lost, e.g. through removal of vegetation or draining a pond. Vegetation impacts are the most significant for future land use and management actions. Removal of vegetation affects wildlife by reducing the extent or quality of habitat in terms of food, cover, and structure for nesting and other uses. These impacts are relatively simple to quantify by comparing the amount of habitat loss to the amount preserved. For example, removal of vegetation during construction of a road or well pad essentially strips the affected area of any wildlife value. While closure and reclamation of temporarily disturbed areas can eventually restore lost habitat values, the disturbance may have a long duration (20 or more years for a well) or require years or decades for recovery of pre-disturbance structure and function (pipeline corridors, reclaimed roads).

**Habitat Modification** — Changes in habitat are generally less obvious and less severe than losses of habitat but can be significant, especially if small impacts accumulate across large areas. Examples include removal of forage by domestic livestock, trampling of soils by domestic livestock, invasions of weeds in areas where native plant vigor or cover is reduced, and removal of tree cover during timber harvesting. Modification of aquatic habitats can also occur as a result of increased human use and resource development, including diversions for agricultural and other uses. Low-water crossings or culverted crossings of roads can create impassable segments that interfere with upstream-downstream movement by fish and aquatic macroinvertebrates. A change in grade at the crossing point can create depositional or erosional regimes that affect the type of substrate, channel stability, and water quality. Roadway approaches to streams are often relatively steep and may provide an ongoing source of sediments that can make the substrate unsuitable for spawning or feeding, and increased suspended loads can smother fish eggs, suffocate larvae, and change the temperature or other physicochemical characteristics.

Habitat modification can also be beneficial and is an important tool in wildlife management. Examples include use of prescribed fires to stimulate new growth on senescent (older) woody vegetation, thinning of overly dense shrubs to enhance forage production, construction of protective fencing along riparian areas, and creation of alternative watering features to reduce the need for cattle to access streams.

**Habitat Fragmentation** — This type of impact is increasingly recognized as an important, and often the most important, impact of human population growth and associated development on wildlife. Impacts of habitat fragmentation relate to the reduced size of individual habitat blocks and the increased percentage of “edge” on smaller blocks as compared to larger blocks. Thus, two 50-acre blocks of habitat may support fewer individuals of a particular species than one 100-acre block, and four 25-acre blocks may be incapable of sustaining any individuals of that species. Fragmentation may benefit as many species as it harms by creating conditions favorable for “edge species” (those that prefer the interface between two or

more habitat types) and “habitat generalists” (those that are not restricted to a specific habitat to meet their needs). However, species adversely affected by fragmentation—“habitat-interior” species and most “habitat-specialist” species—include many of the special status species described in Section 3.2.3. These and other habitat-interior or habitat-specialist species have suffered disproportionate levels of adverse impact from human population growth and resource development. Therefore, while some species benefit from fragmentation, they tend not to be the species of special concern within a given area, while species adversely affected by fragmentation typically are. Moreover, species benefiting from habitat fragmentation include most of the species commonly associated with human habitation, including farmlands, ranchlands, and rural or suburban residential development.

Habitat-interior species may avoid habitat edges because the species are either (1) less well-adapted there than edge specialists and habitat generalists, or (2) more secretive and likely to seek the greater seclusion available away from an edge. Gutzwiller et al. (1998) found that more detectable (brightly colored or loudly and frequently singing) forest birds were more furtive than less detectable species. In general, the more detectable species are migrants. The need for bright colors and loud or frequent songs is associated with the greater likelihood of having to find a new mate each year due to mortality during migration and the need to establish a territory and form a pair bond more quickly. Maurer and Heywood (1993) noted that neotropical migrant songbirds (Section 3.2.3) tend to be more detectable and more frequently are habitat-interior and habitat-specialist species; these species include warblers, vireos, and tanagers. Selected studies on the effect of habitat fragmentation are summarized below.

- Hargis et al. (1999) found that American martens respond negatively to small amounts of fragmentation and do not occupy forests when more than 25 percent of the tree canopy has been removed by logging of patchwork clearcuts.
- Moore and Hooper (1975, cited in Whitcomb et al. 1981), Forman et al. (1976), and Galli et al. (1976) all reported that numbers of bird species in forests were positively correlated with patch (habitat block) size. Whitcomb et al. (1981) reported that neotropical migrant forest-interior species (see Section 3.2.3) were rare in blocks of 2.5 to 12 acres, intermediately abundant in blocks of 15 to 35 acres, and abundant in blocks of 175 acres or more, occurring at 80 to 90 percent of their normal density in extensive unfragmented tracts. McIntyre (1995) reported that small tracts (<8 acres) had only 742 total birds and an average of 2.9 species per patch, compared to 1,041 total birds and 3.9 species per patch for large tracts (up to 325 acres). Keller and Anderson (1992) reported similar effects of timber cutting on forest bird species.
- Forman and Alexander (1998) reported reduced use by habitat-interior birds extending 150 meters away from forest roads and 1 to 2 kilometers away from grassland roads. Forman (2000) reported that the “road-effect” zone averages 200 meters (660 feet or 0.125 mile) wide for secondary roads. Ingelfinger (2001) reported that numbers of sagebrush steppe songbirds are reduced by up to 60 percent within 100 meters of high-traffic roads (>12 vehicles per day) associated with oil and gas development and by up to 50 percent within 100 meters of low-traffic roads.

While the discussion above focuses on fragmentation associated with human activity and development, it can also occur as a result of natural changes. Chief among these in forested habitats are the effects of major wildland fires. By destroying forest canopies that provide contiguous habitat for arboreal species and contiguous cover for ground-dwelling species, fires can create unforested openings that impede movement by forest-interior species and increase the amount of edge. The change in fire management for the top of the plateau to one with a higher priority on suppression is based in part on the sensitive forest and aquatic habitats there (Section 4.5.11).

**Reduced Habitat Effectiveness** — In addition to the effects of reduced patch size, increased edge, and shifts in vegetation composition associated with habitat fragmentation are impacts associated with increased human activity. This is because most sources of habitat fragmentation—e.g., roads, trails,

timber clearcuts, conversion of habitats to agricultural or residential uses, and energy developments—are also associated with increased levels of human activity.

While some species are more tolerant of human activity than others, virtually all species have some threshold of disturbance above which they would abandon an area or use it at a significantly reduced level. The result is a *de facto* loss of habitat, because avoided areas meet no survival needs. The amount of habitat actually available to wildlife is called “effective habitat,” and reductions in the amount of effective habitat (or “habitat effectiveness”) can greatly exceed any direct habitat loss. For example, Reed et al. (1996) calculated that the effective habitat loss associated with construction of new roads in an area open to logging was 2.5 to 3.5 times the actual habitat loss, assuming a “road-effect” zone extending 100 meters from a road.

The scientific literature contains a number of studies on the effects of roads, logging activities, and oil and gas activities on deer and elk, two species of special interest and concern in the Planning Area. Particularly relevant studies are summarized below. When reviewing these studies, however, it is important to note that the term “avoidance” as used in these articles does not mean total avoidance but instead refers to disproportionately low use based on the type or extent of habitat present.

- For elk, Ward (1976) and Irwin and Peek (1979) reported reductions in use within 400 meters (0.25 mile) of little-used, slow-speed National Forest roads. Hershey and Leege (1976) reported reduced use within 400 meters (0.25 mile) of forest roads in summer range. Frederick (1991) found that 73 percent of use by elk occurred in the 50 percent of an area more than 400 meters (0.25 mile) from a road. Lyon (1979) reported that use by elk was reduced by 37 percent within 0.1 mile of a road and by 57 percent within 0.2 mile. Pedersen (1979) and Rost and Bailey (1979) reported that use by elk decreased within 250 meters (820 feet) of paved roads. Czech (1991) reported reduced use within 500 meters of a logging road after it was opened to public use. Gillin and Irwin (1985) reported reduced use of calving habitat within about 1,200 meters (0.75 mile) of seismic exploration roads in more open (unforested) summer range.
- Thiessen (1976) reported for a study area in Idaho that 75 percent of use by elk was in the 25 percent of the site that was roadless. Similarly, Frederick (1991) found that 73 percent of use by elk occurred in the 50 percent of an area more than 400 meters (0.25 mile) from a road.
- However, both Lyon (1979) and Perry and Overly (1976) noted that the actual extent of reduced habitat use along roads was affected by the amount of vehicular traffic and the density of nearby vegetation cover. Pedersen (1979) and Rost and Bailey (1979) also noted that paved roads had more impact than unpaved roads, and the latter more impact than primitive roads (presumably related to differences in the frequency and speed of vehicular traffic). Witmer and DeCalesta (1985) found that open spur roads showed a significant reduction up to 250 meters away.
- Regarding the duration of road impacts, Witmer and DeCalesta (1985) found no reduction in use within 250 meters of spur roads after the roads were closed to vehicles. Edge and Marcum (1985) found that elk avoided logging roads by distances of 500 to 1,000 meters on working days but showed no avoidance of the roads on weekends. Similarly, Johnson et al. (1990) reported that elk returned to areas of both summer range and winter range when construction activities that had caused them to leave an area had ceased. Czech (1991) reported that tolerance of logging roads by elk was correlated with the distance to hiding cover.
- In a study of the effects of oil and gas development on elk in southwestern Wyoming, Powell (2003) found reduced use within 500 meters of roads and drill pads during fall, winter, spring, and calving season (early summer). However, although he reported reduced use within 500 meters, he did not collect data for narrower zones, so it is not known whether the overall reduction was uniform or greater in closer proximity to the disturbance. Also, the habitat types that dominated the 500-meter

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zone were dominated by grasses and low-growing sagebrush and saltbush providing little visual screening.

- More recently, Sawyer and Nielson (2005) reported that elk showed reduced use of areas within 2.8 kilometers (1.7 miles) of roads on summer range. In winter, the zone of reduced use was 1.2 kilometers (0.75 miles), which the authors attributed to greatly reduced human use of the roads.
- Regarding the duration of impacts on elk from oil and gas development, Hiatt and Baker (1981) found that an oil well drill pad was temporarily avoided but that the access road was not. Johnson et al. (1990) also found that elk avoided oil and gas activities temporarily but returned to these areas when the activities ceased. Knight (1980) reported that elk showed alarm responses when exposed to a continually shifting seismic exploration line but not in relation to regular activities at an oil and gas well pad and access road. Van Dyke and Klein (1996) reported that elk responses to oil drilling activities were not permanent but instead that “elk compensated for site-specific environmental disturbance by shifts in use of range, centers of activity, and use of habitat rather than abandonment of range.”
- Regarding the benefits of road closures, Irwin and Peek (1979) found that elk tended to remain on summer range later into the fall in areas of closed roads than in areas of open roads accessible to hunters. Witmer and DeCalesta (1985) found that habitats adjacent to closed roads showed no reduced elk use, while open spur roads showed a significant reduction up to 250 meters away. Holland (1989) reported that impacts were reduced by 70 percent for roads limited to public access (administrative use only) and by 90 percent for permanent closures.
- For deer, Knight et al. (2000) found that use by mule deer was reduced within 200 meters of a road (i.e., the road-effect zone is 200 meters, or 0.125 mile). Lyon (1979) found that the reduction in habitat use was greater in areas of sagebrush than pinyon/juniper, apparently due to difference in the amount of vegetation screening.
- In ongoing studies of oil and gas activities on mule deer in southwestern Wyoming, Sawyer et al. (2004, 2005) documented decreasing use beginning at Year 1 of drilling and continuing to decline through Year 4 (the most recent report reviewed). During the first three years, deer gradually increased their zone of reduced use to distances of 2.1, 3.1, and 3.7 kilometers (1.3, 1.9, and 2.3 miles), respectively. In Year 4, habitat selection did not seem to be affected by the distance from a pad. The authors attributed this to severe winter conditions (heavy and protracted snow cover), which may have forced deer to revert to their pre-development habitat use despite the presence of drilling operations. The 2004 report (presenting findings for Year 3) included the following statement: “While results from our analyses suggest that natural gas development...has affected mule deer habitat use, no statistically significant changes in survival or reproduction have been detected.” However, the 2005 report noted a 46-percent reduction in deer abundance in the area of oil and gas development as of Year 4. Whether this was related to lower survival or reproduction due to the severe winter conditions, lower survival or reproduction due to deer being “forced” to use areas where they were more subject to disturbance effects (with associated increased stress), or dispersal to other winter ranges (as evidenced by one radio-collared animal)—or some combination of these—is not known. However, the authors noted that no similar decline was detected in the offsite (“control”) population.

Some researchers have described road effects in terms of road density (length of roads per unit area). For example:

- Lyon (1983) stated that use by elk is reduced 25 percent at a road density of 1 mile per square mile, and 50 percent at 2 miles per square mile. Baker and Cai (1992) reported that a road density of 1.7 miles per square mile caused an 80-percent reduction in elk use and total avoidance by mountain lions, and that a density greater than 4.2 miles per square mile also eliminated elk use.

- Thomas (1979) used data of Perry and Overly (1976) to plot use of summer range by deer and elk in response to different types of roads and differing road densities. At a density of 2 miles of road per square mile of habitat, use by elk decreased only 3 percent for primitive (narrow, unimproved) roads but 40 percent and 54 percent for secondary and primary roads, respectively. Main roads were 1.5 or more lanes wide, improved, regularly maintained, and regularly traveled. In comparison, use by mule deer at the same road density decreased by 6 percent, 8 percent, and 16 percent for primitive, secondary, and primary roads. At densities of 3 miles per square mile, decreases in use by elk were 4, 52, and 65 percent for these road categories, while deer decreased 14, 16, and 31 percent, respectively.

The current “road” density on BLM land within the Planning Area is approximately 2.3 miles per square mile, based on 259 miles of mapped motorized routes. However, this represents the baseline (pre-development) condition in much of the area. Furthermore, it is not known precisely where increased traffic volumes associated with oil and gas development would occur, and what percentage of existing roads would be subject to increased traffic sufficient for the effects summarized above. For example, the Proposed Plan is assumed to result in 16 miles of new or upgraded access roads atop the plateau in 20 years (Table 4-2), which would increase the effective road density by only a factor of 0.3. Therefore, calculating decreases in use by deer and elk using the density method is not practicable.

**Other Sources of Disturbance** — Roads, timber clearcuts, and oil and gas developments are not the only reported sources of disturbance that can affect wildlife use:

- Gutzwiller et al. (1998) experimentally subjected forest birds to increased human activity, which consisted of walking through breeding territories. Effects included nest abandonment and reduced nest attentiveness leading to nest failure. However, Riffell et al. (1996) noted that this impact is not cumulative—i.e., does not carry across years if the disturbance ceases. Friesen et al. (1995) discussed the exacerbating effect of disturbance on habitat fragmentation due to decreased seclusion in the interiors of smaller patches. They found that 10-acre woodlots not located near human habitations supported more species and individuals of neotropical migrant songbirds than did 62.5-acre urban woodlots.
- Freddy et al. (1986) reported that deer would move away in response to pedestrian traffic as close as 200 meters (660 feet), similar to the distance reported by Ward et al. (1980) who also reported a “locomotor response” distance for elk of only 86 meters (about 200 feet). Parker et al. (1984) emphasized the importance of avoiding situations in which wintering deer would be forced to move to avoid human activity, owing to decreased energy stores in winter and greater effort in moving through snow. Ward (1986) reported that elk were disturbed by firewood gathering closer than 800 meters (0.5 mile), with a similar buffer requirement from logging operations (Ward 1976).
- Williams and Lester (1996) compiled an annotated bibliography of OHV and other recreational impacts on wildlife. Joslin and Youmans (1999) provide in-depth information on the effects of recreation on Rocky Mountain wildlife in Montana. Their compendium includes a listing by Knight and Cole (1995) of specific effects of recreational activities on wildlife (excerpted below):
  - Viewing (close encounters) – Altered behavior, unnecessary energy expenditure during flight, altered nest placement, and reduced survivorship of young due to abandonment or predation.
  - Backpacking/hiking/riding/cross-country skiing – Flight, displacement, or elevated heart rate.
  - Rock climbing – Disturbance of preferred raptor perching and nesting sites.
  - Spelunking (caving) – Disturbance or abandonment of bat roosting and maternity sites.
  - Pets (dogs) – Stronger predator-alarm response than a person without a dog; increased stress and energy expenditure while fleeing, risk of injury or mortality.

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- OHVs – Potential disturbance (flight and stress) and redistribution.
- Snowmobiles – Same as OHVs.
- Boyle and Samson (1985) also discussed recreation effects on wildlife and found that many more species were adversely affected by hiking and camping, boating, wildlife viewing/ photography, OHV use, snowmobiles, caving, swimming, and rock climbing than were either unaffected or benefited.

**Interference with Movement Patterns** — Habitat loss or modification, habitat fragmentation, and disturbance impacts can also affect wildlife by altering important daily or seasonal movement patterns. These patterns may be altered through shifts to avoid human activity, to avoid crossing open areas that provide inadequate cover, or to circumvent some physical barrier (e.g., fences, steep roadcuts). This type of impact is not as much of an issue for small mammals or reptiles that do not move across large areas, or for birds that easily avoid them. Even without the need for these regular movements, most mammals tend toward some population dispersal as young seek new habitats to occupy. This is important to the species to ensure that suitable habitat is occupied and facilitate gene exchange between distinct populations. This is also seen in snakes and other reptiles. Barriers that prevent snakes from accessing winter dens or that isolate amphibian breeding pools from feeding areas can also affect or even eliminate a population.

For large mammals such as deer and elk, changes in the landscape can profoundly affect their ability to meet daily and annual requirements. For example, these large species must drink water regularly (daily during warm weather, even during winter), and home ranges must include sources of water. Blockage of a route between foraging or bedding areas and watering areas can cause the animals to abandon the larger area altogether. Seasonal movements between summer and winter range are also important for these species. In the Planning Area, for example, movement through the cliffs is limited to a few areas, many of which are included in the security areas described previously. Any human activity or landscape modification that prevents the use of one or more of these limited migration routes could effectively reduce the use of habitat either above or below the constrictions (“bottlenecks”).

**Harassment and Impacts from Dogs** — Harassment is an extreme type of disturbance and involves intentional actions to frighten or chase a species. Because wildlife react more severely to directed movements by people rather than incidental movements, the magnitude and duration of the displacement is generally greater. This increases the risk of injury to the fleeing animal, placing greater stress on the animal by increasing metabolic rates and creating more prolonged disruption in behavior and habitat use.

One potentially important source of harassment results when wildlife is chased by dogs. See Sime and Schmidt (1999) for a treatise on the topic. In some cases, this can result in direct mortality if the dogs either kill or mortally wound an animal. Less obvious, but potentially as serious, is the increase in stress that occurs when wildlife are forced to flee or are simply displaced from an area. As noted above, this can be of particular importance during winter, when animals have low energy reserves and are more vulnerable to stress because of low temperatures and, depending on conditions, movement through snow. Dogs can also cause especially severe disturbance during the fawning and calving seasons, when young or pregnant females are highly susceptible to stress and less able to flee. Young are especially vulnerable to stress and more likely to be directly attacked.

**Direct Mortality** — In addition to attacks by dogs, direct mortality can result in areas of increasing human use due to collisions with (or being run over by) vehicles, electrocution of raptors on utility lines, increased likelihood of illegal hunting, or inadvertent trampling of nests. In the case of oil and gas development, wildlife mortality associated with petroleum pollution has also been reported. The USFWS (1991) and Esmoil and Anderson (1995) described wildlife mortality associated with oil pits in Wyoming. Affected species included waterbirds as well as large mammals, raptors, and songbirds. Additional mortalities of birds and mammals were attributable to hydrogen sulfide gas being stripped from the petroleum. Since these studies were in an area of oil (rather than predominantly gas) production, the

number and toxicity of the oil pits would be expected to be greater than analogous situations associated with predominantly natural gas production such as the Planning Area.

### ***Impact Analysis Methodology***

**Impact Estimation** — Impacts on wildlife from habitat loss, habitat fragmentation, and increased human disturbance are difficult to quantify. Among the reasons are the following:

- Species differ in their tolerance of disturbance.
- Species differ in their ability to utilize less desirable habitats if displaced from more desirable habitats, or to otherwise adapt to changing conditions.
- Habitats differ in their ability to screen wildlife from areas of disturbance.
- Habitats differ in their importance to wildlife.
- Areas differ in their existing (baseline) quality.
- Areas differ in the existing level of human activity to which wildlife may have already adjusted their use patterns.
- All of the above may differ by season or other variables, both within and among years and within and among areas.

Added to these inherent variables are the realities of the RMPA/EIS process. Despite efforts to predict future conditions to a reasonably realistic level, unavoidable uncertainty remains. These uncertainties include factors such as (1) specific locations of well pads, access roads, or other types of surface disturbance; (2) specific rates at which changes in existing land uses occur, and how those rates may differ through time; and (3) specific degrees and rates of success in areas undergoing reclamation or habitat improvement programs.

Recognizing this difficulty, the Draft RMPA/EIS used an impact estimation tool for wildlife that attempted to “flatten out” the unavoidable uncertainties. This was intended to base the analysis on total changes across 20 years, since it was not possible to predict exactly where drill rig operation, road construction, and completed oil and gas production facilities would be located in any given year. Therefore, the analysis applied an estimate of reduced habitat effectiveness to all habitat losses that would occur over the 20-year period of analysis. The “multiplier” used was 3.5, which was derived from a study by Reed et al. (1996) indicating that the cumulative area affected by timber clearcuts and logging roads in forest habitat was up to 3.5 times the actual area of direct habitat loss, using a road-effect zone extending 100 meters from the disturbance. Assuming that this equates to total wildlife avoidance would compute to habitat loss of 3.5 acres for each acre of area impact (e.g., well pad) and 80 acres for each mile of road (assuming a straight road).

During the Consultation and Coordination process following publication of the Draft, CDOW stated that they did not agree with the use of this methodology and instead would prefer application of findings by Sawyer et al. (2004) and other authors who attempted to quantify effective habitat loss for deer and elk due to reduced use of areas around roads, drill rigs, or similar disturbances. Applying this approach would mean assuming, for example, an area of reduced use within some “buffer” zone. While the reported road-effect widths vary (see discussion earlier in this section), an average width at which reduced use is documented would be approximately 250 meters (820 feet). Because of the more intensive and continuous disturbance associated with a drill rig, it would seem reasonable to use a wider impact zone, such as 400 meters (1,320 feet or 0.25 mile), also borrowing from the studies cited above. Assuming approximately 50-percent avoidance within these distance zones, which are at the upper end of the typical ranges in the literature, computes to 63 acres of effective habitat loss around an operating drill rig and 99 acres of effective loss per mile of road length (assuming a straight road). Note that a very sinuous road has less total impact area per mile of length because the impact areas for individual points along the road

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may be “stacked” or overlap. For example, a 250-meter buffer along a 1-mile section of road with a sinuosity of 0.7 (typical of winding roads in the Planning Area) would include 82 acres, as opposed to 99 acres for a straight road of the same length.

A shortcoming of the distance (instead of area) method is that it does not provide a basis for estimating a reduced zone of use around a production facility or access road once it has entered the long-term stage of occasional and lower intensity human. Furthermore, it is unlikely that many of the species present within the Planning Area would be subject to the same level of sensitivity to human disturbance as reported by some authors for hunted populations of deer and elk (unhunted populations being much more tolerant of human activity). Other furtive species include carnivores (black bears, mountain lions, and bobcats) and some raptors. Zones of effective habitat loss for smaller mammals and most birds would be much narrower.

As throughout this RMPA/EIS, the impacts resulting from quantitative and qualitative analyses are expressed in general terms for comparison among alternatives and resources. As pertains to fish and wildlife, adverse impacts are defined as follows:

- **None** – No changes in species occurrence, distribution, or abundance are expected.
- **Negligible** – Changes in distribution or abundance of some species may occur, but at levels that may not be discernible or demonstrable except at specific impact sites.
- **Minor** – Changes in distribution or abundance of some species would be discernible and demonstrable at a localized level, but current types and patterns of use and species occurrence would continue.
- **Moderate** – Changes in distribution or abundance would be readily discernible and demonstrable, and some species may occur in markedly lower numbers or be exterminated from localized parts of the Planning Area.
- **Major** – Similar to moderate, except that several species may occur at markedly lower numbers, and some species are likely to be extirpated from large portions of the Planning Area.

The same terms are applied in a more relative sense to describe beneficial impacts.

**Oil and Gas Development** — The following subsections describe fish and wildlife impacts associated with future management actions and land uses contained within the Proposed Plan. Selected comparisons are also made to one or more of the five alternatives analyzed in the Draft RMPA/EIS. Some impacts are direct, while others are indirect and affect wildlife through a change in another resource. Also, some of the most ecologically sensitive species such as raptors, and most socially and recreationally important species such as big game, are highly mobile and require large areas to meet their annual requirements. Thus, onsite impacts could also result in offsite and cumulative impacts.

Although fish and wildlife would be affected to some degree by all of the future land uses and management actions associated with implementation of the final Plan arising from this RMPA/EIS process, impacts resulting from development of oil and gas on both Federal and private lands are likely to be the most important (i.e., detectable, demonstrable, and deleterious). This conclusion is based on the increasing amount of habitat loss, habitat fragmentation, and disturbance from human activity associated with increasing levels of development. Therefore, the analyses below emphasize this land use.

Each phase of oil and gas development—from exploration and construction through operation and abandonment—has a specific combination of impact type, intensity, and duration.

- Exploration and Construction – The initial phase of development typically lasts for 25 to 40 days, depending on depth, and is very equipment-intensive. Associated activities include blading an access road and pad (with an average combined area of 3.4 acres per well) and nearly continuous operation of a drill rig and other specialized heavy equipment. On average, 580 round trips by heavy trucks and

pickups are associated with each new well. Resultant impacts are likely greatest when the first well is drilled in an area, because wildlife would not have had an opportunity to habituate to low-level disturbance or adjust their movement patterns to avoid high-level disturbance.

- Operation and Production – This phase typically involves minimal personnel in the field except at compressor stations and water disposal facilities, with periodic traffic to each well for monitoring and maintenance. Reclamation of temporarily disturbed areas begins upon completion of construction. Successful reclamation for weed and erosion control is expected to occur within 3 to 5 years after disturbance; however, restoration to productive wildlife habitat could take up to 20 years. The remainder of the disturbed area is occupied by surface facilities and ongoing human activity throughout the life of the well.
- Abandonment – The final phase of an oil or gas well occurs at the end of its productive life, typically ranging from 20 to 40 years. During abandonment, surface facilities are removed, wells are plugged, and access roads are reclaimed unless deemed necessary for resource management or if requested by the landowner. These activities involve a short-term increase in workers and vehicles in the project areas. Abandonment and reclamation activities require approximately 3 days per well and 4 days per mile of access road, for a crew of four people.
- Reclamation – Restoration of temporarily disturbed areas at the well pad and along the access road begins upon completion of construction. Attaining reclamation standards in terms of erosion control, weed control, and establishment of vegetation cover typically requires at least 3 to 5 years following planting. Actual recovery of reclaimed areas to conditions that represent productive wildlife habitat may take 20 years or longer, especially in drier sites. Areas of long-term disturbance, which are occupied by surface facilities and ongoing human activity throughout the life of the well, are reclaimed following abandonment.

### **Impact Mitigation**

Direct and indirect impacts of oil and gas development and other land uses or activities are generally best mitigated by avoiding or minimizing the impact to the degree practicable, given other management considerations. The various surface use restrictions outlined in Table 4-1 and described in Section 4.1 emphasize this approach for protecting fish and wildlife resources. Impacts that cannot be avoided would be minimized by a variety of BMPs, examples of which are provided in the following subsections.

Besides avoidance or minimization, some impacts can be mitigated by measures that improve the quality of habitats not directly affected. These measures may be implemented in portions of the Planning Area not affected or only minimally affected by development (e.g., the various NGD/NSO areas) or, potentially, in offsite areas. Habitat enhancement may include measures to improve shrub stands that are approaching decadence due to long-term fire suppression, restoring areas of degraded rangeland through reseeding and fertilization, use of fencing to exclude livestock from important wildlife habitats (e.g., riparian areas), and development of water sources.

Habitat restoration and enhancement measures could also be implemented on lands outside the Planning Area. A recent example of offsite mitigation occurred in GMU 42, in which an oil and gas operator purchased 320 acres of deer and elk winter range and implemented habitat improvements such as vegetation treatments (including prescribed fires and mechanical manipulation), construction of fences to protect riparian areas, and development of upland water sources (BLM 2002a). A variant on the concept of offsite mitigation is that of “habitat banking.” Under this concept—analogueous to the widely used practice of wetland banking—relatively large and unfragmented blocks of habitat would be improved and/or preserved in perpetuity for the purpose of supporting a specific wildlife use. The bank would then be used to offset unavoidable impacts in the project area. When applied correctly, an offsite bank or other mitigation area may be of more benefit to wildlife than attempting to minimize or offset impacts in multiple smaller (fragmented) areas subject to ongoing disturbance by human activity.

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During the Consultation and Coordination process, CDOW noted that abandonment of active agriculture (irrigated hay production) along some portions of Parachute Creek have reduced the value of these lands, which provided a source of forage from fall through spring and helped offset impacts to native winter range. Reestablishment of irrigated hay production specifically as wildlife mitigation could benefit deer and elk as well as a variety of other species. While BLM does not believe that it can require offsite mitigation, the agency has agreed to consult with CDOW in identifying potential offsite mitigation programs for the Planning Area and to work with oil and gas operators to encourage such measures when deemed appropriate.

The levels of impact ascribed to the Proposed Plan in the following analyses assume that all applicable stipulations and other management actions constituting an element of the Plan and would be applied and enforced. Management prescriptions specific to oil and gas development and common to both the Proposed Plan and Alternatives I through V include the following:

1. Where feasible and deemed appropriate by BLM, use clustering, collocation, or consolidation of facilities to reduce habitat loss, habitat fragmentation, and vehicular activity (this is a key component of the Proposed Plan).
2. Place locked gates across well access roads to prevent unauthorized motorized use.
3. Require that development be “contained” so that produced waters and other drilling products are hauled offsite and disposed safely rather than retained onsite where they could pose a potential risk of toxicity to wildlife or pollution of surface waters.
4. Require that water used in drilling operations, dust suppression, pad revegetation, or other consumptive uses be hauled or piped from offsite areas so that natural watering sources for wildlife are not depleted or unnecessarily disturbed.
5. Require that new oil and gas drill pads and access roads be located to avoid or minimize new drainage crossings, unless avoiding a drainage would cause greater impacts from increased road length, cut-and-fill, etc.
6. Where practicable, use radiotelemetry to monitor oil and gas production facilities as a means of reducing vehicular traffic, especially in sensitive habitats or seasons of sensitive wildlife use.
7. Construct watering sources (e.g., “guzzlers”) in areas not subject to oil and gas development to reduce the need for movement from secluded areas to watering areas along drainages, some of which may necessitate crossing through areas of increased human activity or new roads.
8. Prohibit oil and gas crews from bringing dogs onto BLM lands during the course of their work.
9. Develop cooperative programs among the oil and gas lessees, BLM, and CDOW to fund and implement onsite or offsite habitat enhancement measures to offset unavoidable onsite impacts and reduce regional habitat loss.

While these measures would not prevent direct or indirect impacts to fish and wildlife, they would help reduce the severity of these impacts or slow the rate at which they accumulate.

### 4.3.2.2 Impacts of Proposed Plan

The analysis of impacts of oil and gas development on fish and wildlife resources under the Proposed Plan is based on the protective stipulations, assumed numbers of pads and wells, assumed miles of new or upgraded access roads, and acres of short-term and long-term surface disturbance presented in Tables 4-1 and 4-2. For BLM lands within the Planning Area, the Proposed Plan represents a substantially different ratio between the number of well and the amount of surface disturbance associated with pads and access roads than Alternatives I through V. This is the result of the requirement for phased and clustered development with a focus on ridgetop development on top of the plateau, and management toward

clustering and collocation of facilities below the rim. Cumulative impacts of oil and gas development result from existing and anticipated drilling on private lands in the Planning Area and on both Federal and private lands in adjacent areas of the GSRA.

Although generally less important as a source of adverse impacts to fish and wildlife than oil and gas development, other land uses and activities—such as recreation and grazing and, to a lesser extent, range management and travel management—are also addressed below for the Proposed Plan, with selected reference to one or more of Alternatives I through V.

### ***Direct and Indirect Onsite Impacts***

**Vegetation and Range Management** — Vegetation goals would focus on improving the diversity, production, and native species composition of upland and riparian/wetland areas. Livestock grazing would be managed to conform to BLM grazing regulations and meet Land Health Standards as well as vegetation community objectives. Because the Proposed Plan makes greater use of active management than Alternatives I and II, which rely primarily on natural processes, the rate of improvement over existing vegetation and range conditions is expected to be more rapid. Over time, the Proposed Plan is expected to have moderate to major positive benefits on vegetation condition, which in turn would benefit wildlife.

**Travel Management** — Limiting travel to designated routes throughout the Planning Area (except for over-snow travel by snowmobile and 2,640 acres of open travel in the Hubbard Mesa OHV Riding Area), closing/rehabilitating 28 miles of existing routes, and limiting 68 miles of existing routes to administrative use would increase solitude for wildlife and reduce the area of habitat loss associated with existing road-effect zones along these routes. Of the total of 96 miles of existing routes to be closed or limited to administrative use, all but 78 miles would be above the rim in areas that include crucial elk calving habitats, fawning habitats for deer, summer range for mountain lions and black bears, and nesting habitat for a host of small birds and raptors. The associated gain in effective habitat above the rim would be substantial, assuming an existing zone of reduced use along these routes (see discussion on impact estimation).

**Oil and Gas Development** — Protection of terrestrial and aquatic wildlife resources under the Proposed Plan include application to oil and gas development of NGD/NSO, SSR/CSU, and TL restrictions for a variety of related resources. These include:

- **NGD/NSO** – Colorado River corridor, high-value (including both “high-risk” and “moderate-risk”) habitat for the Colorado River cutthroat trout, riparian and wetland areas, wildlife security areas below the rim, bald eagle nesting and winter roosting areas, mapped nests of other raptors, and the Anvil Points claystone cave (bat habitat).
- **SSR/CSU** – Parachute Creek WMA (atop the plateau), wildlife security areas atop the plateau, big game migration routes, and the peregrine falcon cliff-nesting complex.
- **TL** – Big game winter range, bald eagle nesting and winter roosting areas, raptor nesting and brood-rearing areas, peregrine falcon cliff-nesting complex, and waterfowl/shorebird nesting and brood-rearing areas (Fravert Reservoir).

Approximately 52 percent of habitats on the top of the plateau and along or below the cliffs would be protected with NGD/NSO restrictions under the Proposed Plan. An additional 33 percent would be in areas of SSR/CSU restrictions. The NGD/NSO restriction for wildlife security areas along and below the cliffs, and the SSR/CSU restriction for security areas along some stream valleys atop the plateau, are considered by CDOW to be particularly important. So too are the six “passages” (migration routes) used by deer and elk during seasonal movements through the otherwise impassable Roan Cliffs. These areas would be protected with SSR/CSU restrictions. Neither the wildlife security areas nor the migration routes were provided special protection under the Preferred Alternative of the Draft.

Of the 15 percent of BLM lands to be managed under standard lease terms for oil and gas, or similar measures for other land uses, almost 55 percent would have TL restrictions to protect seasonally sensitive wildlife uses and areas. The most extensive TL (34,668 acres) prohibits oil and gas drilling, roadbuilding, and other construction projects during the most crucial period of winter range use (December through April). Other TLs include seasonally crucial uses such as raptor and waterfowl nesting and brood rearing.

This alternative would result in approximately 210 wells on 13 pads above the rim and 1,360 wells on 180 pads below the rim. The wells on top (in deer and elk summer range, also supporting dispersed calving and fawning) would result in direct, long-term loss of 32 acres associated with the pads and 43 acres along 16 miles of existing or new roads needed for access across the top of the plateau (from the point at which the Cow Creek Road enters the Planning Area). The wells below (in deer and elk winter range) would result in direct, long-term loss of 450 acres associated with the pads and 287 acres along 108 miles of existing or new roads needed for access. Although this discussion emphasizes deer and elk due to their recreational and economic importance and generally high level of public interest, the same losses would apply to other wildlife using the habitats of the Planning Area.

As described previously in this section, impacts associated with disturbance from human activity would add effective habitat losses to the areas of direct habitat loss. Also as described previously, quantifying this effective loss is difficult. Two methods for doing so are to (1) multiply the area of direct impacts by a factor of 3.5, referred to here as the “area” method, based on the work of Reed et al. [1996] regarding habitat fragmentation (and used in the Draft RMPA/EIS); and (2) calculate a zone of reduced use around drill rigs and roads based on distances and percent reductions reported for deer and elk in the scientific literature, referred to here as the “distance” method. Because reported distances and percent reductions vary, the following analysis uses a combination of assumptions. For roads, the impact zone is assumed to extend 250 meters on either side of a major (regularly traveled) access route for oil and gas activities. For drill rigs, the impact zone is assumed to extend a distance of 500 meters. For both types of disturbance, the reduction in use is assumed to be 50 percent. Both the 500-meter and 50-percent values are at the upper end of the typically reported range.

#### **Impacts below the Rim**

Under the Proposed Plan, winter range on BLM lands would be protected by a 5-month TL that restricts drilling, road construction, and other major sources of disturbance from December through April. The protected winter range on BLM lands is in close contact with winter range on private lands for which no seasonal restriction applies. The assumed seven drill rigs operating on BLM lands below the cliffs would probably shift their operations to these private lands during the winter. The impact analysis shown below using the distance method assumes that half of the seven drill rigs assumed to be operating on BLM lands below the cliffs would shift to private lands but would be located on the edge of BLM lands. Therefore, while avoidance by big game would still extend into the BLM lands from the adjacent private lands for half of the operating drill rigs and access roads, and the percentage of habitat loss during winter would also be reduced by one-half compared to a scenario with no TL. This assumption probably overstates the amount of effective habitat loss in BLM lands below the cliffs during winter, because few if any of the drill rigs would actually be on the very edge of the TL area.

Table 4-11 compares the results of applying the two methods for estimating effective habitat loss of deer and elk and winter range below the cliffs, as well as summer range atop the plateau, under the Proposed Plan and Preferred Alternative. For both methods, the estimates for the Proposed Plan reflect phased and clustered development throughout the area above the rim and management toward greater clustering below the rim, instead of concurrent drilling at more numerous and widespread locations.

As shown in Table 4-11, the distance method and assumptions described above yields long-term habitat loss of approximately 6,496 acres below the rim under the Proposed Plan during the 20-year period of analysis. This is equivalent to approximately 18.7 percent of total winter range on BLM lands below the rim (34,668 acres), a somewhat smaller impact than under the Preferred Alternative. Thus, the Proposed

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Plan would result in slightly less loss of winter range while accommodating somewhat more oil and gas development.

**Table 4-11. Comparison of Habitat Impacts Using Different Methods to Estimate Effective Loss**

<b>Component <sup>1</sup></b>		<b>Proposed Plan <sup>2</sup></b>		<b>Preferred Alternative <sup>2</sup></b>	
		<b>Area Method</b>	<b>Distance Method</b>	<b>Area Method</b>	<b>Distance Method</b>
Summer Range	Drill Rigs and Pads	112 ac	534 ac	364 ac	606 ac
	Roads	204 ac	1,648 ac	217 ac	2,348 ac
	<b>Combined</b>	<b>316 ac (0.9%)</b>	<b>2,182 ac (6.3%)</b>	<b>581 ac (1.7%)</b>	<b>2,954 ac (8.5%)</b>
Winter Range	Drill Rigs and Pads	1,575 ac	824 ac	2,940 ac	1,280 ac
	Roads	1,372 ac	5,645 ac	2,642 ac	5,417 ac
	<b>Combined</b>	<b>2,947 ac (8.5%)</b>	<b>6,469 ac (18.7%)</b>	<b>5,582 ac (16.1%)</b>	<b>6,697 ac (19.3%)</b>

<sup>1</sup> Summer range = atop the plateau; winter range = area below the rim within the winter range TL.

<sup>2</sup> Based on data in Table 4-2 and 34,668 acres of mapped winter range. Values shown include areas of direct habitat loss and surrounding areas of effective habitat loss due to disturbance.

As discussed previously, the reduction in winter range reported for the Preferred Alternative in the Draft RMPA/EIS was 22.3 percent (very close to the 19.3-percent reduction shown in Table 4-11) but was erroneously described as 33 percent in a summary statement that was meant to refer to the combined area of private and Federal lands.

In comparison to the distance method, the area method yields a lower impact estimate for both the Proposed Plan and the Preferred Alternative (Table 4-11). To ensure that the Proposed Plan/Final EIS does not underestimate impacts to big game winter range, the impact analyses presented in this section use the distance method, based on avoidance zones cited in scientific literature sources recommended by CDOW.

If a reduction in effective habitat were equivalent to direct habitat loss and proportional to a reduction in deer carrying capacity, the data in Table 4-11 would indicate approximately an 18.7 percent decrease in the sustainable deer population of BLM lands in the Planning Area. The assumption of a one-to-one relationship was used in the Draft RMPA/EIS. Sawyer et al. (2004), one of the references favored by CDOW, included the following statement in their study of impacts of oil and gas development on deer in Wyoming:

“There are several potential concerns with the apparent avoidance of roads and well pads by mule deer. [This] avoidance results in indirect habitat loss that can be substantially greater than the direct habitat loss to road and pad construction. This reduction in winter range size and quality of available habitat may decrease the carrying capacity of the winter range. [However], changes in habitat use or distribution do not necessarily translate into lower survival or reproduction. Assuming some energetic cost associated with the change in distribution or habitat use and that alternate winter range is not available, the potential for negative effects on mule deer survival and reproduction exists. Initial changes...would most likely be evident in the fawn segment because of their high susceptibility to over-winter survival.”

If effective habitat loss does not result in a one-to-one reduction in carrying capacity, or if the current population is below the carrying capacity for one or more reasons (see Section 33.2.3), the calculated estimate of an 18.7 percent reduction in winter range would be an overestimate.

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In terms of the effectiveness of the TL restriction for big game winter range, the estimate of impacts to deer carrying capacity on BLM lands would be at least twice as great without the TL. This is because the calculations used for Table 4-11 assume that the amount of effective habitat loss on BLM lands due to avoidance of drill rigs, pads, and roads by deer would be reduced by half as a result of shifting operations to private lands in winter. However, when looking beyond the BLM lands, benefits of the TL are potentially less significant than suggested by Table 4-11. Precluding drilling operations on BLM lands during the winter would probably shift a substantial portion of the drilling to privately owned winter range. The proportion of winter range on private lands below the rim is actually greater than that on BLM lands (approximately 63 percent versus 47 percent)(Table 3-13).

While this discussion has focused on impacts to big game winter range, oil and gas activities below the rim would also affect other wildlife using the mostly pinyon/juniper and semi-desert shrub habitats subject to development. The TL stipulation for winter range would benefit species using these habitats during winter but would not benefit species such as carnivores, small mammals, raptors, and songbirds that use the habitats for feeding and breeding in spring and summer. However, these species would likely be less sensitive than deer to oil and gas drilling activities, road construction, and vehicular travel (i.e., would have a narrower impact zone).

A commonly reported zone of reduced use for other species is 100 meters (328 feet) instead of the assumed distances for deer of 250 meters (820 feet) along roads and 500 meters (1,640 feet) around well pads. Using these narrower impact zones would result in proportionately lower impact estimates for the distance method in Table 4-11.

### **Impacts atop the Plateau**

In the higher elevation areas, implementation of the Proposed Plan would result in 63 acres of direct habitat loss over 20 years, compared to 166 acres under the Preferred Alternative. Applying the distance method, and using the assumptions of a 250-meter zone of reduced use by deer and elk along roads and a 500-meter zone around drill rigs, yields the following estimates of loss of summer range: (1) Proposed Plan – 534 acres of total (direct and effective) habitat loss for wells and pads and 1,648 acres for roads; and (2) Preferred Alternative – 606 acres for wells and pads and 2,348 acres for roads. The combined impacts are therefore 2,182 acres for the Proposed Plan, representing 6.3 percent of the area, compared to 2,954 acres for the Preferred Action, representing 8.5 percent of the area.

As with the analysis above for winter range, this loss of available habitat may not translate to an equivalent loss of wildlife populations. Such a direct relationship would be more likely for elk than deer, since summer range and calving habitats may be a limiting factor for elk in the Planning Area.

Similar or larger avoidance zones than the assumed 250 meters could apply to carnivores (e.g., mountain lions, bobcats, black bears) and some raptors (e.g., northern goshawks) due to their furtiveness. However, as discussed for the area below the rim, narrow impact zones around drill rigs, production facilities, and roads would be expected for most species, including some carnivores as well as most small mammals and birds. For these species, using a 100-meter impact zone but assuming total avoidance results in an estimated 1,331 acres of habitat loss associated with the assumed two drill rigs and 16 miles of new or upgraded and actively used access roads. This represents 3.7 percent of the area on top of the plateau. In comparison, the estimated habitat loss for these species under the Preferred Action is 1,913 acres (5.5 percent of the top of the plateau).

Another benefit of phased and clustered development atop the plateau is the restriction of well pads to ridgetops with slopes of 20 percent or less. Ridgetop development preserves a large percentage of the higher quality riparian, mountain shrub, aspen, and spruce/fir habitats along the drainages and sideslopes. The various drainage-oriented NGD/NSO and SSR/CSU restrictions described above provide additional protection for these sensitive habitats.

A third benefit of the phased and clustered development of the Proposed Plan for habitats atop the plateau is the decrease in the amount of habitat fragmentation compared to Alternatives II through V. While staged development under the Federal Unit would specify that only one portion of the plateau could be drilled at any one time, this would not apply under Alternatives I through V. Therefore, the other alternatives could include multiple drill rigs working simultaneously in different parts of the summer range. Besides the multiple drilling areas, this would result in drilling-related vehicle traffic on multiple travel routes.

Finally, the Proposed Plan would have a relatively low level of development throughout the 20-year life of the Plan, resulting in an assumed 210 wells on 13 pads atop the plateau. In contrast, the Preferred Alternative would have had fewer wells (51) but more pads (39), all of which would occur within a period of a few years at the end of the deferral period—i.e., within a span of about 4 years. Thus, deferred development under the Preferred Alternative would delay the onset, but not the magnitude, of disturbance-related impacts on wildlife.

**Special Management Designations and Restrictions** — Atop the plateau, the Proposed Plan would include the designation of two ACECs along the East Fork Parachute Creek and Trapper/Northwater Creek valleys and a WMA encompassing all of the Parachute Creek tributaries within BLM lands. The ACECs focus on protection of sensitive aquatic and terrestrial species and habitats and the watershed processes that affect them. The WMA includes an emphasis on protection of water quality for human uses but also provides protection of aquatic habitat and watershed processes, including the streams themselves as well as minor tributaries and slopes that contribute runoff to them.

Most of the drainages and lower sideslopes atop the plateau would be designated as NGD/NSO for the protection of riparian/wetland areas and the Colorado River cutthroat trout (Sections 3.3.1 and 3.3.4). The balance of the Parachute Creek WMA and two drainage-based ACECs would be designated as SSR/CSU. Also atop the plateau, streams found to be eligible for possible designation as WSRs would be managed to protect and preserve that eligibility until a determination regarding suitability has been made.

Special management to protect water quality, riparian and wetland vegetation, and watershed processes would benefit a wide variety of wildlife, and not only aquatic species. Throughout the region, areas providing a combination of reliable surface moisture, lush forage, and structural complexity (different strata and types of vegetation) consistently support disproportionately high species density and diversity, including use by “special status” species (Section 4.3.4).

Management emphasis on preserving ecological values in the ACECs, WMA, and WSR areas atop the plateau includes the application of BMPs (Appendix I) and reclamation standards (Appendix J) for areas subject to ground-disturbing activities.

Some of the deeper valleys atop the plateau are also identified as wildlife security (seclusion) areas (Map 19). These areas provide hiding cover for big game and other wildlife and serve as movement corridors. The mapped security areas atop the plateau, totaling 11,404 acres, would be protected with SSR/CSU restrictions to provide tools for minimizing habitat loss and wildlife disturbance. These areas were identified in the 1999 FSEIS but were not given special protection under Alternatives II through V of the Draft (Alternative I did not include oil and gas leasing in this area).

Below the rim, special designations include the Anvil Points and Magpie Gulch ACECs. These two areas would be managed to protect and preserve wildlife resources identified as relevant and important criteria. The Anvil Points ACEC includes the claystone cave that provides roosting and nursery habitat for sensitive bat species. The Magpie Gulch ACEC contains areas of mature (loosely termed “old growth”) Douglas-fir forest that supports a variety of species and uses not found elsewhere below the rim or, in some cases, within the Planning Area.

Mapped security areas below the rim are more extensive than those atop the plateau and include a total of 11,481 acres (Map 19). These consist of rugged or broken terrain, dense conifers, and/or dense brush that

provide important hiding cover for big game. In addition to diurnal shelter for species such as deer and elk that may move into more open habitats at night to feed, the security areas also provide places to which furtive species can escape during periods of intensive human activity. The security areas also include all cliff passages that accommodate movement of big game between lower and higher elevations. The Proposed Plan would protect these security areas with NGD/NSO restrictions. Although they were incorporated into the 1999 FSEIS and Alternatives I and II of the Draft RMPA/EIS, the security areas were not given special protection under the Preferred Alternative. However, during the Consultation and Coordination process (Chapter 6) CDOW reiterated the importance of including the security areas in the Proposed Plan. While identified largely on the basis of security for big game, these areas also include some of the most important habitats for other wildlife, including carnivores, birds of prey, small birds, and other wildlife sustained by the rugged and mostly heavily wooded terrain.

### **Offsite and Cumulative Impacts**

As shown by Table 4-3, cumulative impacts in terms of long-term ground-disturbing activities would be less under the Proposed Plan than the five previous alternatives except for No Action (Alternative I). This underscores the significance of phased and clustered oil and gas development atop the plateau and management toward greater clustering below the rim. However, in comparing assumed cumulative impacts to those for Federal lands (Tables 4-2 and 4-3), it is obvious that the offsite impacts (i.e., on private lands within the Planning Area) are proportionately greater than for the Federal lands. This reflects the greater proportion of available surface on private lands, where only areas steeper than 50 percent are assumed to be unavailable (versus other NGD/NSO restrictions on Federal lands). In addition, a higher proportion of private lands within the Planning Area are in lower elevation habitats (i.e., big game winter range).

Based on assumptions used in the RFD (Appendix H), approximately 3,691 wells would be developed on Federal and private lands in 20 years, using comparable development rates in proportion to the acres available for drilling operations (Table 4-3). This estimate includes the assumed 1,570 wells on Federal lands. Because more of the private lands are located below the rim than are Federal lands—64 percent versus 53 percent—the relative impacts on winter range of development on private lands would be greater. This is compounded by the lack of a seasonal restriction (TL stipulation) for oil and gas drilling and associated activities on private lands and an assumed lesser emphasis on clustering than to be encouraged by BLM on Federal lands.

Comparing the cumulative impact of long-term ground-disturbing activities on winter range below the rim (2,447 acres) to the data presented in Table 3-13 indicates that this direct loss would represent less than 4 percent of the total of 68,225 acres of total winter range in the Planning Area (34,668 acres BLM and 33,557 private). If the same ratio of effective habitat loss to direct habitat loss were to apply to the total area as on BLM lands (approximately 8:1), this would yield a total loss (effective-plus-direct) of approximately 22,000 acres, representing 32 percent of the winter range in the Planning Area, 11 percent of the winter range in GMU 32, and 3 percent of the winter range in DAU 41 (GMU 31 + 32). These losses would be cumulative to the losses resulting from oil and gas development in lands outside the Planning Area. For example, COGCC data indicate a total of 2,265 wells in GMU 32 as of late 2005, of which only 780 were in the Planning Area. Thus, the winter range in GMU 32 has already been subject to loss of winter range and would probably continue to be subject to such losses at levels comparable to, or greater than, those on BLM lands in the Planning Area.

### **Summary of Impacts to Fish and Wildlife**

The requirement of phased and clustered development across the top of the plateau would substantially limit impacts compared to any of the five alternatives analyzed in the Draft RMPA/EIS (except for Alternative I, No Action, which did not include leasing of that area).

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The sensitive and important stream corridors atop the plateau would be protected by NGD/NSO restrictions, with SSR/CSU restrictions on adjacent sideslopes and the headwaters of smaller streams. These streams would also be managed to protect current WSR eligibility. Lesser streams below the rim would have an NGD/NSO stipulation for riparian and wetland areas. The NGD/NSO for high-value fish habitat under this alternative (Section 4.3.4) would also benefit other wildlife. Similar NGD/NSO protection would also apply to the bat habitat of the Anvil Points claystone cave and, along with TLs, to raptor and waterbird nesting areas. Most of the old-growth Douglas-fir remnant communities would also be protected by an NGD/NSO associated with wildlife security areas in the Magpie Gulch ACEC, preserving unfragmented habitat for forest-interior small birds.

Another important component of the Proposed Plan is the application of NGD/NSO restrictions to the 11,481 acres of wildlife security areas below the rim and SSR/CSU restrictions to 11,404 acres atop the plateau. These areas are important as hiding cover for big game, contain the six passages through the Roan Cliffs barrier, and provided rugged, wooded terrain that benefits a variety of other wildlife.

The 5-month winter TL for construction activities in the winter range would minimize disturbance-related impacts to use of this crucial habitat by deer and elk. However, some impacts would result from ongoing operations and maintenance activities during the 5-month season (e.g., vehicular traffic and some monitoring and repairs), as well as from the gradual accumulation of habitat loss associated with construction of pads and of new or upgraded roads. Probably the greatest impact under this alternative would be related to loss or fragmentation of portions of big game winter range, despite the TL restrictions. However, this impact would be less than for the Preferred Alternative due to a management goal of greater clustering of well pads on Federal lands below the rim.

Compared to current management (Alternative I), the restriction of motorized and mechanized travel to designated routes (except in the Hubbard Mesa OHV Riding Area) would reduce the potential for disturbance-related impacts to wildlife, as would the closure of 28 miles of roads and the restriction to administrative use of an additional 68 miles of existing routes. These actions would reduce the impacts associated with new roads for oil and gas access.

Additional benefits to wildlife under the Proposed Plan, compared to Alternatives I and Alternative II, is the more intensive and comprehensive vegetation management, including weed control, and the implementation of active as well as administrative measures for range improvement.

Notwithstanding the special designations, resource management actions, and other wildlife-related measures described above, oil and gas development on Federal lands within the Planning Area would result in direct loss of approximately 75 acres of habitat above the rim and 737 acres below the rim in 20 years. Including effective habitat loss due to reduced wildlife use in areas of human activity would increase these losses to approximately 2,182 acres and 6,469 acres above and below the rim, respectively, using the distance method (see discussion in Section 4.3.2.1). These numbers represent approximately 6.3 percent and 18.7 percent of the upper and lower areas of BLM lands (Table 4-11), respectively, and approximately 9.1 percent of all BLM lands in the Planning Area.

Table 4-12 summarizes direct and indirect impacts to major groups of terrestrial and aquatic wildlife under the Proposed Plan. Overall, the Proposed Plan would have minor adverse impacts on wildlife. More severe (moderate) temporary impacts would occur in areas of active road, pad, or well construction—particularly the operation of drill rigs—as well as other ground-disturbing activities. For impacts to special status species, see Section 4.3.4.

Table 4-13 compares the impacts of the Proposed Plan to those for the alternatives analyzed in the Draft RMPA/EIS. Due to the major improvement on Federal lands atop the plateau and, to a lesser extent, below the rim as a result of the phased and clustered development, impacts to wildlife under the Proposed Plan would be similar to or less than Alternatives I through V, including the most environmentally protective alternative (Alternative II)(Table 4-2 and 4-3).

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**Table 4-12. Summary of Impacts of Proposed Plan to Terrestrial and Aquatic Wildlife** <sup>1,2</sup>

<b>Taxonomic or Trophic Group</b>	<b>Vegetation and Range Management</b>	<b>Recreation and Travel Management</b>	<b>Oil and Gas Development</b>	<b>Special Management Designations</b>
Large Carnivores, Deer/Elk Summer Range	Minor (+)	Moderate (+)	Minor (-)	Moderate (+)
Big Game Winter Range	Minor to Moderate (+)	Minor (+)	Moderate (-)	Minor (+)
Medium-size Predators and Small Mammals	Minor (+)	Moderate (+)	Minor (-)	Moderate (+)
Raptors	Negligible (+)	Moderate (+)	Minor (-)	Moderate (+)
Waterbirds	Negligible (+)	Minor (+)	Negligible (-)	Minor (+)
Small Birds	Minor (+)	Moderate (+)	Minor (-)	Moderate (+)
Reptiles and Amphibians	Negligible to Minor (+)	Moderate (+)	Minor (-)	Moderate (+)
Aquatic Species	Moderate (+)	Moderate (+)	Minor (-)	Moderate to localized Major (+)

<sup>1</sup> Overall impact level after combining adverse (-) and beneficial (+) effects of land uses and management actions and after incorporating BMPs described in text and Appendix I.

<sup>2</sup> Does not include special status (threatened, endangered, proposed, candidate, or sensitive) species; see Section 4.3.4 and Table 4-15.

**Table 4-13. Overall Summary of Impacts to Fish and Wildlife** <sup>1,2</sup>

<b>Taxonomic or Trophic Group</b>	<b>Alt. I No Action</b>	<b>Alt. II</b>	<b>Alt. III Preferred</b>	<b>Alt. IV</b>	<b>Alt. V</b>	<b>Proposed Plan</b>
Large Carnivores, Deer/Elk Summer Range	Negligible to Minor (-)	Negligible to Minor (-)	Negligible to Moderate (-)	Moderate (-)	Moderate to Major (-)	Negligible to Minor (-)
Big Game Winter Range	Minor to Moderate (-)	Minor to Moderate (-)	Moderate (-)	Moderate to Major (-)	Major (-)	Moderate (-)
Medium-sized Predators and Small Mammals	Negligible to Minor (-)	Negligible to Minor (-)	Minor to Moderate (-)	Minor to Moderate (-)	Moderate (-)	Negligible to Moderate (-)
Raptors	Negligible to Minor (-)	Minor (-)	Moderate (-)	Moderate (-)	Moderate to Major (-)	Minor to Moderate (-)
Waterbirds	Negligible (-)	Negligible (-)	Negligible (-)	Negligible (-)	Minor (-)	Negligible (-)
Small Birds	Negligible to Minor (-)	Minor (-)	Minor to Moderate (-)	Moderate (-)	Moderate to Major (-)	Minor (-)
Reptiles and Amphibians	Negligible to Minor (-)	Minor (-)	Minor (-)	Minor (-)	Moderate (-)	Minor (-)
Aquatic Species	Negligible to Minor (-)	Minor (-)	Minor to Moderate (-)	Minor to Moderate (-)	Moderate (-)	Minor (-)

<sup>1</sup> Overall impact level after combining adverse (-) and beneficial (+) effects of land uses and management actions and after incorporating BMPs described in text and Appendix I.

<sup>2</sup> Does not include special status species; see Section 4.3.4 and Table 4-15.

Note in Table 4-13 that that the overall impact levels for big game summer range under Alternatives IV and V and for winter range under Alternatives I, II, and IV have been raised compared to the Draft

RMPA/EIS table. This reflects the greater estimate of effective habitat loss using the distance method than with the area method of the Draft. The same type of adjustment was not necessary for other habitats, species, or seasons that are less susceptible to disturbance or are dispersed more widely throughout the Planning Area (and thus less vulnerable to localized impacts).

In considering the impact levels for big game winter range, it should be remembered that deer and elk are the focus of hunting throughout the region. In this regard, they and other game species are fundamentally different from the special status species discussed in Section 4.3.4. Much of the concern regarding game species involves the maintenance of populations that can support the desired level of consumptive recreational use, with its associated local economic benefits, whereas the primary concern for special status species is the potential for local or regional extirpation. However, very large reductions in deer, elk, or other game species—besides affecting hunting—would also adversely affect the quality of the recreational experience for visitors who enjoy observing wildlife as the purpose for, or a desirable outcome of, their outdoor activity.

Some of the impacts to wildlife described above, including reductions in big game winter range and carrying capacity, could represent an irreversible and irretrievable commitment of natural resources (Section 4.6).

### **4.3.3 Special Status Plants and Significant Plant Communities**

#### **4.3.3.1 Introduction**

The special status plant species and significant plant communities addressed in this section are defined and listed in Section 3.3.3. A number of management actions proposed for incorporation into the RMPA have the potential to impact these species and communities. These fall into two categories. The first is management actions directed specifically at these resources. The second is all other proposed management actions that may affect these resources including special management designations and restrictions, vegetation, grazing and rangeland, public travel/access and recreation management, and oil and gas development.

For the purposes of this analysis, direct impacts to these plant resources include the physical disruption or removal of rooted vegetation or disruption of habitat in the immediate vicinity of rooted plants; disruption to a plant community that results in the reduction of total numbers of plant species (species richness) within an area; and/or reduction or loss of total area, diversity, structure, and/or function of a community.

Potential indirect impacts include disruption or reduction of pollinator populations; disruption of hydrological processes (particularly in relation to wetlands and riparian habitat); loss of habitat suitable for colonization due to surface disturbance; introduction of noxious weeds by various vectors or conditions that enhance the spread of weeds; and general loss of habitat due to surface occupancy, surface compaction, or trampling. Upgradient physical disruption can result in sedimentation into occupied habitat and/or potential habitat. Failed reclamation or mitigation may also cause indirect impacts to these resources. Most indirect impacts are assumed to result from direct impacts in proportion to the relative amount of surface disturbance that occurs.

For the impact analysis of oil and gas development, the following measures are assumed:

- BLM would determine whether potential habitat for these resources occurs in a lease area during pre-drill review.
- All potential habitat for a specific species or community would be surveyed during the appropriate season, prior to disturbance.

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- If a resource is found in areas with SSR/CSU restrictions, the proposed disturbance would be moved up to 400 meters from the outer resource perimeter, as well as its local habitat, to prevent direct negative impacts.
- In areas of standard lease terms, the proposed disturbance would be moved up to 200 meters to avoid these impacts.
- If potential disturbance sites are moved to avoid direct impacts to sensitive plant resources and their habitat but are still in their vicinity, a fence would be constructed around the resource and its local habitat to protect it from inadvertent trampling or other disturbance and to alert people to the presence of the plant resource, unless it is determined that this would create additional unacceptable impacts.

This protocol is also assumed for the analysis of other activities that result in localized ground disturbance. It is also assumed that any additional special status plant species or new locations of known species found on the Planning Area subsequent to the implementation of the RMPA would be entered into the BLM location database and managed in the same way described for currently known locations.

Standardized definitions were used to categorize impacts of specific management actions on special status plant species and significant plant communities. Categories are based upon the potential physical impacts to this resource in terms of the special status species policy (BLM 2001b) and Colorado Land Health Standard #4: these species and their habitats are maintained or enhanced by sustaining healthy, native plant communities. As an indicator, stable and increasing populations of endemic and protected species must occur in suitable habitat and suitable habitat must be available for recovery of endemic and protected species.

The following categories were used to define levels of adverse impacts to special status plants and significant plant communities:

- **None** – No physical disruption of the resource. Effects are unlikely to be detectable. No impairment of the resource value in terms of Land Health Standards.
- **Negligible** – Physical disruption to less than 5 percent of the resource. Effects may be detectable but of short duration (would last no more than one growing season) and not of concern to the general public. Unlikely to impair the resource value in terms of Land Health Standards.
- **Minor** – Physical disruption to less than 5 percent of the resource. Effects would be detectable but temporary (would last no more than 2 years) and unlikely to be of concern to the general public. Likely to cause some impairment of the resource value in terms of Land Health Standards.
- **Moderate** – Physical disruption to 6 to 15 percent of the resource. Effects would be readily visible and maybe of concern to the general public. Effects may increase over time or be long-term to permanent. May cause substantial impairment of the resource value in terms of Land Health Standards.
- **Major** – Physical disruption to more than 15 percent of the resource. Effects would be highly visible and of concern to the general public. Effects likely to increase over time and be long-term or permanent. Likely to cause substantial impairment of the resource value in terms of Land Health Standards.

Note that the same terms are applied in a more relative sense to describe beneficial impacts.

### 4.3.3.2 Impacts of Proposed Plan

BLM Manual 6840 (IM No. 97-118)(BLM 2001b) directs that the “conservation of special status species means the use of all methods and procedures which are necessary to improve the condition of special status species and their habitats to a point where their special status recognition is no longer warranted.” Under the Proposed Plan, the general management goal for these resources is to ensure that no actions

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contribute to the need to add candidate or sensitive species to the Federal list of threatened or endangered species. Toward this end, specific management of special status plants and significant plant communities focuses on protection of occupied habitat through special management designations and restrictions. These resources would also be impacted by general vegetation, grazing and rangeland, travel and recreation management as well as oil and gas development.

Potential beneficial and adverse impacts to special status plant species and significant plant communities are summarized in Table 4-14, and discussed by alternative and management action below.

**Table 4-14. Summary of Impacts to Special Status Plants and Significant Plant Communities <sup>1</sup>**

<b>Land Use or Management Action</b>	<b>Alt. I No Action</b>	<b>Alt. II</b>	<b>Alt. III Preferred</b>	<b>Alt. IV</b>	<b>Alt. V</b>	<b>Proposed Plan</b>
Resource-specific Surface Management Restrictions	Minor (+)	Minor to Moderate (+)	Minor (+)	Minor (+)	Minor (+)	Minor (+)
Management of Proposed ACECs	NA	Minor to Moderate (+)	Minor (+)	Minor (+)	NA	Minor (+)
Parachute Creek Watershed Management Area	NA	Minor to Moderate (+)	Minor to Moderate (+)	Minor (+)	NA	Minor to Moderate (+)
Management of WSR-eligible Streams	NA	Minor to Moderate (+)	Minor to Moderate (+)	Minor to Moderate (+)	NA	Minor to Moderate (+)
Management for Wilderness Values	NA	Minor to Moderate (+)	Minor (+)	NA	NA	NA
Vegetation Management	Minor to Moderate (-)	Minor to Moderate (+)	Minor to Moderate (-)	Minor to Moderate (-)	Minor to Moderate (-)	Minor to Moderate (+)
Grazing and Rangeland Management	Localized Moderate to Major (-)	Moderate (+)	Minor to Moderate (+)	Minor to Moderate (+)	Minor to Moderate (-)	Minor to Moderate (+)
Travel and Recreation Management <sup>2</sup>	Localized Moderate to Major (-)	Minor to Moderate (+)	Minor to Moderate (+)	Minor to Moderate (+)	Minor (-)	Minor to Moderate (+)
Oil and Gas Development <sup>3</sup>	Localized Minor (-)	Negligible to Minor (-)	Localized Minor (-)	Localized Minor (-)	Minor to Moderate (-)	Negligible to Minor (-)

<sup>1</sup> Overall impact level after combining adverse (-) and beneficial (+) effects of land uses and management actions and after incorporating BMPs described in text and Appendix I.

<sup>2</sup> Minor to Moderate (-) for Great Basin grassland under Alternative I.

<sup>3</sup> Oil and gas impacts for Alternative I almost entirely below cliffs due to no-lease of NOSR 1.

**Direct and Indirect Onsite Impacts**

The Proposed Plan comprises a number of protective surface-use restrictions specific to special status plants and significant plant communities. These restrictions are listed in Table 2-1 and detailed in Table C-1. These include an NGD/NSO for known occupied habitat of the two candidate species, DeBeque phacelia and Parachute penstemon. This is in contrast to the Preferred Alternative which includes similar restrictions for all special status plants and significant plant communities. Therefore, most of these species and communities and their habitat would be at greater risk of direct negative impacts of surface disturbance under the Proposed Plan should NGD/NSO and SSR/CSU restrictions for other resources be in conflict with relocation of activities for special status plants and significant plant communities.

A large area of SSR/CSU restrictions for other special status plants and significant plant communities would apply in areas below the rim. A separate SSR/CSU would apply to protect the habitat for hanging garden special status species along the East Fork Parachute Creek and Trapper/Northwater Creek watersheds above the rim (Map 22). Four populations of Utah fescue atop the plateau occur outside any special restriction areas for special status plants and so would not be protected from potential ground-disturbing activities.

These and other surface-use restrictions that are specific to other resources (e.g. riparian/wetland areas, wildlife security areas, etc.) could also result in indirect benefits to many of the special status species as they result in future physical conditions in these areas determined largely by natural processes. This is especially pertinent to management of the several sensitive plants that are early succession species. These require ongoing natural disturbances for maintenance of potential habitat. The overall impact of these restrictions would result in minor positive impacts to these resources.

Special management areas under the Proposed Plan include four ACECs, the Parachute Creek WMA, and WSR-eligible stream corridors. Sensitive plant species within the four ACECs that would be designated under the Proposed Plan are considered relevant and important values and as such would be the focus of some special management prescriptions, resulting in potential minor positive impacts (Table 2-2). Likewise, management actions that support goals and objectives for the proposed WMA include specific prescriptions for protection of these resources that would result in minor to moderate positive impacts to these resources. Prohibitions on long-term ground-disturbing activities within WSR-eligible stream corridors would indirectly provide minor to moderate potential positive impacts in terms additional protection to these resources, their habitat, and supporting ecological processes.

Vegetation resources would be managed for their intrinsic ecological value under the Proposed Plan, guided by specific objectives for the major natural plant communities in the Planning Area. Accomplishing these objectives would be supported by the establishment of reference sites to provide a context for long-term monitoring and management decisions regarding vegetation treatments, attainment of reclamation success criteria, and siting and mitigation requirements for project approvals and permits.

The Proposed Plan incorporates the Alternative II emphasis on noxious weed inventory, detection, and monitoring. These management actions would allow for a far more focused and effective application of the current weed management program by providing data and information upon which to base a number of important decisions such as: incipient population locations, priority-to-control strategies, and the efficacy of different integrated methods for particular species and locations. These actions would indirectly provide minor to moderate positive impacts to special status plant species and significant plant communities as general vegetation habitat quality is expected to exhibit a general improving trend.

Livestock grazing would be managed to conform to BLM grazing regulations and meet Land Health Standards as well as vegetation community objectives. Allotment management plans, to be developed and reviewed in collaboration with grazing permittees on a regular schedule, would provide a basis for monitoring of rangeland health and making grazing management decisions. A combination of administrative solutions, range improvement projects, and application of reclamation guidelines and

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BMPs would be applied to meet resource objectives and standards. These actions would indirectly provide minor to moderate positive impacts to special status plant species and significant plant communities as general vegetation habitat quality is expected to exhibit a general improving trend.

Management under the Proposed Plan would limit OHV use by restricting motorized and mechanized travel to designated routes, except for the Hubbard Mesa OHV Riding Area and over-snow travel by snowmobiles in areas with at least 12 inches of snow cover. This would reduce the expansion of travel routes throughout the Planning Area that have the potential to introduce physical disturbance and noxious weeds in the vicinity of special status plant species and significant plant communities. Combined with the closure and revegetation of existing routes such as the Anvil Points Mine Road and those that currently bisect significant plant communities, these proposed management actions would result in minor to moderate positive impacts to special status plant species and significant plant communities.

All restrictions specific to the protection of special status plant species and significant plant communities are applicable to oil and gas development activities and structures in the form of stipulations. In addition, a number of BMPs discussed above are assumed for potential impacts to these resources from oil and gas development activities.

Under the Proposed Plan, oil and gas development is assumed to result in negligible to minor negative impacts to special status plant species and significant plant communities. This conclusion is based on the protective stipulations, other restrictions on surface use, and the BMPs described above.

### ***Offsite and Cumulative Impacts***

Of some special concern under the Proposed Plan is the population of Parachute penstemon near the Anvil Points Mine. This population is located near the interface of BLM and private lands in the south-central part of the Planning Area. A number of individual plants grow near the Anvil Points Mine portals and along roadcut slopes. For the purpose of this analysis, it is assumed that the specific NGD/NSO restriction for this species would be applied rigorously to prevent negative impacts from any ground-disturbing actions, including possible remediation of this site. However, additional mitigation measures such as boundary fences and signage may be required to protect this unique and rare resource from negative offsite impacts.

A positive impact to offsite areas could occur should any of the existing populations of special status plant species expand, or new populations be recruited, as a result of management actions that protect the populations themselves as well as habitat and supporting ecological processes. Larger or new populations could serve as larger sources for propagating these species into new offsite areas. In addition, information collected from monitoring these species may be useful in managing them on other sites.

The CNHP reports that some sensitive plants are being heavily impacted by road construction and both residential and commercial development accompanying rapid human population growth and recreational use throughout the region (CNHP 2001). Threatened or endangered plant species that occur on private lands are not specifically protected under the ESA. Likewise, the State of Colorado provides no legal protection for any plant species other than the State flower, the blue columbine. Neither special status plant species nor significant plant communities are necessarily inventoried on private lands. Therefore, monitoring and protection of these species occurs on a voluntary basis on private lands. If negative impacts to these resources continue to increase as expected, the occurrences on public lands become even more important to their survival and continuation.

Any potential negative impacts to significant riparian communities would be cumulative to some past and some ongoing degradation of surrounding riparian areas due to livestock grazing, unregulated stream crossings, noxious weed proliferation, and current drought effects (Section 3.3.1). Localized negative impacts would result from oil and gas development. A number of positive impacts to special status plant species and significant plant communities would be anticipated to occur under the Proposed Plan. These would result from the special management for these resources, as well as positive impacts as a result of

travel and rangeland management actions. These positive impacts would be offset by widespread minor to moderate negative impacts that may result from noxious weed management actions.

Cumulative to these impacts would be an inevitable reduction of potential habitat and ecological processes due to a large portion of these areas being under SSR/CSU restrictions that would protect actual occurrences and occupied habitat, but not necessarily prevent all indirect impacts. Cumulative impacts would therefore include widespread positive impacts to sensitive plants and significant plant communities combined with some general negative impacts from increasing noxious weed infestations and localized minor to moderate impacts from ground-disturbing activities.

#### 4.3.4 Special Status Fish and Wildlife

##### 4.3.4.1 Introduction

Special status fish and wildlife species discussed in this section are defined and discussed in Section 3.3.4 and listed in Table 3-16. A number of management actions already established for currently leased areas are proposed for the Planning Area, as a whole, under some of the alternatives analyzed in this RMPA/EIS. These include actions focused on different resources (e.g., vegetation, visual resources, or recreational travel) but that could affect fish and wildlife either positively or negatively. The alternatives represent different combinations of management actions and land uses, with differing types and levels of impacts.

Under all alternatives, the general management goal is to ensure against actions that would jeopardize the continued existence or recovery of currently listed, proposed, or candidate threatened or endangered species or contribute to the need to list additional species as threatened or endangered. Further management objectives specific to the Proposed Plan, with selected reference to one or more of the five alternatives analyzed in the Draft RMPA/EIS, are described below.

Potential impacts to special status fish and wildlife fall into one or a combination of the categories described in Section 4.3.2 and include habitat loss or modification, habitat fragmentation, disturbance, interference with movement patterns, and direct mortality. These impacts can reduce numbers of one or more species, potentially to the point of local extirpation; disrupt community composition and function through changes in the distribution, relative abundance, and habitat use of various species (e.g., reduced prey abundance affects predator abundance); and make populations and communities hypersensitive to other perturbations. For example, increased habitat fragmentation can make forest-interior species more vulnerable to disturbance by reducing patch size, increasing the amount of edge, and increasing accessibility to predators or (in the case of songbirds) nest parasitism by brown-headed cowbirds.

As described in Section 4.3.2 for non-special-status wildlife, impacts associated with changes in management, human use, and resource development can have direct and indirect impacts on these species. For wide-ranging or migratory species, onsite impacts can also affect community composition and function in offsite areas, and project impacts can combine with non-project impacts to cause cumulative impacts.

For the impact analysis of oil and gas development, it is assumed that BLM would evaluate whether habitat for special status species is present in a specific area during the review of an APD. If the area is covered by a SSR/CSU restriction, BLM may cause the proposed activity to be shifted by more than 200 meters to avoid or minimize the impact.

As pertains to special status fish and wildlife, the analysis of the Proposed Plan uses the following general terms to describe impact levels:

- **None** – Changes in species occurrence, distribution, or abundance are not expected.

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- **Negligible** – Changes in distribution or abundance of some species may occur, but at levels that may not be discernible or demonstrable except at specific impact sites.
- **Minor** – Changes in distribution or abundance of some species would be discernible and demonstrable at a localized level, but current types and patterns of use and species occurrence would continue.
- **Moderate** – Changes in distribution or abundance would be readily discernible and demonstrable, and some species may occur in markedly lower numbers or be extirpated from localized parts of the Planning Area.
- **Major** – Similar to moderate, except that several species may occur in markedly lower numbers, and some species are likely to be exterminated from large portions of the Planning Area

Note that the same terms are applied in a more relative sense to describe beneficial impacts.

While these impact categories are applied in all special status species in this RMPA/EIS, some of the species are also being addressed in a biological assessment (BA) being prepared separately by BLM for submittal to USFWS pursuant to Section 7 of the ESA. The BA will address Federally listed, proposed, or candidate threatened or endangered species, state-listed threatened or endangered species, state-listed species of special concern, and selected additional special status species. For each species addressed, the BA will determine whether implementation of the Proposed Plan would be likely to adversely affect, not likely to adversely affect, or likely to benefit the species. For all species with a “likely to adversely affect” determination, USFWS will issue a biological opinion (BO) determining whether the Proposed Plan would jeopardize the maintenance or recovery of the species. In such a case, BLM would develop, in consultation with USFWS and CDOW, additional conservation measures to avoid jeopardy.

The following analysis considers both short-term and long-term impacts to special status fish and wildlife resources. For the purpose of this analysis, short-term or temporary impacts are those most often associated with a period of initial habitat loss or modification and intensive human activity. In the context of future management and development scenarios for the Planning Area, short-term impacts are mostly associated with oil and gas development, during which activity at a specific well may last for several weeks or months but then is reduced in severity as that part of the field enters the production phase. This already occurs to some extent in currently leased BLM lands and nearby private areas. Short-term impacts also currently occur during the hunting season, during which time the number of visitors atop the plateau is much higher than in the remaining seasons, and the activity is coupled with noise, harassment, and pursuit, injury, or mortality of wildlife.

Long-term impacts are those that last more than 2 years, and most of these would extend throughout or potentially beyond the period of the management action or development activity. Examples include impacts associated with the continued presence of elevated levels of human activity throughout the life of the oil and gas field (40 years or longer) and the protracted period needed for final reclamation of disturbed areas. Permanent impacts are those with a likely duration of more than 50 years.

### 4.3.4.2 Impacts of Proposed Plan

The 1984 GSRA RMP had no specific objective for managing special status species but identified monitoring, maintaining, or improving habitat for threatened or endangered species as a priority for implementation. For the production area of NOSR 3 below the rim, the 1999 FSEIS and ROD established a number of stipulations to reduce or avoid potential impacts from the oil and gas development on special status species and their habitats. The Proposed Plan would also apply these existing stipulations and extend them to activities in addition to oil and gas development. The existing stipulations to be applied under the Proposed Plan include:

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- NGD/NSO for Colorado River corridor would prohibit long-term ground-disturbing activities within a 0.5-mile buffer on either side of the Colorado River.
- NGD/NSO and TL for raptor nest sites would prohibit long-term ground-disturbing activities within a 0.125-mile buffer around raptor nests year-round and establish a 0.25-mile buffer from February 1 through April 15.
- NGD/NSO and TLs for bald eagle nesting and winter roosting sites would prohibit long-term ground-disturbing activities within a 0.25-mile buffer around a nest or roost site year-round, a 0.5-mile buffer around nest sites from December 15 to June 15, and a 0.5-mile buffer around roost sites from November 15 to April 15.
- SSR/CSU and TL for the peregrine falcon cliff-nesting complex would require special design and/or relocation of projects by more than 200 meters to protect the complex and surrounding 0.25-mile buffer year-round and prohibit ground-disturbing activities or other major disturbance within a 0.5-mile buffer around the cliff-nesting complex from March 15 to July 31.
- NGD/NSO for threatened or endangered species would prohibit ground-disturbing activities within occupied habitat or any other habitat required for the maintenance or recovery of the specific species.
- NGD/NSO for the Anvil Points Cave would prohibit long-term ground-disturbing activities in the area encompassing the cave opening, subsurface features, and watersheds overlying the cave.
- TL for waterfowl and shorebird nesting would prohibit long-term ground-disturbing activities within a 0.25-mile buffer around the nesting and brood-rearing habitat of Fravert Reservoir.
- SSR/CSU for BLM sensitive species would require special design and/or relocation of projects by more than 200 meters may be required to protect the resource.

The Proposed Plan would also include two new restrictions specific to fish and wildlife and relevant to special status species:

- NGD/NSO for high-value habitat for special status fish species would minimize direct loss or degradation of habitat for the Colorado River cutthroat trout by prohibiting long-term ground-disturbing activities along occupied or other high-quality stream reaches.
- SSR/CSU for the Parachute Creek WMA would minimize indirect loss or degradation of Colorado River cutthroat trout habitat by requiring that proposed ground-disturbing activities be relocated by more than 200 meters if necessary to protect areas identified as having a high value for watershed processes (i.e., upslope or upstream from areas of high-value trout habitat).

In addition, some protective stipulations not aimed specifically at special status fish and wildlife would also benefit them. These include an NGD/NSO and SSR/CSU for riparian and wetland zones, an NGD/NSO and a SSR/CSU for wildlife security areas, an NGD/NSO for areas with slopes steeper than 50 percent, an SSR/CSU for the Parachute Creek WMA, and a TL for big game winter range during the 5-month period December through April.

While these restrictions are specific to the GSRA portion of the Planning Area, the 1997 WRRRA RMP lists additional stipulations for special status species that apply within the small part of the Planning Area in Rio Blanco County.

Importantly for sensitive species associated with habitats atop the plateau, the staged development component of the Proposed Plan would also be a major benefit. Specifically, as described in Chapter 2 and the introduction to Chapter 4, this would limit oil and gas development to only one of six phased development areas at a time (Figure 2-1). Assuming relatively uniform sizes of these areas, no more than one-fifth (20 percent) of the upper area would be subject to development during any given year. Furthermore, with an assumed average of two drill rigs operating at the higher elevations, the portion

actually subject to disturbance at any one time would be much smaller. Finally, the requirement that development cannot result in more than 350 acres of active (unreclaimed) disturbance at any one time further reduces both the direct and effective habitat loss in the ecologically sensitive upper plateau.

Another important component of the Proposed Plan (compared to Alternative I, No Action) is that travel management would prohibit motorized or mechanized cross-country travel, except for over-snow travel by snowmobile with a minimum of 12 inches of snow cover and OHV travel in the Hubbard Mesa area. Permanently closing and rehabilitating 28 miles of existing routes and limiting 68 miles of existing routes to administrative travel would also benefit special status wildlife.

#### **Direct and Indirect Onsite Impacts**

A total of 210 wells on 13 pads above the rim and 1,360 wells on 180 pads are assumed under the Proposed Plan (Table 4-2). Direct habitat loss from long-term ground-disturbing activities during the 20-year period of analysis is estimated to be 75 acres and 737 acres in the upper and lower areas, respectively. Using the distance method to estimate reduced wildlife use near areas of oil and gas activity (discussed in Section 4.3.2.2) yields effective habitat losses of 2,182 acres (6.3 percent) of the area atop the plateau and 6,469 acres (18.7 percent) of the area below the rim (see Table 4-11). However, this estimate should be applied only to furtive species such as the lynx, which is not known to occur onsite. For most species, the area method described in Section 4.3.2.2 (and used in the Draft RMPA/EIS) probably provides a more realistic estimate. This method, which differs by not assuming such large zones of reduced use along roads and around drill pads, yields effective habitat losses of 316 acres (0.9 percent) and 2,947 acres (7.6 percent) for the upper and lower portions of the Planning Area, respectively. Regardless of which method is used, the emphasis on clustered development under the Proposed Plan—with a minimum of 2,640 feet between pads (one pad per 160 acres) atop the plateau and a management goal of one pad per 80 acres below the rim—would reduce habitat losses compared to the previous other alternatives, including No Action (see Table 4-2).

While the NGD/NSO and SSR/CSU restrictions on the mapped wildlife security areas would be established primarily for big game, the restrictions would also benefit special status species associated with these areas of steep, rugged, and/or heavily wooded terrain. The security areas include some of the best developed pinyon/juniper, Douglas-fir, and spruce/fir habitats in the Planning Area. These restrictions would help preserve the seclusion provided by this terrain and prevent or minimize any fragmentation of the relatively contiguous habitats.

Benefits to special status fish and wildlife under the Proposed Plan would also result from the restriction of motorized or mechanized travel to designated routes (except over-snow travel by snowmobiles and cross-country travel by OHVs in the Hubbard Mesa Area) and from the closure and restoration of 26 miles of existing routes atop the plateau. Limiting an additional 68 miles of existing routes to administrative travel would also help offset the increased traffic associated with oil and gas activity.

Finally, the more active management of vegetation and range resources under the Proposed Plan than under Alternatives I or II is expected to more effectively control weed infestations, hasten recovery of degraded rangeland areas, and provide more intensive monitoring of reclamation success. Riparian areas and river corridors are a focus of vegetation protection and management under this alternative and will be managed to achieve a minimum condition rating of PFC and late-seral stage plant community development. This includes a specific objective for maintaining proper hydrologic function in areas along and adjacent to streams. Due to these protections and specific management actions, it is expected that many riparian reaches would return to PFC and late-seral stage community development over time, resulting in positive impacts to riparian habitats, riparian wildlife communities, and aquatic species.

Potential impacts to special status species under the Proposed Plan are described below. These descriptions exclude species not expected to occur in the Planning Area and vicinity. See Section 3.3.4

(Table 3-16) for a listing and synopsis of the habitat requirements and range limitations of special status fish and wildlife in the Planning Area and vicinity.

**Federally Listed or Candidate Threatened or Endangered Species**

**Colorado River Fishes** — USFWS has designated critical habitat for two endangered big-river fishes—the razorback sucker and Colorado pikeminnow—as including the Colorado River and 100-year floodplain along the southern boundary of the Planning Area as far upstream as the town of Rifle. In addition, critical habitat for two other endangered fishes, the bonytail and humpback chubs, has been designated for the Black Rocks area near the Colorado-Utah border approximately 80 miles downstream from the Planning Area. Factors affecting the decline of these species include lower water temperatures and altered flow regimes associated with reservoirs, depletion in flows due to diversion for agricultural and other consumptive uses, evaporative losses from reservoir surfaces, and predation on eggs and larvae by introduced non-native game (predatory) fishes.

**Impacts from Decreases in Water Quantity**

The primary impact under the Proposed Plan is the depletion of water in the Colorado River Basin. Adequate flows are necessary to provide for the various life-stage requirements of these native fishes. Most important are the spawning and backwater habitats identified in and downstream of the “15 Mile Reach” located in Grand Junction, Colorado. This segment of river is important for spawning and the rearing and development of young. Adequate flows are needed to maintain the integrity of these important habitats during critical periods. Reduced water flows can reduce spawning habitat use, dewater backwaters, and result in lowered productivity and recruitment.

In May 1994, BLM prepared a Programmatic Biological Assessment (PBA) that addressed water-depleting activities in the Colorado River Basin. In response to the PBA, the USFWS issued a BO on June 13, 1994 (USFWS 1994), which determined that water depletions from the Colorado River Basin would jeopardize the continued existence of the Colorado pikeminnow, humpback chub, bonytail, and razorback sucker and result in the destruction or adverse modification of their critical habitat. The BO included reasonable and prudent alternatives developed by USFWS to allow BLM to authorize projects with resultant water depletions of less than 125 acre-feet. Projects or actions resulting in depletions of greater than 125 acre-feet per year fall outside the PBA and require individual consultation with USFWS.

The PBA and BO were written to remain in effect until a total depletion threshold of 2,900 acre-feet per year is reached. An amendment to that BO in 2000 (USFWS 2000) stated that the threshold would be 3,000 acre-feet per year. BLM has estimated future depletions from oil and gas drilling activities on BLM lands under the Proposed Plan at 43 acre-feet per year (see Section 4.2.4). This is well below the remaining allowable amount under the amended BO. Put in perspective, this depletion is equivalent to an average of 0.06 cfs, or less than 0.002 percent of the average flow in the Colorado River near the Planning Area.

Additional depletions could result from use of Colorado River Basin waters in dust suppression of roadways used for oil and gas access. Because dust suppression would be required only on roadways actively used for oil and gas access, and only during portions of the year, the exact number of miles or acres of roads requiring dust suppression per year is not known. Methods to reduce depletions related to dust suppression include surface treatments such as magnesium chloride or gravel. Surface treatments would not be allowed in areas where they could adversely affect surface waters. Other water conservation measures could include onsite treatment and reuse of imported or produced waters.

Other water-depleting activities under the Proposed Plan and other alternatives include use in dust suppression, evaporative loss from stockponds and spring developments, and evapotranspiration from irrigation during reclamation. Because several stockponds and spring developments are already in place in the Planning Area, it is anticipated that no more than ten new water developments would be constructed during the life of the plan. Stockponds and spring developments are generally 0.1 acre in size

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or less and deplete an annual average of 0.425 acre-feet of water. Given this amount of depletion per development, average annual depletions from ten typical stockponds would equal 4.25 acre-feet.

Additionally, as described in Section 4.2.4.2, successful enhancement of areas not meeting Land Health Standards due to livestock use could decrease runoff due to increased vegetation cover. However, the result of this impact is generally beneficial, because contributions to runoff as shallow subsurface flow following infiltration into a vegetated hillside are less “flashy” and more protracted than in poorly vegetated situations, even if actual flow to the stream is reduced. The 1984 GSRA RMP allows for enhancing water yield by vegetation manipulation, which alters the timing, duration, and intensity of runoff. Treatments could include thinning of brush, prescribed fires, and timber harvests.

If it were to become apparent that the combination of oil and gas drilling, dust suppression, and other sources of depletion were to exceed the threshold amount established by USFWS, BLM would be required to implement one or more measures to avoid jeopardizing the existence or recovery of the fishes. Such measures could include limits on drilling but, more realistically, would include requirements for conservation.

### *Impacts from Decreases in Water Quality*

Another potential threat to the endangered fishes is decreased water quality related to industrial and other developments on private lands along the Colorado River, including oil and gas. Impacts could result from direct discharge of pollutants or by transport of pollutants in sheet runoff or tributary drainages. While most of the tributaries to the Colorado River (except Government Creek and Parachute Creek) are ephemeral, episodic runoff associated with rainstorm or snowmelt events could transport any pollutants that have accumulated in the sediments since the previous runoff event. This potential is reduced by protective restrictions and limitations contained within standard oil and gas leases and aimed at capturing spills and releases before they can be transported to receiving waters. The NGD/NSO for protection of the Colorado River corridor would help reduce the potential for direct impacts on water quality from oil and gas or other industrial activities along the corridor.

For tributary streams, the NGD/NSO protections for riparian/wetland vegetation and Colorado River cutthroat trout habitat and the SSR/CSU protections for riparian/wetland buffers and the entire Parachute Creek WMA atop the plateau would further reduce of indirect impacts on water quality in potential habitats for the endangered fishes.

Potential pollution risks associated with generally highly saline produced water from drilling operations would be minimized by trucking the excess waters offsite for disposal at an approved location or, where risk of flow to surface water is not present, discharged into lined evaporation ponds. The potential also exists for onsite treatment of produced water and subsequent use to water livestock, but this is not a requirement under the Proposed Plan. Regardless of the method for disposing of produced water, BLM requirements would prohibit direct discharge into surface water, including ephemeral or more persistent tributaries of the Colorado River and other perennial streams.

An existing potential threat to these species is the risk of transport of contaminants to the Colorado River from the spent oil shale pile located on BLM land north of I-70 and within the Planning Area. Remediation of the pile, for which BLM has selected a remedy, would reduce or eliminate this potential threat.

**Bald Eagle** — The bald eagle occurs in the Planning Area but is not documented to nest within or near the area in recent years. Mature trees of riparian habitats at lower elevations of the site (e.g., the Colorado River, Parachute Creek, and to a lesser extent Government Creek) provide perching and roosting habitat as well as potential nesting habitat. The Colorado River and Parachute Creek provide suitable year-round hunting habitat for favored prey (fish and waterfowl), while nearby areas of open terrain (e.g., semi-desert shrublands) provide suitable habitat for other prey. The latter includes rabbits and carrion, which may be particularly important during winter and migration seasons. No significant impacts to the bald eagle

would be expected under the Proposed Plan, based on NGD/NSO protection of the Colorado River corridor and other riparian areas, and NGD/NSO and TL restrictions for nests and winter roosts. Any loss of hunting habitat from oil and gas development would represent a small portion of the suitable habitat in the area.

**Mexican Spotted Owl** — Although this species has not been observed in the Planning Area, potentially suitable habitat occurs in tributary gulches of the Parachute Creek drainage. NGD/NSO restrictions on riparian/wetland areas and wildlife security areas under the Proposed Plan would reduce the potential for impacts to this species. If the species were found to be present, any nest, brood-rearing habitat, or other critical habitat would be protected by the NGD/NSO for Federally listed species. However, the extent to which the Proposed Plan could affect potential hunting habitat is unknown, since that would depend on the location of any active nest or roost.

**Lynx** — This species of subalpine forests has not been documented in the Planning Area, although no comprehensive surveys have been conducted. However, as discussed in Section 3.3.4, the 2,600 acres of mixed aspen/conifer habitat atop the plateau is potentially suitable in terms of plant species composition and community structure. Additionally, the Planning Area is known to support a population of the favorite prey of the lynx, the snowshoe hare, as well as other suitable prey (blue grouse, mountain cottontail, and the young of deer and elk). Reintroduced lynx have begun to reproduce in Colorado and are gradually moving into areas where not released. The potential for dispersal of lynx into the Planning Area is reduced by the limited amount and patchiness of the suitable habitat and its isolation from more extensive habitat in the White River National Forest.

**BLM and USFS Sensitive Species, USFWS Birds of Conservation Concern, and State-listed Species**

**Native Non-game Fishes** — The roundtail chub, flannelmouth sucker, and bluehead sucker are found in the mainstem of the Colorado River in the Planning Area vicinity and may occur in lower reaches of Parachute Creek. The Colorado River and general riparian area NGD/NSO restrictions afford protection to these species except for any degradation of riparian habitat due to livestock grazing and cross-country OHV travel, and sediment transport from oil and gas development below the rim. Even these impacts probably would not affect either species because of their tolerance for turbid streams. Loss of vegetation along the streams could affect water temperature but would be unlikely to significantly raise the temperatures of the large streams above the ranges tolerated by these species. Substantial depletions would not be expected (see discussion for endangered fishes, above). The existing spent oil shale pile located north of I-70 within the Planning Area may pose an ongoing risk of contaminant transport to the Colorado River, but this area would be remedied (removed or capped) under any of the alternatives. Transport of chemical pollutants, including dissolved salts, as runoff or discharges from oil and gas activities on private and public lands below the rim would also be minimized by BMPs (Appendix I). Based on the discussion above, potential impacts to these species are expected to be none to negligible.

**Colorado River Cutthroat Trout** — Only negligible to minor impacts would be expected, based on the phased and clustered oil and gas development and the special management designations and NGD/NSO and SSR/CSU restrictions described above. These include protection of occupied stream reaches, as well as upslope and upstream areas affecting water quality and other watershed processes. The suggested BMPs to protect stream quality (Appendix I) would further benefit the Colorado River cutthroat trout. Examples of these include a requirement that new road crossings of streams use culverts or bridges where feasible, to reduce impacts to streams and direct mortality of fish or eggs.

Restricting cross-country travel and closing 26 miles of routes above the rim would further reduce stream impacts—in terms of both limiting direct physical disturbance to specific crossing points and reducing the amount of fishing pressure in remote areas. Beneficial impacts to riparian habitats from active vegetation management and changes in grazing would also benefit the trout by reducing bank erosion and sediment inflow and by increasing vegetation canopy cover for shade and as a source of allochthonous (“from outside the stream”) insect prey or other food items.

**Amphibians** — The boreal toad, a BLM sensitive species and State-listed endangered species, is not known to occur in the Planning Area. Although no comprehensive surveys have been conducted, the area is near the lower elevational limits of the species, and potentially suitable habitats within the Planning Area are both limited and isolated.

The occurrence of the Great Basin spadefoot and the northern leopard frog (both BLM sensitive species and Colorado special-concern species) is limited by the availability of suitable habitats, i.e., seasonal ponds or pools for the toad and perennial ponds or slow-flowing streams for the frog. Impacts to these species would be negligible to minor, depending on whether drainages crossed by new roads support these species. In general, the phased and clustered development and protective measures cited above for streams, riparian/wetland areas, and watershed functions would benefit all three of the potentially present special status amphibians. Limiting motorized mechanized travel to designate routes would be beneficial by limiting stream crossings. BMPs such as requiring that stream crossing culverts or bridges where feasible would reduce potential impacts (see Appendix I). Changes in grazing management to improve stream corridors would also benefit the amphibians. The Proposed Plan is therefore expected to have negligible impacts to both of these potentially present species.

**Reptiles** — The Utah milk snake and midget faded rattlesnake (both BLM sensitive species, and the midget faded rattlesnake also a Colorado special-concern species) are expected or known to occur in the Planning Area. The NGD/NSO for steep slopes would preserve much of the potential denning habitat for the rattlesnake. The milk snake occurs in riparian habitats and moist gulches and would be generally protected by the NGD/NSO for riparian/wetland vegetation and other stream-oriented designations or stipulations. Restrictions on motorized and mechanized travel and more active management to improve condition of upland and riparian/wetland vegetation would also benefit the rattlesnake and milk snake, respectively.

**Waterbirds** — Barrow's goldeneye and the white-faced ibis (BLM sensitive species) are known to occur as migrants in the Planning Area or vicinity. The Colorado River corridor provides the most suitable habitat, although the goldeneye and ibis also occur at Fravert Reservoir. The TL for waterbird nesting at Fravert Reservoir provides seasonal protection for these and other waterbird species that may nest there, but the Colorado River NGD/NSO is probably the most important habitat protection within the Planning Area. The TL stipulation for bald eagle winter roosting extends into part of the spring migration season for Barrow's goldeneye and the white-faced ibis and therefore also benefits these species. The Proposed Plan is therefore expected to have negligible impacts to either species.

**Raptors** — The peregrine falcon, prairie falcon, ferruginous hawk, Swainson's hawk, golden eagle, northern goshawk, northern harrier, boreal owl, flammulated owl, and burrowing owl could be affected under the Proposed Plan due to some loss of hunting habitat. Of these species, the burrowing owl is State-listed as threatened, while the others are some combination of BLM sensitive species, Colorado special-concern species, or BCC species (Table 3-16). All of these and, except for cliff-nesters such as the peregrine falcon and golden eagle, face potential loss of nesting habitat. Direct long-term loss of 812 acres of habitat due to oil and gas development under the Proposed Plan would represent 1.1 percent of the BLM lands in the Planning Area. Applying the larger amount of effective habitat loss calculated previously for deer and elk under the Proposed Plan (Table 4-11) is not appropriate for estimating impacts to breeding raptors, because of the NGD/NSO and TL restrictions for active nests. However, if effective habitat loss were assumed, such as by limiting the amount of habitat available for searching for prey, the amount of such loss would be less under the Proposed Plan than any other alternative, due to the smaller number of pads and fewer miles of new or upgraded access roads.

Cliff-nesting areas for peregrine and prairie falcons and the golden eagle are especially important because these species depend on high cliffs for nesting. For the peregrine falcon, proximity to a large body of water (the Colorado River) is also important because it supports the falcon's favorite prey—waterfowl. The other two cliff-nesters hunt in open terrain, potentially including sparsely vegetated habitats below

the rim and sagebrush shrublands atop the plateau. The cliff-nesting area would continue to be protected by an SSR/CSU under the Proposed Plan, and active nests would be protected by NGD/NSO and TL restrictions.

For the northern goshawk and boreal owl, aspen and conifer forests at higher elevations of the Planning Area and some areas of mature Douglas-fir below the rim provide suitable hunting and nesting sites. The flammulated owl could occur in any of these habitats as well as denser stands of pinyon/juniper. The NGD/NSO restrictions for steep slopes and the wildlife security areas below the rim would benefit these species, as would NGD/NSO and TL restrictions for mapped or other active nests and the restriction on motorized and mechanized travel. Furthermore, the phased and clustered development atop the plateau would reduce impacts by limiting oil and gas drilling to only one development area at a time (Figure 2-1), leaving other areas relatively undisturbed.

Another special status raptor, the northern harrier, nests and hunts in more open habitats dominated by grasses, forbs, and low shrubs, while the Swainson's hawk hunts in open habitats but nests in trees. Either species could occur in any part of the Planning Area that provides suitable habitat. Impacts to these species would be in proportion to the direct loss of habitat—again, a relatively minor area under the Proposed Plan. The NGD/NSO and TL restrictions for raptor nests would also apply to these species.

Based on the protective measures summarized above, impacts to raptors under the Proposed Plan are expected to range from negligible (atop the plateau) to minor (below the rim).

**Neotropical Migrants and Other Native Birds** — Not all neotropical migrants are designated as sensitive, nor are all of them forest species. However, many of these species, including several species on the USFWS list of BCC, either occur or could occur in habitats of the Planning Area (see Section 3.3.4). Lower elevation sensitive species or BCC species, such as Lewis's woodpecker, loggerhead shrike, gray vireo, Virginia's warbler, black-throated gray warbler, and sage sparrow (as well as many other, unlisted species), would lose approximately 737 acres (1.9 percent) of the habitat below the rim. If effective habitat loss from reduced use by birds near areas of human activity were considered, the loss below the rim would be 2,947 acres (7.6 percent of the lower elevation habitats). This is based on the smaller zone of avoidance represented by the area method, discussed in Section 4.3.2 and shown in Table 4-11.

For neotropical migrants nesting atop the plateau, including sensitive and/or BCC species such as the northern three-toed woodpecker, Williamson's sapsucker, and olive-sided flycatcher, the amount of direct long-term habitat loss would be only 75 acres (0.2 percent of the area), while effective habitat loss would be 316 acres (0.8 percent of the BLM lands atop the plateau).

Another BCC species that could occur onsite is the black swift, which often nests on cliffs behind or adjacent to waterfalls. If this species is present, it would be most likely to occur in the vicinity of the East Fork Falls, which would be protected by an NGD/NSO restriction.

BLM has not yet developed conservation strategies for species on the BCC list. However, NGD/NSO and SSR/CSU restrictions aimed at reducing impacts to high-quality habitats—including riparian habitats, major portions of the Douglas-fir and spruce/fir forests, and much of the aspen forest and mature pinyon/juniper—would benefit these species. Many of these species would benefit from other NGD/NSO restrictions and the raptor nesting and waterbird nesting TL restrictions. Additionally, the restrictions on motorized and mechanized travel, closure of some existing routes, and vegetation and range management measures aimed at improving both upland and riparian/wetland communities would tend to offset a portion of the adverse impacts from oil and gas activity.

The conclusions regarding BCC species also applies to all of the native birds protected by the MBTA (i.e., excluding upland gamebirds). In considering projects and management activities that could affect native birds, BLM would consider the species and habitats to be affected and the type, intensity, timing, and duration of the impact in evaluating the overall population effect. Where an adverse population impact could result, BLM could require that the project or activity be relocated, postponed, or mitigated.

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Where these measures would not be effective in avoiding or minimizing the adverse population effect, BLM could deny the request. In general, negative impacts to neotropical migrants and other birds are expected to be negligible both above and below the rim.

**Bats** — The combination of NGD/NSO restrictions for the Anvil Points Cave, most cliff areas, and most areas of mature forest and the limited amount of direct long-term habitat loss (812 acres) is expected to result in impacts to bats of none to negligible under the Proposed Plan.

**Carnivores** — In the event that the lynx, wolverine, or American marten occurs in the Planning Area, any of these would be most likely in subalpine forest habitats atop the plateau. As described above, the Proposed Plan would result in an assumed 75 acres of direct long-term habitat loss in these habitats, representing 0.2 percent of the upper area. Using the wide buffers from human activity assumed earlier for deer and elk (Section 4.3.2), the effective habitat loss would be only 6.3 percent of the upper area (Table 4-11). Additionally, the phased and clustered development, with oil and gas drilling limited to a single area at any one time, would reduce the disturbance-avoidance impacts by leaving most of the upper plateau in a relatively undisturbed condition.

Other relevant components of the Proposed Plan include the NGD/NSO protections for most of the higher quality forest habitats along drainages or along the cliffs. The combination of these considerations, the restrictions on motorized and mechanized travel, and implementation of measures to improve upland and riparian/wetland vegetation supports the conclusion that impacts to these special status carnivores would be none or negligible.

Another USFS sensitive species and State-listed endangered species potentially present in the Planning Area is the river otter. If this aquatic carnivore were to disperse into or through the Planning Area from future release sites or by natural dispersion from occupied habitat, movement would most likely be limited to the Colorado River or Parachute Creek. Because of the various NGD/NSO restrictions associated with other riverine resources (special status fishes, bald eagle, Colorado River corridor, riparian vegetation, etc.), impacts to potential future use by this species would be none or negligible.

### **Offsite and Cumulative Impacts**

One of the principal cumulative impacts under the Proposed Plan would include the combination of oil and gas development on BLM lands with that on private lands within the Planning Area, and with both Federal and private lands in nearby areas. Because of assumed higher well densities and lower levels of ecological protection on private lands, the combined result would be direct long-term habitat loss of 2,791 acres, or 2.2 percent of the total Planning Area, compared to 1.1 percent for the BLM lands alone. Using effective habitat loss—i.e., accounting for reduced use near areas of human activity—as the indicator of cumulative impacts, the relative amounts are estimated at approximately 7.7 percent of the entire Planning Area, compared to 2.9 percent of the BLM lands. These estimates are derived from the information presented in Table 4-3 and the area-method calculations of effective habitat loss in Table 4-11 (most species are not subject to the wider disturbance-avoidance zones of the distance method). In comparison, effective habitat loss on private and Federal lands combined under the Preferred Alternative is estimated at 8.5 percent of the Planning Area.

About 88 percent of the cumulative (private plus Federal) habitat loss within the Planning Area would be in areas below the rim. Combined effective loss of the private and Federal lands at these lower elevations would be approximately 11.7 percent under the Proposed Plan, compared to 12.7 percent under the Preferred Alternative (again using the area method). For the 12 percent of cumulative impact area atop the plateau, the comparison of effective habitat loss for the Proposed Plan and Preferred Alternative is 2.2 percent versus 2.8 percent.

For large, wide-ranging species such as raptors and carnivores with home ranges that include nearby offsite lands, the estimated cumulative impacts of habitat loss and disturbance avoidance due to oil and

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gas development within the Planning Area would be cumulative to losses from the same type of development in nearby lands.

Quantifying cumulative impacts that incorporate offsite lands is more difficult, due to uncertainties about the location, scale, and rate of oil and gas development on BLM lands, private lands, and other lands both inside and outside the Planning Area, as well as uncertainties about the application and effectiveness of environmental protections on these non-BLM lands. However, the long-term surface disturbance from new wells on BLM lands in 20 years (812 acres) represents 29 percent of the cumulative total for private plus Federal, existing plus projected development (Tables 4-2 and 4-3). Also, the total number of BLM and private wells projected for the Planning Area at the end of 20 years (approximately 3,700) is in comparison to a project total of 10,000 to 20,000 in Garfield County for the same time-frame (Section 3.4.3).

Finally, it should be noted that habitat losses from oil and gas development are in addition to the direct and effective losses resulting from the ongoing human population growth in the region, with an annual increase of approximately 4.5 percent in western Garfield County. While some portion of this growth is related to oil and gas development in the Planning Area (Section 4.4.3), most of the growth is unrelated to either the Planning Area or the oil and gas sector of the local economy.

***Summary of Impacts to Special Status Fish and Wildlife***

Impacts to special status species under the alternatives analyzed are summarized in Table 4-15. Some impacts may represent an irreversible and irretrievable commitment of natural resources (Section 4.6).

**Table 4-15. Summary of Impacts of Proposed Plan to Special Status Fish and Wildlife<sup>1,2</sup>**

<b>Management Action</b>	<b>Alt. I No Action</b>	<b>Alt. II</b>	<b>Alt. III Preferred</b>	<b>Alt. IV</b>	<b>Alt. V</b>	<b>Proposed Plan</b>
Special Stipulations for ACECs	NA	Major (+)	Moderate to Major (+)	NA	NA	Moderate to Major (+)
Protection of WSR-eligible Streams	NA	Moderate to Major (+)	Moderate to Major (+)	Moderate to Major (+)	NA	Moderate to Major (+)
Watershed Management Areas	NA	Moderate to Major (+)	Major (+)	NA	NA	Major (+)
Management for Wilderness Values <sup>3</sup>	NA	Moderate to Major (+)	Moderate (+)	NA	NA	NA
Vegetation/Weed Management	Minor to Moderate (-)	Minor to Moderate (+)	Minor to Moderate (+)	Minor to Moderate (-)	Minor to Moderate (-)	Moderate to localized Major (+)
Recreation/Travel Management	Moderate (-)	Moderate to Major (+)	Moderate to Major (+)	Moderate to Major (+)	Moderate (+)	Moderate (+)
Range Management	Moderate (-)	Moderate (+)	Moderate (+)	Moderate (+)	Minor (-)	Moderate to localized Major (+)
Oil and Gas Development <sup>4,5</sup>	Negligible to Minor (-)	Minor to Moderate (-)	Negligible to localized Major (-)	Moderate to localized Major (-)	Moderate to Major (-)	Negligible to localized Major (-)

<sup>1</sup> Overall beneficial (+) or negative (-) impacts after balancing positives and negatives for resource components and assuming implementation of BMPs described in text and Appendix I..

<sup>2</sup> For Federally listed, proposed, or candidate threatened or endangered species, USFWS would issue a BO addressing potential effects and required conservation measures.

<sup>3</sup> Limited to roadlessness and naturalness under Alternative III.

<sup>4</sup> Under Alternative I, oil and gas impacts for Alternative I almost entirely below cliffs due to no-lease of NOSR 1.

<sup>5</sup> Under Alternative III, development above the rim would be deferred until 80% of anticipated total wells below the rim during 20-year period of analysis have been drilled.

### 4.3.5 Wild Horses and Burros

No managed populations of wild horses or wild burros occur in the Planning Area or GSRA, and these non-native ungulates are therefore not discussed in this RMPA/EIS.

## 4.4 HUMAN ENVIRONMENT

### 4.4.1 Visual Resources

#### 4.4.1.1 Introduction

As outlined in Section 3.4.1, VRM classes are assigned to the various parts of the landscape based on visual characteristics or to meet management objectives. These range from preserving a natural landscape and existing characteristics (Class I) to providing for management activities that allow major modification of the landscape (Class IV). While numerous management activities can impact visual values, the most significant impacts are large-scale or cumulative ground-disturbing activities that alter the existing form, line, color, and texture that characterize the existing landscape.

Impacts to visual resources are considered major if they substantially change or degrade the character of the landscape as seen from sensitive viewsheds or if the allowable modifications exceed VRM classifications. While topography can allow for some landscape modifications, many types of disturbance, such as roads and artificial structures, can dominate the landscape depending on their size, distance, topographic position, presence/absence of screening, and contrast with surrounding conditions.

All BLM resource uses, management activities, and implementation decisions will be designed to meet VRM objectives established in this Proposed Plan. Visual resource design techniques and BMPs will be utilized to mitigate potential short-term and long-term impacts. Visual contrast ratings will be required for all projects proposed on public lands that fall within VRM Class I, II, and III areas with high value or high visual sensitivity. This will allow BLM to reduce impacts on a site-specific basis to ensure compliance with the assigned VRM Classes. Viewsheds deemed to be of high value are those that have high scenic quality, such as East Fork Canyon, or high visual sensitivity due to the large amount of public interest and viewing.

A viewshed analysis was performed for each of the alternatives assessed as part of this RMPA/EIS process. Although the alternatives include various resource management actions and land uses, increased levels of oil and gas development would be the dominant long-term landscape-altering activity. Visible changes associated with oil and gas exploration and production include not only physical structures, but also altered topography, exposed soils, and construction of roads (often with significant cut-and-fill) and pipelines. All of these activities require the removal of vegetation. While some temporary disturbances are reclaimed within 2 years, most pads and roads remain as long-term areas of physical and biological, and hence visual modification.

#### 4.4.1.2 Methods

The viewshed analysis was performed using ESRI ArcScene software and a USGS DEM. The DEM used for this project was based on USGS 7.5-minute topographic quadrangles with a cell size of 28.5 meters. The viewshed analysis process used the DEM to identify all areas in which well pad locations would be visible from I-70, SH 13, or the Rim Road. As described in Section 2.3.1, GIS was used to place hypothetical well pad locations on top of the plateau (Rim Road viewshed) under the Proposed Plan, with the first 13 pads assumed to be in the southeastern-most development area (see Figure 2-1) due to its horizontal proximity to existing production areas below the rim. For the I-70 and SH 13 viewsheds, the greater flexibility in pad locations (see Section 2.3.1 and the introduction to Chapter 4) required a different approach. For analysis of these viewsheds, the estimated 180 pads to be completed in 20 years

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were assumed to be distributed randomly and proportionately (based on relative areal extent) in terms of visible versus non-visible locations, I-70 versus SH 13 corridors, and SSR/CSU versus standard stipulations and restrictions.

Maps 24 through 26 show the viewsheds for I-70, SH 13, and the Rim Road. The colored area of each map depicts the portion of the landscape visible from that roadway. Note that the Rim Road viewshed (Map 26) differs from the version in the Draft RMPA/EIS by not indicating any visible areas below the rim. This reflects the actual situation, because at no point is the Rim Road close enough to the edge for an occupant of a vehicle to be able to look downward onto the lower plateau. In contrast, the Draft RMPA/EIS erroneously indicated a large area below the rim as being visible. This resulted from a GIS artifact related to the size of pixels compared to the distance from the Rim Road to the actual rim.

Also note the wide overlap between the I-70 and SH 13 viewsheds (Maps 24 and 25). In the Draft RMPA/EIS, this resulted in a number of wells being double-counted and hence overestimating the impacts. To address this situation, the Proposed Plan/Final EIS treats these two viewsheds as separate, with well pad locations in the zone of overlap assigned to the road from which primarily visible (typically, the nearer road, since visual impact is at least partially related to viewing distance). Visibility characteristics for the I-70 and SH 13 viewsheds under the Proposed Plan are summarized in Table 4-16.

**Table 4-16. Visibility Characteristics for Area below the Rim under the Proposed Plan <sup>1</sup>**

<b>Component</b>	<b>Total Area</b>	<b>Private Lands</b>	<b>BLM Lands <sup>1</sup></b>			
			<b>NGD/NSO</b>	<b>SSR/CSU</b>	<b>Standard Restrictions</b>	<b>Total BLM</b>
Below the Rim	73,209 ac	34,365 ac	22,590 ac	11,896 ac	4,358 ac	38,844 ac
Visible Primarily from I-70	21,234 ac	9,108 ac	9,244 ac	2,244 ac	638 ac	12,126 ac
Visible Primarily from SH 13	12,574 ac	4,531 ac	4,682 ac	2,422 ac	939 ac	8,043 ac
Not Visible from I-70 or SH 13	39,401 ac	20,726 ac	8,664 ac	7,230 ac	2,781 ac	18,675 ac

<sup>1</sup> Includes BLM surface and/or mineral estates.

As shown by Table 4-16, slightly more than half (52 percent) of the total BLM lands below the rim and less than half (40 percent) of private lands below the rim are visible from I-70 or SH 13. The remaining (non-visible) portions are either located along CR 215 north of Parachute or are hidden by rugged topography in some of the lower areas bordering I-70 and SH 13 (Maps 24 and 25).

GIS analysis was also used to calculate the amount of visible terrain within specific distance zones as measured from I-70, SH 13, and the Rim Road. The distance zones are as follows:

- Close Range – Less than 0.25 mile
- Near Foreground – 0.25 to 1 mile
- Foreground – 1 to 3 miles
- Midground – 3 to 5 miles
- Background – Greater than 5 miles

As described in Section 3.4.1, landscape features generally are more visible at distances closer to the observer due to the increase in visual size and greater ability to discern the details of form, color, texture,

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and line. Objects viewed at a distance of less than 0.25 mile generally have the highest degree of visual sensitivity, with decreasing importance at increasing distances. However, generalizations about the importance of distance do not necessarily hold in the case of landscape features or modifications that are large, located in a topographically prominent area, or have a high degree of contrast with their surroundings. Table 4-17 presents information on the distance zones for the three viewsheds under the Proposed Plan.

**Table 4-17. Distance Zone Information for Roadway Viewsheds under the Proposed Plan <sup>1</sup>**

<i>Roadway Viewshed</i>	<i>Visible Area</i>	<i>Close Range &lt;0.25 mile</i>	<i>Near Foreground 0.25 – 1 mile</i>	<i>Foreground 1 – 3 miles</i>	<i>Midground 3 – 5 miles</i>	<i>Background &gt;5 miles</i>
I-70	12,126 ac	137 ac	1,439 ac	7,698 ac	2,838 ac	14 ac
SH 13	8,043 ac	540 ac	2,308 ac	4,153 ac	1,042 ac	0 ac
Rim Road	11,566 ac	2,682 ac	1,962 ac	2,136 ac	575 ac	63 ac

<sup>1</sup>Limited BLM lands visible from the three roadway-based viewsheds analyzed. Rim Road analysis also limited to areas atop the plateau (i.e., excludes distant vistas). For all three viewsheds, “visible area” does not assume vegetational screening.

Table 4-18 presents the results of the analysis of the number of well pads visible in the three roadway viewsheds, by alternative and distance zone. As described previously, the analysis assumes that the distribution of pads below the rim would be in proportion to the area of each viewshed and each distance zone, and independent of whether an area is protected by an SSR/CSU or standard restrictions. In reality, the greater protection of visual resources in areas with the SSR/CSU restrictions would reduce the number of visible pads compared to the number predicted solely on the basis of relative area. Not assuming reduced visibility in SSR/CSU areas—even though that is the purpose of the restriction—is intended to ensure that visual impacts of well pads are not underestimated.

**Table 4-18. Number of Well Pads Estimated to be Visible from Road Corridors in 20 Years <sup>1</sup>**

<i>Viewshed</i>	<i>Distance Zone</i>	<i>Alt. I No Action</i>	<i>Alt. II</i>	<i>Alt. III Preferred</i>	<i>Alt. IV</i>	<i>Alt. V</i>	<i>Proposed Plan</i>
I-70 <sup>2</sup>	< 0.25 mi	0	0	0	0	0	1
	0.25 – 1 mi	7	16	17	15	20	11
	1 – 3 mi	15	27	35	31	63	19
	3 – 5 mi	1	1	7	6	16	1
	> 5 mi	0	0	0	0	0	0
	<b>Total</b>	<b>23</b>	<b>44</b>	<b>59</b>	<b>52</b>	<b>99</b>	<b>32</b>
SH 13 <sup>2</sup>	< 0.25 mi	8	9	9	8	8	6
	0.25 – 1 mi	23	22	31	28	28	17
	1 – 3 mi	12	12	42	37	40	12
	3 – 5 mi	1	1	8	7	11	3
	> 5 mi	0	0	0	0	0	0
	<b>Total</b>	<b>44</b>	<b>44</b>	<b>90</b>	<b>80</b>	<b>87</b>	<b>38</b>
Rim Road <sup>3,4</sup>	< 0.25 mi	2	7	3	10	16	5
	0.25 – 1 mi	1	7	4	11	18	3
	1 – 3 mi	1	5	5	17	22	4

**Table 4-18. Number of Well Pads Estimated to be Visible from Road Corridors in 20 Years <sup>1</sup>**

<i>Viewshed</i>	<i>Distance Zone</i>	<i>Alt. I No Action</i>	<i>Alt. II</i>	<i>Alt. III Preferred</i>	<i>Alt. IV</i>	<i>Alt. V</i>	<i>Proposed Plan</i>
	3 – 5 mi	0	3	1	4	5	1
	> 5 mi	0	0	0	0	0	0
	<b>Total</b>	<b>4</b>	<b>22</b>	<b>13</b>	<b>42</b>	<b>61</b>	<b>13</b>

<sup>1</sup> Numbers may differ slightly from Draft RMPA/EIS due to refinement in method but retain same assumptions.

<sup>2</sup> Analyses for I-70 and SH 13 assume 40-acre surface density for Alternatives I through V and average of 80-acre surface density for Proposed Plan. Number of visible pads in I-70 and SH 13 viewsheds under Proposed Plan with 40-acre surface density used for other alternatives can be estimated by doubling the numbers shown.

<sup>3</sup> Analysis for Rim Road incorporates the effective 160-acre surface density to be required atop the plateau.

<sup>4</sup> Analysis for Rim Road differs from Draft RMPA/EIS by not including areas below the rim. As indicated in text of report, wells below the rim indicated in Draft as visible from Rim Road were an artifact of computer analysis. These wells can actually be seen only by exiting vehicle and walking to top of cliffs.

The viewshed analysis did not include potential new roads or improvements to existing roads to provide access to new oil and gas facilities. Estimates of new or upgraded access roads needed to service oil and gas activities on BLM portions of the Planning Area range from an estimated 124 miles for the Proposed Plan to 350 miles for Alternative V. Access roads represent additional impacts to visual resources, especially where they must cross a visible slope or require removal of vegetation.

Some of the impacts may represent an irreversible and irretrievable commitment of visual resources (Section 4.6). Development on private lands within the Planning Area is discussed in the cumulative impact analysis portion. VRM classes under the Proposed Plan and Preferred Alternative are shown on Map 23; and the potential changes to visual resources resulting from prescribed VRM classes are shown in Table 4-19.

**Table 4-19. Acres of VRM Classes by Alternative**

<i>VRM Class</i>	<i>Alt. I No Action</i>	<i>Alt. II</i>	<i>Alt. III Preferred</i>	<i>Alt. IV</i>	<i>Alt. V</i>	<i>Proposed Plan</i>
Class I	0	37,205	925	925	0	1,612
Class II	24,039	13,428	48,752	48,752	0	30,168
Class III	37,115	14,607	15,563	15,563	63,022	33,536
Class IV	10,340	8,350	8,350	8,350	10,568	8,274
Class V	2,096	0	0	0	0	0
Urban	12	12	12	12	12	12

#### 4.4.1.3 Impacts of the Proposed Plan

##### Direct and Indirect Onsite Impacts

**Oil and Gas Development** — While many management activities can have direct impacts on visual values and adversely alter the landscape, oil and gas development is the activity with the greatest anticipated level of visual change during the 20-year life of the Plan. Although all activities will be managed to meet the assigned VRM Class objectives, unavoidable long-term ground-disturbing activities associated with the oil and gas development represents an irretrievable commitment of visual resources. Therefore, oil and gas development is the focus of this analysis. The allowable level of change in the landscape will depend on the VRM Class designation for that particular area.

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Under the Proposed Plan, a total of 1,570 wells on 193 pads are anticipated in BLM portions of the Planning Area. The long-term surface disturbance associated with this level of development would be approximately 812 acres. The development assumptions described in Section 2.4 yield approximately 180 well pads below the rim and 13 above the rim on BLM lands.

Both above and below the rim, oil and gas development would create direct impacts to the existing landscape by introducing new contrasts in form, line, color, and texture. Temporary impacts to visual resources would result from the increased presence of drill rigs, construction vehicles, artificial lights, dust, and other associated uses during construction and drilling phases. Long-term impacts to the landscape would result from the presence of well pads, tanks, compressors, dehydration units, roads, pipelines, power lines, and other features associated with the oil and gas operations.

### **I-70 Viewshed**

As shown in Table 4-18, approximately 32 well pads on BLM lands may be visible from I-70. This number is smaller than any of the previous alternatives except No Action, reflecting a combination of the NGD/NSO restrictions on surface facilities to protect highly sensitivity VRM Class II areas of the I-70 viewshed with the smaller number of pads associated with management toward greater clustering of wells. As a result of NGD/NSO restrictions to protect both the visual and ecological quality, and steeper terrain along the cliffs, 94 percent of the visible pads (30 of 32) would be in the near foreground (0.25- to 1-mile) and foreground (1- to 3-mile) distance zones. The concentration of pads in these distance zones means that the farther but visually conspicuous areas along the cliffs are estimated to have no visible pads.

With the diverse and varied landscape characteristics in the foreground distance zone, opportunities exist to locate roads and pads in areas that would reduce visual impacts. For example, 72 percent of the pads visible from I-70 would be on lands with SSR/CSU restrictions, giving BLM the ability to require relocation by more than 200 meters to reduce visual impact. With standard stipulations, BLM can require that pads be relocated by up to 200 meters. Even with the ability to adjust the location of pads and to require facility colors that reduce visual impact, the removal of vegetation would amplify visual contrasts in line, color, form, and texture. Since much of the foreground distance zone, and especially the distal portion, is pinyon/juniper, increases in contrast created by removing vegetation may be especially visible.

In the near foreground, and especially the proximal portion, vegetation of the Planning Area is dominated by semi-desert shrubs and sparse grasses. As a result, ground disturbance creates less contrast from removal of plant cover. On the other hand, the fewer opportunities to screen a pad behind woody vegetation and irregular terrain, and the fact that viewed objects appear larger because they are closer, offset some of the beneficial impacts of the more arid vegetation.

Indirect impacts under the Proposed Plan would be a more industrialized setting adjacent to I-70. However, with the VRM Class II and the sensitive I-70 viewshed stipulations, most of the existing visual quality in the midground and background distance zones of the I-70 viewshed would be maintained.

### **SH 13 Viewshed**

Approximately 38 well pads on BLM lands are estimated to be visible from SH 13 under the Proposed Plan (Table 4-18). This is the smallest number for any alternative, including No Action. The area nearest the highway, including the close range and near foreground distance zones (i.e., less than 1 mile), would be managed as VRM Class IV, which allows major modifications and direct impacts to the existing landscape. VRM Class IV reflects the present condition of the landscape which includes the existing electric transmission corridors and the Hubbard Mesa OHV Riding Area which has resulted in impacts to visual quality. About 60 percent of the visible pads (23 of 38) would be in the two closest distance zones.

The cliff areas to the west would be managed as VRM Class II, which allows for only minor modifications to the landscape, and protected with SSR/CSU restrictions for visual resources. In addition

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much of the rugged backdrop of the SH 13 viewshed would be protected by NGD/NSO restrictions associated with steep slopes and wildlife security areas. For the estimated 15 pads to be visible at distances greater than 1 mile from SH 13, the contrast of linear access roads, areas cleared of trees, and freshly disturbed soil within pinyon/juniper woodlands could exacerbate visual contrasts compared to those normally expected at such distances. However, the diverse topography, varied landscape characteristics, and woodland habitats also provide opportunities for screening to reduce impacts. The more distant areas, including slopes below the cliffs that support Douglas-fir and are more conspicuous due to higher elevations, are estimated to have only three well pads.

Indirect impacts under the Proposed Plan would be a more industrialized setting adjacent to the SH 13 viewshed. However, with the VRM Class II and the sensitive I-70 viewshed stipulations (which overlap broadly with the SH 13 viewshed), most of the existing visual quality in the midground and background distance zones would be maintained. Maintenance of the scenic cliffs was identified as an important issue to residents, adjacent communities, and travelers along SH 13.

### ***Rim Road Viewshed***

The estimated number visible well pads on BLM lands atop the plateau (13) is the same number as the total number of well pads in that portion of the Planning Area during the 20-year planning period. On one hand, this number is smaller than for any alternative except No Action (with the upper area mostly closed to oil and gas development) and the Preferred Alternative of the Draft RMPA/EIS (with deferral of oil and gas development for approximately 16 years). On the other hand, it represents the entirety of well pads estimated to be constructed atop the plateau in 20 years. This is because one component of the Proposed Plan is the emphasis of oil and gas development along ridgetops. While ridgetop development would protect visual and other qualities associated with the relatively undisturbed stream valleys, it would increase visual impacts along ridgetop roadways in areas of oil and gas development.

The assumption that all 13 pads atop the plateau would be visible from the Rim Road reflects the assumption that development would occur first in the southeastern portion of the upper area due to its closer horizontal proximity to existing oil and gas development in the lower area. This happens to be the area accessed along the Rim Road. If some other portion of the upper plateau is developed first, the number of wells visible from the Rim Road during the 20-year period would be smaller, and potentially none.

The pads visible from the Rim Road would mostly be in the close range (< 0.25 mile) and near foreground (0.25 to 1 mile) distance zones because of the emphasis on development along existing roads (including the Rim Road) and the greater screening due to topography and wooded vegetation farther from the road. The decision by BLM to accept greater visual impacts as a consequence of managing primarily to protect the visually, ecologically, and hydrologically sensitive stream valleys resulted from Consultation and Coordination (Chapter 6).

At a localized scale, some opportunities for screening using existing woodland vegetation or topographic features may exist at specific sites where pads or other surface facilities would be located. The SSR/CSU restriction across the entire top of the plateau would allow BLM to manage visual quality consistently with the VRM Class III designation. While the East Fork Falls and the box canyon below it are not visible from the Rim Road, the NGD/NSO for the associated VRM Class I area of the falls and box canyon would preserve the existing scenic quality. The SSR/CSU associated with VRM Class III across the balance of the upper plateau gives BLM the ability to require that proposed facilities be relocated by more than 200 meters and/or that specific mitigation be incorporated to minimize visual impacts.

Direct visual impacts would be temporary (drill rigs, vehicular traffic, dust generation, etc.) in areas of active drilling and long-term (well pads, well facilities, roads, compressors, etc.) in areas that have moved into the production phase.

Indirect impacts would be a more industrial setting within development areas visible from the Rim Road. Potentially, the southeastern portions of the upper plateau, which includes the Rim Road, would support initial exploration and drilling activities atop the plateau. This is because closest (horizontally) to existing production areas below the cliffs may be developed first. Development along the Rim Road, which provides access to the Anvil Points overlook and other scenic vistas, could in turn have an adverse impact on the attractiveness of the area for tourism and recreation. However, the portion of the top of the plateau to be affected visually during the 20-year period represents only a small percentage of the total Planning Area, leaving the remainder available for the same types of recreational travel and scenic viewing as at present.

**Special Management Designations and Restrictions** — Special management designations under the Proposed Plan include designating two ACECs on top of the plateau, designating two ACECs along the east-facing and south-facing cliff areas, identifying a WMA for the Parachute Creek drainage basin, and managing WSR-eligible streams atop the plateau to retain that condition until a determination of suitability has been made. While all of these area designations would involve some management components that would benefit visual quality, only the four ACECs specifically include visuals as one of the resources being protected.

Management to protect sensitive resources in the two ACECs atop the plateau (East Fork Parachute Creek and Trapper/Northwater Creek) would provide some protection of highly scenic areas along stream valleys and canyons that currently show little influence of human activity. While the component of the Proposed Plan that focuses oil and gas development on ridgetops in the area above the rim would add to this protection of the scenic valleys and canyons, it would increase visual impacts to travelers along roadways through the area(s) of development.

The East Fork Falls viewshed would be managed as VRM Class I under the Proposed Plan to protect its high scenic quality (Map 23). The goal for VRM Class I areas—i.e., to preserve the existing character of the landscape, would be achieved with an NGD/NSO restriction. The remainder of the top of the plateau would be managed as VRM Class III, for which the goal is to partially retain the existing character of the landscape while allowing a moderate level of change. This level of protection and development would be achieved through SSR/CSU restrictions. As described elsewhere, these allow BLM to require that a proposed activity be relocated by more than 200 meters if necessary to protect a resource.

Below the rim, the Magpie Gulch and Anvil Points ACECs provide a basis for management of resources in ways that would benefit visual qualities. These two ACECs include most of the high cliffs, rock outcrops, and other rugged terrain features that provide the highly scenic backdrop for travelers on I-70 and SH 13 and residents of nearby communities.

Most of the lands below the rim would be managed as VRM Class II, for which the goal is to retain the existing landscape character while allowing low levels of change. Portions of the Class II lands on slopes steeper than 30 percent and visible from I-70 would be protected with NGD/NSO restrictions, while the balance would have SSR/CSU restrictions. Some areas along SH 13, including the existing electrical transmission corridor, would be managed as VRM Class IV, which allows for actions and land uses that cause major modifications to the existing character of the landscape.

Areas previously designated as VRM Class V are located in the vicinity of the Anvil Points Mine and along the upper part of the JQS road switchbacks. This designation would no longer be applied, and areas mapped as such under Alternative I (No Action) would be managed under the VRM class of adjacent areas (mostly VRM Class II)(Map 23).

#### **Offsite and Cumulative Impacts**

Until relatively recently, modifications of the natural landscape in the Planning Area have mostly been characteristic of agricultural and ranching lands, with localized industrial impacts associated with the railroad and I-70 highway corridors on private lands and the Anvil Points Mine. More recently, these

changes are cumulative to growth of residential and commercial uses, utility corridors, oil and gas development, and other rural industrial uses. Changes in the overall landscape specifically resulting from oil and gas development under any of the alternatives, including the Proposed Plan, are likely to be disproportionately greater on private lands. This is because private lands include much of the area along I-70 and SH 13 and adjacent to the towns of Rifle and Parachute. Additionally, development on private lands is relatively free of the requirements associated with management of Federal lands as VRM Class II (i.e., management to retain the existing character of the landscape while allowing low levels of change).

In addition to impacts being more noticeable and accumulating more quickly on private lands along I-70, the same will be true for Federal lands managed as VRM Class IV along SH 13. A substantial portion of these impacts would be concentrated in the close range and near foreground distance zones (i.e., less than 1 mile). Also, because VRM Class IV allows major changes in the existing character of the landscape, the magnitude of the potential changes would also be greater.

With the lower levels of visual protection on commingled private lands along I-70 and Class IV designations along SH 13, combined with the past, current, and foreseeable accumulation of landscape modifications, it is expected that the landscape most commonly viewed from major transportation corridors will experience a more developed and industrialized setting through time. While the most visually sensitive lands such as the scenic backdrop of the Roan Cliffs and East Fork Canyon will be preserved, impacts within the foreground zones will change visitors and residents expectations and experiences. Offsite impacts may be realized through a greater appreciation of remaining visual open space throughout the region.

### **Summary of Impacts to Visual Resources**

Long-term, large-scale, and cumulative landscape modifications associated primarily, but not solely, to oil and gas development would contribute to a change in overall landscape character particularly along I-70 and SH 13. Mitigation and reclamation efforts for long-term ground-disturbing activities on Federal lands would reduce visual impacts on Federal lands. Cumulative impacts could degrade overall visual quality on private lands due to their proximity to major highways and population centers. Private lands compose 43 percent of the landscape in the Planning Area, and approximately 67 percent of the developable land below the rim.

All Federal lands within the Planning Area would be managed to meet assigned VRM objectives (see map 23 and Table 4-19). Federal lands within the I-70 viewshed on slopes over 30 percent and East Fork Canyon would retain their natural-appearing landscape character. Lands within the I-70 viewshed with less than 30-percent slopes (VRM Class II lands) would experience a low change to their natural appearance.

Visual quality atop the plateau (except for East Fork Canyon) would experience conditions in which development could be readily observable from some ridgetop roads but does not dominate the landscape. Lands near SH 13 would experience high levels of landscape modification which could dominate the landscape.

Areas previously designated as VRM Class V are located in the vicinity of the Anvil Points Mine and along the upper part of the JQS Road switchbacks. This designation would no longer be applied, and those areas would be managed under the VRM class of adjacent areas (mostly VRM Class II)(Map 23).

## **4.4.2 Cultural Resources**

### **4.4.2.1 Introduction**

Cultural resources, in the broadest terms, are the products of human presence and actions. Cultural resources range from a prehistoric arrowhead to a historic building or a landscape held sacred by a group of people who live on or work the land.

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Consideration of cultural resources by Federal agencies is mandated by a number of Federal statutes. The NHPA of 1966 as amended (16 United States Code [USC] 470a-x6), particularly Section 106 (16 USC 470f) and Section 110 (16 USC 470h-2(a)), requires Federal agencies to “take into account the effects of Federal actions on historic properties” and outlines Federal agency responsibilities for the management, protection, preservation, and use of historic properties. The principal Federal regulations that guide implementation of this statute are found at 36 CFR 800 (Protection of Historic Properties) and 36 CFR 60 (National Register of Historic Places). The National SHPO Programmatic Agreement/Colorado Protocol provides alternative procedures for implementing 36 CFR 800 between the BLM, Advisory Council for Historic Preservation, and the National Conference of State Historic Preservation Officers. BLM Manual 8100 details the alternative procedures implemented by BLM, supplemented by WO-IB-2002-101 (BLM 2002g). Other Federal statutes that may affect the management of historic properties include the ARPA of 1979 (16 USC 470aa-mm), the Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (25 USC 3001-3013), Executive Order 13007 Sacred Sites, and the American Indian Religious Freedom Act (AIRFA) of 1978 (42 USC 1996).

Not all sites are considered significant and qualified for protection under the NHPA. Significant sites are designated as “historic properties” and defined in 36 CFR 800.16(l) as “any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in the National Register of Historic Places (NRHP).” Eligibility criteria for listing in the NRHP are presented in 36 CFR 60.4. Under 36 CFR 60.4, sites can be evaluated as:

- eligible for nomination to the NRHP
- potentially eligible for nomination to the NRHP
- not eligible for nomination to the NRHP

Traditional cultural properties are sites, locations, areas, and landscapes that may be important to certain groups. Although traditional properties are eligible for nomination, no traditional cultural properties have been identified in the Planning Area.

Cultural sites are nonrenewable resources that can be irretrievably lost if subject to certain actions. In general, any activity that destroys or irreversibly alters a historic property is an “adverse effect.” Adverse effects can be mitigated by a variety of methods. The type of site and Proposed Plan affects the chosen method(s) and is determined by consultations between the Federal agency, SHPO, and the Advisory Council on Historic Preservation (ACHP). Applicable Native American tribes and the public are included in these consultations as necessary. Native American consultation requirements are outlined in BLM Manual 8160 and H-8160-1 (BLM 1990).

### 4.4.2.2 Methods

The analysis of impacts to cultural resources included the assumptions that (1) ground-disturbing activities associated with additional oil and gas exploration and development will be the primary impact agent, and (2) any new or upgraded roads will increase the probability that cultural resources are adversely affected, either directly and indirectly.

As described for the five alternatives analyzed in the Draft RMPA/EIS, the effects or potential effects were estimated by analyzing the number, type, significance, and density of cultural resources in comparison to the relative areas subject to ground-disturbing activities. Since 58 percent of the Planning Area has been surveyed for cultural resources and 429 resources recorded, reasonable estimates of the impact of each alternative can be determined. Data used for the analysis were derived from the GIS database compiled for the *Roan Plateau Class I Cultural Resources Overview* (Hoefler et al. 2002). Data used to compile the overview were obtained from files and GIS data generated by the GSFO, the Colorado Historical Society Office of Archaeology and Historic Preservation, and existing reports on archaeological investigations in the Planning Area.

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The analysis began by subdividing each alternative into areas open to mineral leasing, areas closed to mineral leasing, and the utility corridor. The number and types of documented cultural resources in each of these areas was tabulated, along with the NRHP status of each resource. These numbers were used to compare the numbers of known cultural resources in each alternative. The density of cultural resources under each alternative was calculated by dividing the number of acres inventoried for cultural resources by the number of known cultural resources. The density is expressed as one resource per number of acres (e.g., one site per 100 acres).

The potential number of cultural resources that may be affected under each alternative was estimated by dividing the potential number of acres disturbed in each alternative by the site density. The number of significant sites (historic properties) was estimated by multiplying the potential number of sites by 0.18. This number was derived from the Class I Overview (Hoefler et al. 2002), in which 18 percent of the documented cultural resources in the Planning Area were evaluated as eligible or potentially eligible to the NRHP.

The impact analysis considered three types of impacts:

- **Direct** – Direct impacts are caused by ground-disturbing activities that immediately alter cultural resources in a physical manner (e.g., construction of roads, wells, pipelines, and stockponds).
- **Indirect** – Indirect impacts result from activities that may cause degradation to cultural resources as an unintended consequence of the activity. Examples include livestock grazing, cross-country vehicular travel, construction that leads to erosion in areas outside the construction zone, recreation, and increased artifact collection and vandalism.
- **Cumulative** – Cumulative impacts represent the loss of cultural resources over the long term due to the incremental impact of past, present, and reasonably foreseeable future actions. Over time, certain types of cultural resources (e.g., prehistoric campsites or historic homesteads) may be lost if development is concentrated in areas containing these resources.

Impacts to cultural resources in the Planning Area under the Proposed Plan are described below, including selected comparison to one or more of Alternatives I through V. Some impacts may represent an irreversible and irretrievable commitment of cultural resources (Section 4.6).

### 4.4.2.3 Impacts of the Proposed Plan

The Proposed Plan would allow oil and gas leasing atop the plateau, but large areas would be protected from most potential ground-disturbing activities by various NGD/NSO restrictions for specific ecological and sensitive visual resources. Additionally, the phased and clustered development under the Proposed Plan would reduce the number and total acres of surface disturbances. Below the rim, clustering at levels greater than currently used in the Planning Area would be a management goal for new leases as well as for future development on existing leases but would not be a specific requirement. Nonetheless, the combined result of these measures would be less surface disturbance than under Alternatives I through V, including Alternative I (Table 4-2). Total (long-term plus temporary) surface disturbance of approximately 1,130 acres (1.5 percent of BLM lands in the Planning Area) would result from a total of 193 well pads and 124 miles of new or upgraded access roads. In comparison, Alternative I would result in 1,901 acres of surface disturbance, 254 well pads, and 152 miles of new or upgraded access roads—despite almost the entire upper plateau being unavailable for oil and gas leasing.

All of the alternatives include a utility corridor near the eastern side of the Planning Area. The utility corridor covers 6,827 acres of Federal and private lands. Grazing, range management, and recreation (including hunting) could also impact cultural resources. Travel would be restricted to designated corridors throughout the Planning Area, except for over-snow travel by snowmobile with a minimum of 12 inches of snow cover and open (off-route) travel in the Hubbard Mesa OHV Riding Area. Vegetation and range management would use a combination of administrative and physical measures (e.g., additional

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fencing, stock watering ponds, and weed management) to improve currently degraded areas. Coal or oil shale development would be permitted, subject to the NGD/NSO restrictions, but neither is anticipated during the 20-year life of the Plan.

**Direct and Indirect Onsite Impacts**

A cultural resources inventory has been conducted on 66.5 percent of the lease acreage (48,950 acres) and on 16.3 percent (1,116 acres) of the utility corridor. Within the proposed lease area are 316 known cultural resources, of which 51 are eligible or potentially eligible for nomination to the NRHP. It is likely that the portion of the lease area above the rim contains additional cultural resources that are obscured by the denser vegetation in this area (Hoefler et al. 2002). The utility corridor contains 43 known cultural resources, of which six are eligible or potentially eligible for nomination to the NRHP. Table 4-20 lists the types and NRHP eligibility classification for BLM lands in the Planning Area. See Table 4-21 regarding sites in the utility corridor.

**Table 4-20. Cultural Resources in Areas Subject to Oil and Gas Leases, Proposed Plan**

<b>Component Type</b>	<b>Resource Type</b>	<b>NRHP Eligibility</b>			<b>Total</b>
		<b>Eligible</b>	<b>Potentially Eligible</b>	<b>Not Eligible</b>	
<b>Prehistoric</b>	Isolated Find	0	0	117	<b>117</b>
	Lithic Scatter	4	7	37	<b>48</b>
	Open Camp	19	11	52	<b>82</b>
	Other Prehistoric	1	1	5	<b>7</b>
<b>Historic</b>	Isolated Find	0	0	2	<b>2</b>
	Habitation	0	2	18	<b>20</b>
	Aspen Art	0	0	21	<b>21</b>
	Ditch/Water Control	2	0	2	<b>4</b>
	Road	1	1	0	<b>2</b>
	Mine	1	0	2	<b>3</b>
	Artifact Scatter	0	0	4	<b>4</b>
	Other Historic	0	1	5	<b>6</b>
<b>Total</b>		<b>28</b>	<b>23</b>	<b>265</b>	<b>316</b>

**Table 4-21. Cultural Resources in the Utility Corridor**

Component Type	Resource Type	NRHP Eligibility			Total
		Eligible	Potentially Eligible	Not Eligible	
Prehistoric	Isolated Find	0	0	21	21
	Lithic Scatter	0	0	3	3
	Open Camp	0	1	7	8
	Other Prehistoric	0	1	1	2
Historic	Isolated Find	0	0	1	1
	Habitation	0	0	3	3
	Aspen Art	0	0	0	0
	Ditch/Water Control	1	0	0	1
	Road	1	1	0	2
	Mine	0	0	0	0
	Artifact Scatter	0	0	1	1
	Other Historic	0	1	0	1
<b>Total</b>		<b>2</b>	<b>4</b>	<b>37</b>	<b>43</b>

Combined cultural resource density in the utility corridor and the area to be available for oil and gas leasing under the Proposed Plan is one resource per 155 acres. The potential surface disturbance of 1,130 acres from oil and gas development activities indicates that approximately 7.3 cultural resources could be impacted under this alternative. Using the figure that 18 percent of the sites in the Planning Area are eligible or potentially eligible to the NRHP (Hofer et al. 2002), an estimated 1.3 eligible or potentially eligible site ( $0.18 \times 7.3 = 1.3$ ) would be affected. Of course, the actual number could be higher or lower (zero), depending on the exact location of ground-disturbing activities. In comparison, the combined 1,901 acres of surface disturbance under Alternative I (No Action) and 2,948 acres under Alternative III (Preferred) would impact approximately 12 and 19 cultural resources, respectively.

Erosion caused by oil and gas development may increase the potential for indirect impacts on cultural resources outside the direct impact areas. Again, however, the number and acres of well pads and the miles and acres of new or upgraded access roads would be less under the Proposed Plan than any of the alternatives analyzed in the Draft RMPA/EIS.

#### ***Offsite and Cumulative Impacts***

Any direct or indirect impacts on cultural resources on Federal lands would be in addition to impacts associated with increased development and travel on private lands within the Planning Area, and on both Federal and private offsite lands. Furthermore, siting of roads and pipelines on Federal lands may influence the route these developments take across private lands.

#### ***Summary of Impacts to Cultural Resources***

All of the alternatives considered in this RMPA/EIS have the potential to impact cultural resources. The magnitude of potential impacts is directly related to the amount of oil and gas development activities and other ongoing resource uses that involve ground-disturbing activities or increased human access into currently little-used areas. The potential for direct impacts to significant cultural resources increases slightly from Alternative I through Alternative IV of the Draft RMPA/EIS due to relatively modest

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increases in the amount of new development assumed to occur. Impacts under Alternative V could be substantially greater due to the large number of well pads and miles of new or upgraded roads needed to support the assumed level of development.

In contrast to the five previous alternatives, potential impacts would be substantially less under the Proposed Plan. This would result from the smaller number of well pads and miles of new or upgraded roads associated with the requirement for phased and clustered development atop the plateau and BLM management emphasis toward clustered development below the rim.

Tables 4-22 and 4-23 compare the number of cultural resources by NRHP eligibility category and potential numbers of affected resources. The following subsection addresses mitigation measures, management actions, and policy considerations—including legal mandates—that would avoid or minimize these impacts.

**Table 4-22. Number of Known Cultural Resources and NRHP Eligibility by Alternative**

<i>Alternative and Area</i>		<i>NRHP Eligibility</i>			<i>Total Cultural Resources</i>
		<i>Eligible</i>	<i>Potentially Eligible</i>	<i>Not Eligible</i>	
Alternative I	Lease Area	9	10	116	<b>135</b>
	No-Lease Area	19	13	149	<b>181</b>
Alternative II	Lease Area	19	20	218	<b>257</b>
	No-Lease Area	9	3	47	<b>59</b>
Alternatives III, IV, and V (All Leased)		28	23	265	<b>316</b>
Utility Corridor (Alternatives II – V)		2	4	37	<b>43</b>

**Table 4-23 Number of Potentially Affected Cultural Resources by Alternative**

<i>Alternative</i>	<i>Area of Long-term and Short-term Surface Disturbance</i>	<i>Average Cultural Resource Density in Areas of Oil and Gas Leasing</i>	<i>Potentially Affected Cultural Resources</i>	<i>Potentially Affected Significant Cultural Resources</i>
I (No Action)	1,901 acres	1 per 99 acres	19	3.5
II	2,262 acres	1 per 123 acres	18	3.3
III (Preferred)	3,269 acres	1 per 155 acres	21	3.8
IV	3,269 acres	1 per 155 acres	21	3.8
V	4,211 acres	1 per 155 acres	27	4.9
Proposed	1,130 acres	1 per 155 acres	7.3	1.3

#### 4.4.2.4 Mitigation, Management, and Policy Considerations under All Alternatives

##### Mitigation Measures

Impacts to significant cultural resources (historic properties) can be mitigated with a variety of strategies. To conform to the requirements of Section 106 of the NHPA, cultural resource inventory and evaluation projects are conducted prior to development activities. If significant cultural resources are encountered, it is BLM policy to avoid them whenever possible. If a resource cannot be avoided, BLM, SHPO, and the ACHP consult to determine the appropriate mitigation measures, according to the terms of the BLM National Programmatic Agreement (PA). Native American groups and the public are consulted as necessary.

To integrate further the BLM cultural resource policy with the goals and policies for other resources, BLM issued agency-wide Information Bulletin (IB) 2002-101 in May 2002. This IB has two goals. Goal 1 is to preserve and protect significant cultural resources and ensure they are available for appropriate uses by present and future generations. Goal 2 is to identify priority geographic areas based on probability of unrecorded significant resources.

Goal 1 is met by the inventory and evaluation of cultural resources and classification of resources into six use categories:

- scientific use
- conservation for future use
- traditional use
- public use
- experimental use
- discharged from management

Classified cultural resources in the first five categories are subject to management actions that preserve and protect the resource. Those discharged from management have all protective measures removed.

To meet Goal 2, sensitivity areas were developed for the Planning Area to inform future management decisions (Hoefler et al. 2002). High sensitivity areas are those parts of the Planning Area where the density of cultural resources is one per 118 acres. Moderate sensitivity areas have a density of one cultural resource per 234 acres, and low sensitivity areas have a density of one resource per 538 acres.

##### Management Actions

Management actions for each use allocation and sensitivity area are discussed below. Sensitivity area recommendations are summarized in Table 4-24, followed by recommendations for data collection, monitoring, geoarchaeological investigations, site evaluation policies, and impacts to private lands.

Table 4-24. Recommended Cultural Resource Management Actions

Sensitivity Zone	Recommended Action				
	Project Location	Areas Not Yet Inventoried	Areas Inventoried – No resources	Potentially Eligible Resources	Eligible Resources
High	Atop the Plateau	Conduct Class III inventory	Monitor	Avoid or test excavate	Avoid or implement data recovery plan
	Below the Rim	Conduct Class III inventory	Monitor	Avoid or test excavate	Avoid or implement data recovery plan
Moderate	Atop the Plateau	Conduct Class III inventory	Monitor	Avoid or test excavate	Avoid or implement data recovery plan
	Below the Rim	Conduct Class III inventory	No further work	Avoid or test excavate	Avoid or implement data recovery plan
Low	Atop the Plateau	Conduct Class I inventory	No further work	Avoid or test excavate	Avoid or implement data recovery plan
	Below the Rim	Conduct Class I inventory	No further work	Avoid or test excavate	Avoid or implement data recovery plan

Use Allocations

**Scientific** — Sites in this category need to be preserved and protected from all potentially damaging actions until the research potential is fulfilled. Once the research potential is fulfilled through excavations, surface collections, or any other appropriate method, further conservation is unnecessary.

**Conservation for Further Use** — Sites in this category should be segregated from all other land or resources uses, including cultural resource uses, which would threaten the maintenance of their present condition or setting. Protective measures and designations should be developed and implemented for these sites.

**Traditional** — Cultural properties in this category are to be managed in ways that recognize the importance ascribed to them and seek to accommodate their continued traditional use. Tribes should be consulted to determine how traditional use allocations should be protected, managed, and used.

**Public** — Cultural properties assigned public uses should be managed in a way that makes them available for use by the public, but at the same time protects the historic value of the property. For each site in this category, permitted uses and limitations need to be determined. The public, especially historical societies and educational institutions, should be consulted on possible uses and management of such properties.

**Experimental** — Should any sites be placed in this category in the future, the type(s) of experimentation allowed should be specified. It is further recommended that BLM develop a protocol to use for experimental sites including proposal review, monitoring implementation, and reporting requirements.

**Discharged from Management** — Properties discharged from management remain in the inventory, but are removed from further management consideration and do not constrain other land uses. No protective measures would be instituted for sites in this category. It is recommended that BLM develop specific criteria to determine when and how sites should be placed in this category. At a minimum these criteria should consider the physical condition, information potential, and public use potential of the site.

High-Sensitivity Zones

**Areas Not Inventoried** — Class III inventories should be conducted in both the upland and lowland areas where no inventories have occurred. Limited auger or shovel testing should be conducted at all

newly discovered sites. Testing should be of sufficient scope to describe subsurface deposits and make reasonable estimates on the probability of the presence of subsurface deposits.

**Inventoried Areas, No Resources** — In the upland high sensitivity areas, where no surface resources have been encountered, any ground-disturbing activity should be monitored. Such monitoring is needed because much of the surface is obscured by vegetation. In the lowlands, monitoring should occur in areas with potentially intact Holocene or late Pleistocene deposits. Should monitoring encounter any surface or subsurface materials, sufficient testing should be conducted to determine the vertical and horizontal extent of the deposit, evaluate site geomorphology and stratigraphy, salvage any identified manifestations, and determine NRHP eligibility.

**Potentially Eligible Sites** — Sites evaluated as needing additional data and located within areas of potential effect that cannot be avoided would require testing to refine NRHP eligibility further.

**Eligible Sites** — NRHP-eligible sites within the area of potential effect that cannot be avoided would require a data recovery plan to be formulated and implemented.

**Ineligible Sites** — In upland areas, these sites should be monitored during ground-disturbing activities and reevaluated if subsurface remains are found. Although these sites have been field evaluated as ineligible, the vegetation obscuring the ground surface brings into question evaluations of these sites. Many site forms have poorly written evaluation statements and it is unclear whether or not the sites are significant. No further work is recommended for ineligible sites in lowland areas.

#### Moderate-Sensitivity Zones

**Areas Not Inventoried** — Class III inventories should be conducted in upland areas and Class II inventories in the lowland areas. In the uplands section, auger or shovel testing should be conducted at all newly discovered sites. This testing should be of sufficient scope to describe the subsurface deposits and make reasonable estimates as to the probability of the presence of subsurface deposits. The location and amount of Class II inventory in the lowland areas should be determined on a case-by-case basis.

**Inventoried Areas, No Resources** — In upland moderate-sensitivity areas, where no surface resources have been encountered, any ground-disturbing activity should be monitored. Such monitoring is needed because much of the surface is obscured by vegetation. Should monitoring encounter any surface or subsurface materials, sufficient testing should be conducted to determine the vertical and horizontal extent of the deposit, evaluate site geomorphology and stratigraphy, salvage any identified manifestations, and determine NRHP eligibility. In the lowlands, monitoring should occur only in known areas of intact Holocene or late Pleistocene deposits with a good probability of containing intact cultural deposits.

**Potentially Eligible Sites** — Sites evaluated as needing additional data, located within areas of potential effect that cannot be avoided, would require testing to refine NRHP eligibility further.

**Eligible Sites** — NRHP-eligible sites within the area of potential effect that cannot be avoided would require formulation and implementation of a data recovery plan.

**Ineligible Sites** — Upland area sites should be monitored during ground-disturbing activities and reevaluated if subsurface remains are found. Although these sites have been field evaluated as ineligible, vegetation obscuring the ground surface brings into question evaluations of these sites. Many of site forms have poorly written evaluation statements and it is unclear whether or not the sites are significant. No further work is recommended for ineligible sites in lowland areas.

#### Low-Sensitivity Zones

**Areas Not Inventoried** — Conduct a Class I inventory to determine if known sites are in the area of potential effect. Special attention should be focused on possible early oil shale extraction and processing sites in the Roan Cliffs area. If the Class I study identifies areas where sites may occur, these areas should be subject to inventory.

**Inventoried Areas, No Resources** — No further work is recommended.

**Potentially Eligible Sites** — Sites evaluated as needing additional data, located within areas of potential effect that cannot be avoided, would require testing to refine NRHP eligibility further.

**Eligible Sites** — NRHP-eligible sites within the area of potential effect that cannot be avoided would require formulation and implementation of a data recovery plan.

**Ineligible Sites** — No further work is recommended.

### **Policy Recommendations**

#### **Data Collection Policy**

Temporal information is not currently being collected in the study area and accurate temporal information is lacking for most prehistoric sites in the study area. Projectile point and ceramic chronologies have proven less than useful as an indicator of site age. To rectify this situation, different types of information need to be gathered. The best source of temporal information is material that can be dated by radiocarbon methods or ceramic shards that can be dated by thermoluminescence. It is recommended that BLM encourage the collection and analysis of datable materials and develop procedures for the controlled collection and analysis of such samples on all monitoring and testing projects. Any material that is collected for dating should, at a minimum, meet one of the following conditions: (1) the sample is in stratigraphic context, and/or (2) the sample is in good association with artifacts or features.

#### **Monitoring Policy**

The monitoring recommendation is presented to determine if cultural material is being obscured by vegetation in the highlands and to develop a better understanding of sediments correlated with cultural deposits. It is recommended that monitoring be conducted on all ground-disturbing activities in the areas outlined above until sufficient information is gathered to determine if (1) the vegetation is obscuring additional cultural remains in the uplands, and (2) certain sediments contain buried cultural components. The results of such monitoring should be reviewed annually to determine if this approach is reaching the stated objectives.

#### **Geoarchaeological Policy**

To ensure that the archaeologist conducting test excavations or monitoring activities is adequately informed, a geoarchaeological investigation of the study area is desirable (Waters 1992). A geoarchaeological investigation focusing on the formation of current and past landforms and sediments and the ages of sediments provides a context to evaluate subsurface cultural deposits discovered during testing or monitoring. A geoarchaeological evaluation can be done two ways. A geoarchaeological specialist can be required to be part of any investigation where ground disturbance is likely. Alternatively, a geoarchaeological overview of the study area would be initiated and the results made available to future archaeological investigations. It is recommended that BLM pursue funding for a geoarchaeological overview of the study area, or require a geoarchaeological specialist on all archaeological monitoring and testing/excavation projects. Such work is critical for proper NRHP evaluations to be conducted.

#### **Site Evaluation Policy**

It is recommended that a more rigorous methodology of NRHP site evaluations be required, particularly on sites that may contain historic archaeological remains or are representative of a single occupation. In formulating site recommendations, the research questions presented at the end of the Results Section should be used as a basis for the recommendations. Research questions presented in Reed and Metcalf (1999) can also be used if applicable to the study area, and research questions not identified in the Class I overview (Hoefler et al. 2002) can also be used if they identify an applicable research problem. Following a method such as that outlined below may remedy some of the evaluation bias problems discovered in the

site analysis. First and foremost, it is recommended that the method presented in Little et al. (2000) be used as a model for evaluation methodology. The method includes the following steps:

1. Identify the data set(s) or categories of archaeological, historical, or ecological information available for the property.
2. Identify the historic context(s), i.e., the appropriate historical and archaeological framework in which to evaluate the property.
3. Identify the important research question(s) that the data sets can be expected to address.
4. Taking archaeological integrity into consideration, evaluate the data sets in terms of their potential and known ability to answer research questions.
5. Identify the important information that an archaeological study of the property has yielded or is likely to yield.

***Recommendations for Inventory of Private Lands in the Planning Area***

To develop information on portions of the study area not under Federal jurisdiction, archaeological investigations on private lands are encouraged. Section 112 of the NHPA encourages Federal agencies to work with private landowners whose property contains historic resources. The types of sites on private lands and the information contained within them are needed to complete the picture of prehistoric and historic developments in the area. This may be a unique opportunity to develop a public-private partnership to explore the prehistory and history of the upper Grand Valley. It is recommended that BLM actively pursue partnerships with existing Federal, State, and non-profit programs to help inventory, evaluate, and protect cultural resources on private lands.

**4.4.3 Socioeconomics**

**4.4.3.1 Introduction**

A number of the management changes proposed by BLM have the potential to produce socioeconomic (sociological and economic) impacts. Proposed changes in the amount of Federal mineral estate available for oil and gas leasing could substantially increase the region’s mineral fuel reserves and would extend the length of time that the region would continue to supply oil and gas. These changes would also increase Federal and local government revenues and local employment. Other management actions proposed under the various alternatives analyzed in this RMPA/EIS—e.g., to establish ACECs, close some of the roads in the Planning Area to public motorized or mechanized use, and prohibit cross-country travel in most of the Planning Area—could change the recreational experience in the area, which in turn could alter the pattern of local expenditures for recreation equipment and supplies.

Proposed management changes under the various alternatives would have the potential to alter the perceptions of area residents about their lifestyles and the quality of their lives. Impact assessment standards used in this analysis are described below. Because impact assessment involves professional judgment, often based on contradictory elements, the standards should be viewed as guidelines. Some proposals could have impacts that vary in degree depending on the scale of comparison. For example, changes in the grazing program could have a major impact on individual ranchers, a moderate impact on grazing in the region, and a negligible impact on the local economy. In general, adverse impacts are described in terms of the local economy or the local community of residents.

- **None** – The action is unlikely to result in any change in socioeconomic conditions.
- **Negligible** – The action may bring about temporary, short-term, or marginal changes that are unlikely to be of interest to the general public. If the impact indicator could be quantified, it would be less than 1 percent of the current or future condition.

- **Minor** – The action may bring about permanent or temporary changes that would not substantially alter socioeconomic conditions that could be of interest to some of the general public. If the impact indicator could be quantified, it would be 1 to 5 percent of the current or future level.
- **Moderate** – The action is likely to bring about permanent or long-term changes that alter socioeconomic conditions and would be of interest to the general public. If the impact indicator could be quantified, it would be 5 to 15 percent of the current or future level.
- **Major** – The action is likely to bring about permanent or long-term changes that substantially alter socioeconomic conditions and would be of significant interest to the general public. If the impact indicator could be quantified, it would be more than 15 percent of the current or future level.

Note that the same terms are applied in a more relative sense to describe beneficial impacts.

#### 4.4.3.2 Impacts of Proposed Plan

The potential social and economic impacts of the Proposed Plan are considered in the context of the fast growing, dynamic environment of the region. The Planning Area is in Garfield County, one of the fastest growing counties in Colorado. Garfield County also hosts the fastest growing area of oil and gas development in Colorado. The socioeconomic analysis measures the potential direct, indirect, and cumulative impacts of the Proposed Plan on population, housing, cost of living, employment, personal income, and dependency on Federal lands. Environmental justice and transportation are considered in subsequent sections.

#### *Socioeconomic Impacts of Oil and Gas Development*

Table 4-25 compares the potential socioeconomic impacts and trends for Garfield County and the Planning Area under the Preferred Alternative and the Proposed Plan. These potential impacts are based on proposed oil and gas development for Garfield County as a whole and inside the Planning Area under the Preferred Alternative or Proposed Plan.

Estimates for drilling rigs in operation, wells drilled per year, oil and gas employment, total wells drilled, and natural gas production for Garfield County during the 20-year period of analysis are based on recent operation and drilling data as well as industry forecasts (*Post Independent* 2005, COGCC 2006). The estimates of the number of drill rigs, wells drilled per year, and total wells drilled for the Preferred Alternative and Proposed Plan were taken from Table 4-2. Annual oil and gas employment was estimated based on the number of drill rigs. Industry data reveal that about 30 to 45 jobs in Garfield County are associated with each operating drill rig (Barrett 2004, *Post Independent* 2006).

Indirect employment was estimated using a job multiplier of three from State data and recent research on oil and gas impacts for La Plata County, Colorado (CDLE 2004, Ft. Lewis College 2005). Indirect employment represents the jobs in support services that would be created by oil and gas employment.

Gas production for the 20-year planning period was estimated using an average annual production rate for a well with a 30- to- 40-year lifetime and production levels taken from the RFD (Appendix H). This assumption simplifies the actual production curve for an individual well. However, new wells would be drilled each year throughout the 20-year planning period, and wells drilled early in the period may be declining as new wells are added. Therefore, total production from all wells would level out to an overall production rate within the estimated range. The estimated production rate for Garfield County assumes continued increases in annual gas production. In 2005, about 237 BCF of natural gas was produced in Garfield County (COGCC 2006). At this annual rate, about 5,000 BCF would be produced over 20 years.

**Table 4-25. Comparison of Potential Socioeconomic Impacts and Trends**

<b>Component Analyzed</b>	<b>Garfield County</b>	<b>Increment on BLM Lands in Planning Area</b>	
		<b>Alternative III (Preferred)</b>	<b>Proposed Plan</b>
Drilling Rigs in Operation	60 – 90	6-8	9
Wells Drilled per Year	1,500 – 2,250	79	86
<b>Annual Employment</b>			
Oil and Gas Employment	1,800 – 4,000	234	270 – 400
Indirect Employment	3,600 – 8,000	700	540 – 800
<b>Cumulative Gas Development over 20-Year Plan Period</b>			
Total Wells Drilled	10,000 – 20,000	1,324	1,570
Natural Gas Production 20 Years (BCF)	6,000 – 12,000	781	700 – 900
<b>Cumulative Fiscal Impact over 20-Year Plan Period</b>			
Value of Gas Production <sup>1</sup>	\$6 – \$12 trillion	\$7.8 billion	\$7 – \$9 billion
Property Tax Revenues <sup>2</sup> (to Garfield County)	\$72 – \$143 billion	\$93 million	\$84 – \$108 million
Property Tax Revenues <sup>3</sup> (Total)	\$300 – \$600 billion	\$390 million	\$350 – \$450 million
Federal Severance Taxes <sup>4</sup>	--	\$1,200 million	\$875 – \$1,125 million
State Share of Federal Severance Taxes <sup>5</sup>	--	\$600 million	\$438 – \$563 million

<sup>1</sup> Assumes long term gas price of \$10 per thousand cubic feet (EIA 2005).

<sup>2</sup> Assumes a mill levy of 13.655 on 87.5% of production value. (Garfield County 2005).

<sup>3</sup> Assumes a mill levy of 50 (Garfield County 2004).

<sup>4</sup> Would be reduced by an estimated \$40 million due to provisions of the Transfer Act regarding NOSRs 1 and 3.

<sup>5</sup> County totals depend on the amount of gas production on Federal lands.

Fiscal impacts of natural gas production were estimated using a long-term average gas price of \$10 per MCF (EIA 2005). Property tax revenues to Garfield County were estimated using a mill levy of 13.655 on the assessed value of gas production (87.5 percent)(Garfield County 2005). Potential Federal royalties (12.5 percent of production value) and the share of these royalties that would go to Colorado (50 percent) are included to illustrate additional revenues from the Preferred Alternative and Proposed Plan.

**Population and Housing**

Potential impacts of the Proposed Plan on population and housing are minimal if considered in the context of growth rates and patterns for central Garfield County. Population for Garfield County is predicted to more than double over the next 20 years, from just over 50,000 in 2005 to between 105,000 and 115,000 in 2025. Given an average household size of 2.7, the direct employment associated with the Proposed Plan could increase population by 730 to 1,080 persons, assuming that an average-size household moves into the area with the job (DOLA 2005). This amounts to less than 2 percent of the expected population growth in Garfield County over the next 20 years.

Housing has been a critical issue in Garfield County for the past few years because of very low vacancy rates and relatively high prices. Between 1990 and 2000, municipalities in Garfield County experienced population growth rates significantly higher than rates at which housing was being built (USFS White

River FEIS, Volume 2002). For example, the population of Rifle grew by about 40 percent between 1990 and 2000, but housing stock increased only 25 percent. Between 2000 and 2004, the Rifle population grew by about 15 percent, and housing stock grew at about the same rate (DOLA 2005). However, housing stock would have to grow faster than population to fill the housing gap. The housing vacancy rate in Rifle was just under 3 percent in 2004. By comparison, in 2004, the housing vacancy rate in Garfield County was just over 6 percent, and the Colorado average was about 12 percent (DOLA 2005).

A moderate to severe impact on housing availability could occur if employees choose to live in municipalities such as Rifle, Silt (2004 housing vacancy rate 1.5 percent), or Parachute (4.5 percent vacancy rate). Currently, insufficient vacant housing exists in Rifle, Silt, and Parachute combined to accommodate the 270 to 400 potential households associated with direct oil and gas employment under the Proposed Plan. However, Garfield County as a whole currently has 1,200 vacant housing units or more. Also, employment practices in the oil and gas industry in Garfield County—such as use of temporary drill rig crews and subcontractors from outside the region—could reduce the need for permanent housing. Depending on access routes to oil and gas production in the Planning Area and resident housing needs, the Proposed Plan could exacerbate the local housing crunch. Mitigation measures could include applying federal royalty revenues to construction of temporary and permanent affordable housing in central Garfield County.

#### **Employment and Personal Income**

Total employment in Garfield County was just under 30,000 in 2005 (DOLA 2006a). It is expected to increase to between 45,000 and 60,000 during the next 20 years. In 2001, employment in mining and extractive industries (including oil and gas) represented less than 2 percent of total employment in Garfield County (DOLA 2003a). Therefore, the 270 to 400 jobs associated with oil and gas development under the Proposed Plan would be insignificant. The indirect employment (540 to 800) in goods and services jobs supported by the oil and gas industry would also be insignificant in the greater Garfield County employment picture. Total employment (direct and indirect) expected from the Proposed Plan (810 to 1,200) would constitute less than 5 percent of present employment in Garfield County. Therefore, significant employment impacts would be unlikely to result from the Proposed Plan.

Since oil and gas jobs have relatively high wages, they could have a larger impact on personal income than overall employment. Average wages for oil and gas jobs range from about \$40,000 to \$100,000 per year (Fort Lewis College 2005, DOLA 2006a, *Post Independent* 2006). This range is higher than average wages for jobs in the top five employment categories for Garfield County (construction, retail trade, real estate, hotel and food service, and government)(NWCOG 2005). Median household income in Garfield County was \$48,018 in 2003 (BLS 2005). Almost three-fourths of all personal income in Garfield County is derived from wages or salaries (DOLA 2005). Therefore, the relatively high-paying oil and gas industry jobs resulting from the Proposed Plan could have a small positive (beneficial) impact on personal income levels in Garfield County.

Although oil and gas jobs pay relatively high wages, the cost of living in Garfield County is also higher than average. A recent study of the Rural Resort Region in Colorado that includes Garfield County found that a hypothetical family of four living on the median household income for the area would be facing 13 percent higher cost of living in Garfield County than a standard city (NWCOG 2004). The higher cost of living in Garfield County is due primarily to higher housing costs, which are almost double those of the standard city. It takes a household with more than double the median income to qualify to purchase a home of 1,800 to 3,000 square feet in Garfield County (NWCOG 2005). Therefore, the higher paying oil and gas jobs under the Proposed Plan (and Alternatives I through V) could have a small beneficial impact on the standard of living in Garfield County by enabling more households to meet the higher cost of living without lowering their living or housing standards.

### Tax and Other Government Revenues

Taxes on revenues from oil and gas production in Garfield County contribute a significant and growing share of total government revenues. In 2004, taxes on oil and gas production were almost 18 percent of Garfield County's total revenue of \$44 million (Garfield County 2005). Property taxes on oil and gas production represented almost half of total property taxes collected in Garfield County that year. The school districts in the vicinity of the Planning Area rely on property taxes from the oil and gas industry for more than three-fourths of their annual funding (*Post Independent* 2006). Another revenue source from oil and gas production in Garfield County consists of State and Federal severance tax distributions, including both direct distributions and grants. With natural gas production in Garfield County increasing and gas prices rising, tax revenues from this source would probably have an increasingly significant impact on government revenues.

Property taxes are paid to the cities and counties on the value of annual oil and gas production, as well as land and improvements owned and leased by the gas producers. In Garfield County, 87.5 percent of this total value is assessed with a tax rate of \$0.013655 per dollar of property value. For the value of natural gas production estimated under the Proposed Plan, tax revenues to Garfield County would be about \$4 to \$5 million per year over the planning period. This would constitute about 10 percent of total annual revenues to Garfield County at current budget levels. In addition to county taxes, gas producers pay taxes to school districts and municipalities. These tax revenues are a large share of the budgets for the school districts (Garfield RE-2 and District 16) in proximity to the Planning Area. Therefore, the gas production estimated under the Proposed Plan could have a small beneficial impact on total county property tax revenues but a larger beneficial impact on revenues for school districts in Rifle and Parachute.

In addition to property and sales taxes, gas producers pay between 2 and 5 percent of gross income as State severance taxes on every cubic foot of gas produced inside Colorado. This tax revenue is distributed through the DOLA Affairs Energy and Mineral Impact Assistance fund. The State of Colorado uses a complex set of formulas and conditions for distributing State and Federal severance tax revenues (see Appendix M). About 7.5 percent of the State severance taxes are given back to the local governments, depending on the share of resident oil and gas employees living inside the county or municipality. Recently, Garfield County and the City of Rifle saw significant reductions in their severance tax distributions because the State changed how it determined "resident" employees (*Post Independent* 2006). According to press reports, Garfield County's portion of severance tax revenues decreased from \$2.7 million in 2004 to \$2.1 million in 2005 because the number of qualified resident employees dropped from 900 to 476, despite significant increases in overall gas production and employment in Garfield County during the same 2-year period. Because of Colorado's complex severance tax distribution system, it is difficult to estimate the amount of State severance taxes actually received by the counties and municipalities due to natural gas production under the Proposed Plan. The impact of these possible revenues is likely to be beneficial, and perhaps substantially so, to the City of Rifle and Town of Parachute.

Another source of tax revenues relevant to the Proposed Plan is Federal Mineral Severance Tax distribution. For natural gas production on Federal lands, 12.5 percent of the production value is collected as severance taxes. This revenue is divided evenly between the Federal and State governments. The Federal half of the revenues collected on BLM lands is used as follows: 20 percent to the general treasury and 80 percent to the Reclamation Fund for Bureau of Reclamation Projects. The other half of the collected revenues is returned to the State as compensation for mineral production impacts and to fund mitigation measures. Colorado distributes these funds according to a complex set of formulas and conditions. Appendix M provides more information on severance tax distribution and a worksheet for estimating distributions to local governments.

The severance tax revenues collected on oil and gas production on BLM lands inside the Planning Area is subject to an additional condition in the agreement that transferred the NOSR from DOE to BLM. This

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condition requires that about \$40 million spent on oil and gas development on the NOSRs must be repaid before severance tax funds would be dispersed to the State. Colorado's distribution system is too complicated to allow a reliable estimate of the Federal severance tax funds that would be distributed to the counties and municipalities under the Proposed Plan. Based on production and revenues estimated over the 20-year planning period, Colorado's share of the Federal Severance Tax would be about \$22 to \$28 million per year.

In 2003, Colorado's share of Federal Severance Tax revenues was about \$63 million, with about \$36 million coming from oil and gas production (DOLA 2005b). In that year, Garfield County received about \$1.3 million in Federal Severance Tax distributions (Garfield County 2003). Since then, the value of oil and gas production has increased across Colorado, especially in Garfield County. Therefore, the impact of potential Federal Severance Tax revenues from oil and gas production under the Proposed Plan could have a substantial beneficial impact on revenues for Garfield County and the municipalities near the Planning Area. However, whether these funds would be sufficient to pay for mitigation measures to offset negative impacts would depend on how the funds are distributed. Significant effort by local governments may be required to secure these funds, especially grant funds for mitigation projects (Appendix M).

### **Environmental Justice**

An environmental justice review requires that each Federal agency identify any "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Under the Proposed Plan, it is very unlikely that minority or low-income populations would suffer a disproportionately severe effect.

The largest minority population in the Planning Area is the Hispanic community, representing about 17 percent of the Garfield County population in 2000 (Sonoran Institute 2003a). The Hispanic population in Garfield County has been growing at a fast pace. Between 1990 and 2000, this population segment increased from 1,673 to 7,300 (RRR 2005). In 2003, almost one-third of total school enrollment was Hispanic (RRR 2005). The Hispanic population appears to be dispersed throughout Garfield County, as demographics for Rifle and Parachute show similar results for percentage of Hispanic population (Sonoran Institute 2003 b,c).

Garfield County presents some challenges to low income families because of the relatively high cost of housing in the region. Median household income in Garfield County in 1999 was just over \$47,000 and about one-fourth of all households earned less than \$30,000 (Sonoran Institute 2003a). In 1999, a household earning median income could not afford the median priced house (Sonoran Institute 2003a). In 2003, just over 8 percent of children in Garfield County were living in poverty. Average wages for the top job categories were all below median household income, ranging from \$13,624 annual wages for food and accommodation services up to \$38,200 for construction jobs in 2002 (RRR 2005). This means that many households need two or more wage earners to live in Garfield County; more than two-thirds of all families in Garfield County contained at least two wage earners in 1999 (Sonoran Institute 2003a). Under the Proposed Plan, the direct jobs for oil and gas development generally have wages above the median household income (Denver Post 2005). This could result in a small beneficial impact on household economic conditions in the region.

Overall, no evidence suggests that the Hispanic community or low-income population segments would be affected by the Proposed Plan to a greater or lesser degree than any other population segment.

### **Cumulative Impacts**

The proportion of cumulative socioeconomic impacts from the anticipated level of oil and gas development under the Proposed Plan is very minor. For example, the estimated 1,570 new wells on BLM lands in 20 years would be in comparison to the projection of 10,000 to 20,000 for the county during the same timeframe (Table 4-25). There could, however, be some significant socioeconomic

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impacts to the Town of Silt, City of Rifle, and Town of Parachute, depending on employee housing requirements and the distribution of Federal Severance Tax revenues.

Moreover, while the contribution to impacts of the Proposed Plan are insignificant compared to the cumulative impacts from the county-wide oil and gas development and county-wide population growth, the impacts of the cumulative total could be significant, even under the No Action alternative. For example, while 300 to 400 new households under the Proposed Alternative is not significant in comparison to the large growth forecasted for Garfield County over 20 years, limited availability of housing in these municipalities could create some impacts over the mid-term. The rate at which housing is being built in these municipalities has not kept pace with past growth. If significant shares of the potential new households are located in Silt, Rifle, or Parachute, current housing would be insufficient.

To address the potential mid-term shortage in both temporary and permanent housing, it would seem appropriate to use Federal Severance Tax revenues to meet this need. However, Colorado’s distribution system for these funds does not guarantee that they would be available to the affected municipalities. Therefore, the potential exists for some adverse impacts to housing availability in Silt, Rifle, and Parachute, and the means to mitigate these impacts may not be readily available.

**Impacts on Hunting and Hunting-related Revenues**

Tourism is an important economic force in Garfield County, supporting 18 percent of all jobs in the County in 2003 (DOLA 2006c). Tourists require lodging, restaurants, sporting goods stores, guide and outfitter services, food, fuel and other types of supplies. In addition to Ski Sunlight, the Hot Springs Pool, and the Glenwood Caverns Adventure Park in eastern Garfield County, the many types of outdoor recreation opportunities throughout the County attract tourists. Hunting, fishing, river rafting, and OHV use draw visitors from throughout the state and nation.

In central Garfield County, big game hunting in particular is viewed as critical to the economy. In addition to providing economic diversity, hunting gives a seasonal boost to many local businesses that could not otherwise survive. In addition to outfitters and sporting goods stores, restaurants, motels, gas stations, motor vehicle sale and repair shops, and grocery stores all rely to some extent on hunting-season sales. Interviews with business people in the Roan Plateau area frequently elicited a comment that the hunting season makes the difference between profit and loss for the year.

Big game hunting occurs primarily on public lands managed by BLM or USFS. The Planning Area is nearly coincident with CDOW GMU 32, which is a popular hunting destination that includes the top of the plateau. During the 1990s, the number of deer and elk hunters in GMU 32 usually exceeded 2,500. However, the number has declined in recent years due to decreased numbers of deer and resultant changes in hunting regulations. In 2002, the number of hunter recreation-days (5,800) was less than half the average for the previous 10 years. Table 4-26 provides hunting statistics.

**Table 4-26. Big Game Hunting Effort and Impact on Local Economies in 2002 <sup>1</sup>**

<b>Game Management Unit(s)</b>	<b>Hunters</b>	<b>Hunter-Days</b>	<b>Direct Dollars</b>	<b>Indirect Dollars</b>
Planning Area and Immediate Vicinity (GMU 32) <sup>2</sup>	1,273	5,842	\$1,700,000	\$1,400,000
All GMUs Located Entirely or Primarily in Garfield County (GMUs 30 – 34)	10,782	48,273	\$16,100,000	\$12,900,000

<sup>1</sup> Source: CDOW (2004, 2005)

<sup>2</sup> Data for GMU 32 pro-rated from combined data for all GMUs.

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At least three outfitters hold permits to provide guide and outfitting services in the Planning Area. The one outfitter interviewed felt that hunting success was poor atop the plateau because the prevalence of motorized vehicle use quickly drove the game to less accessible locations including large tracts of private land to the west. The outfitters employ as many as 20 people for 3 to 4 months each. CDOW recently estimated the economic impacts of big game hunting in Garfield County at \$14.4 million in 2002. Using total recreation-days to pro-rate total estimated expenditures, it is estimated that approximately \$1.7 million were expended in Garfield County by deer and elk hunters using the Planning Area and immediate vicinity in 2002 (Table 4-26).

The Planning Area is mostly contained within GMU 32, while GMUs 30, 31, 33, and 34 include most of the remainder of Garfield County. In addition to the direct expenditures by hunters are associated indirect economic impacts. Using a multiplier of 1.8 from CDOW and Colorado Demography statistics, the total direct and indirect economic impacts of hunters in the Planning Area and immediate vicinity was just over \$3 million in 2002 (CDOW 2004, DOLA 2004). Potential economic expenditures for fishing were not included as a potential economic impact because the Planning Area is not a significant fishing destination in comparison to other locations in Garfield County.

CDOW statistics indicate that big game hunting effort and harvest inside the Planning Area have been on a downward trend for the past 15 years. Early in this period, the declines were probably related to a combination of natural and human-caused factors. More recently, declines reflect more stringent restrictions on hunting levels permitted by CDOW in an attempt to facilitate recovery of the declining deer population. Due in part to these recent declines, hunting is a relatively small contributor to total tourism expenditures in Garfield County. Data for 2002 were not available, but in 2003, tourism expenditures (including tourist services, resorts, and second homes) amounted to over \$90 million. However, big game hunting expenditures can be locally substantial and timely, especially for specific types of commercial enterprises (sporting goods suppliers, motels, restaurants, etc.).

The impact of natural gas drilling on deer and elk populations has recently been studied in Wyoming and is currently under study in Garfield County (Sawyer et al. 2005, Post Independent 2006)(see Section 4.3.2.2 of this RMPA/EIS). Results from these studies are somewhat inconclusive. For the Wyoming study of a migratory deer population, Sawyer et al. (2005) reported a 46-percent reduction in overall population 4 years after drilling began. While most of the decline followed a severe winter, no similar decline was observed in a “control” area without oil and gas activity. Even without the population decline, it was clear from earlier years of the study that deer were shifting their patterns of use away from the oil and gas activity. Preliminary results of the study in Garfield County indicate no significant impact of drilling activity on resident mule deer populations. Therefore, more analysis would be needed before a definitive estimate of impacts of oil and gas development on BLM lands under the Proposed Plan could be made.

As described in Section 4.3.2.2 of this RMPA/EIS, various assumptions regarding avoidance by deer and elk of active oil and gas development and the effectiveness of seasonal restrictions on development within winter range and year-round restrictions on use in wildlife security areas were used to estimate effective habitat loss. The result was an effective loss of 19.2-percent of the mapped winter range in the Planning Area. Even so, however, this does not necessarily mean that the populations of deer and elk in the Planning Area and adjacent GMUs would be affected sufficiently to alter current levels of hunter use.

Restrictions on cross-country travel atop the plateau under the Proposed Plan could also affect the experience of hunters by not allowing use of ATVs or other motorized or mechanized vehicles off designated routes. As with reductions in the amount of available winter range, however, it is not possible to estimate whether these restrictions would alter hunter use of the Planning Area to an extent that could be detected economically.

***Impacts on Recreational Travel and Related Revenues***

The Proposed Plan would designate all BLM lands in the Planning Area as the Roan Plateau ERMA, with custodial objectives and implementation actions intended to (1) retain some level of opportunity for participation in traditional recreation activities, (2) provide for visitor health and safety, (3) address use and user conflicts, and (4) protect resources.

Two significant changes from current travel and transportation management could have socioeconomic impacts related to changes in patterns of human use. The first is restricting or closing motorized travel on 26 miles of BLM routes atop the plateau and 2 miles below the rim. The second is managing the JQS Road for historical and public use but diverting industrial travel to Cow Creek Road for access to the top of the plateau. Access for oil and gas development through private land on the west (i.e., in the Parachute Creek valley) could also receive a substantial portion of oil and gas traffic. Although modifying public use patterns somewhat, the route closures and restrictions are unlikely to impact significantly the traditional uses in the Planning Area. Table 4-27 shows the travel management designations for BLM lands under the Proposed Plan, Preferred Alternative, and No Action Alternative.

<b>Table 4-27. Comparison of Travel Management Designations</b>				
<b>Category</b>		<b>No Action</b>	<b>Preferred</b>	<b>Proposed Plan</b>
<b>Travel Designation</b>		<b>Acres</b>		
Open to Motorized and Mechanized Travel		66,934	0	2,640
Limited		0	66,934	64,474
Closed		0	0	0
<b>Route Management</b>		<b>Miles</b>		
Open to Motorized or Mechanized Use	Atop the Plateau	162	113	86.5
	Below the Rim	97	96	86.5
Limited to Administrative Access	Atop the Plateau	0	24	52
	Below the Rim	0	0	16
Closed to Motorized or Mechanized Use	Atop the Plateau	0	26	26
	Below the Rim	0	0	2

The Proposed Plan would designate Hubbard Mesa as open to OHV travel. Motorized and mechanized travel on all other BLM public lands in the Planning Area would be limited to designated routes except for over-snow travel by snowmobiles where snow cover is at least 12 inches of snow. These designations would not exclude vehicles used for emergency, official, or other authorized purposes. OHV travel and access may also be limited at certain times or seasons, in certain areas, or to certain vehicles types and numbers of vehicles. In Colorado, off-road driving is one of the fastest growing recreation activities (Colorado State Parks 2003). The economic impact of OHV use in Colorado is estimated between \$200 million and \$230 million per year (Colorado State Parks 2003). While current OHV and mountain bike use numbers for Hubbard Mesa are not available, designation as a free-ride area is likely to increase its use as a riding destination. This could result in a positive economic benefit to the community through increased tourism and demand for tourist services

Potential impacts of oil and gas development under the Proposed Plan on traditional recreation opportunities would vary depending on the type of recreation and experience being sought. Many recreation opportunities would be protected by NGD/NSO and SSR/CSU restrictions in areas of sensitive resources values—including an SSR/CSU in the Hubbard Mesa OHV Riding Area. As noted in the 1999 FSEIS, “Non-motorized recreation values in places outside these areas may be affected by road

construction and a change in the overall recreation setting if oil and gas development occurs within them. Construction of roads and well pads makes an area appear less natural and less remote and increases the likelihood that the visitor would encounter other visitors, most likely on motorized vehicles.”

Depending on the pattern of oil and gas development inside the Planning Area, the character of some areas could change from a more primitive, remote experience to one with more human impacts and interactions with other people. These changes would be less noticeable in areas with existing roads that receive regular traffic. For visitors seeking a motorized recreation experience and expecting to encounter other visitors, these changes could be considered positive. Visitors who prefer more natural settings with fewer visitors and less obvious human-caused landscape modifications would likely view these changes as negative (BLM 1999a). While these changes may affect the types of visitor experiences being sought, the effect on tourism expenditures is expected to be negligible.

#### **4.4.4 Transportation and Traffic**

##### **4.4.4.1 Introduction**

Potential impacts on the Planning Area transportation system include changes in the amount and type of traffic and the construction of new roads or abandonment of existing roads. Changes in the level of traffic and the type of traffic inevitably have secondary impacts on the governmental entities that manage the road system and may have to deal with increased maintenance and other traffic management issues, like safety. Road construction and abandonment also have secondary effects, either increasing or decreasing the need for maintenance and system management.

Whatever impacts are brought about by changes in BLM management in the Planning Area, traffic levels near and into the Planning Area are expected to increase. Table 3-31 in Section 3.4.4 describes traffic levels that might occur in the year 2023. The relatively low levels of traffic occurring currently at critical Planning Area access points suggest the potential for changes in public land uses to have a major effect at those points. CR 242, the JQS Road, shows 84 average daily trips currently and a projected 113 in 2023. CR 244 at Fravert Reservoir shows 317 and 428 trips, respectively.

The change in BLM management with the greatest potential to affect traffic levels would be offering for lease the oil and gas mineral estate in the NOSRs. An assumed 210 wells would be drilled above the rim and 1,360 below the rim under the Proposed Plan. The lower drilling rate atop the plateau reflects a combination of a smaller area of available land, more difficult access, a thicker geologic section to penetrate, more stringent environmental constraints, and a reduced drilling season due to snow accumulation (an assumed 6-month season)(Appendix H).

The traffic generated by an average of approximately 78.5 wells per year during the 20-year period of analysis is shown in Table 4-28. The table includes the number of vehicle trips required to develop a single well, the number required for an assumed 78.5 wells per year, and the average daily traffic generated by 78.5 wells. These numbers are derived from data used previously by Notar (1998) in modeling air quality impacts from oil shale development on the NOSRs.

In addition to increases in traffic volume, oil and gas development has a substantial impact related to the construction of new roads or upgrading of existing routes for access to well pads. These newly constructed or improved roads are the source of much of the environmental impact of drilling due to removal of vegetation, disturbance of the soil, invasion of disturbed soil by noxious weeds and other undesirable plants, erosion of disturbed soil into streams, and airborne dispersal of disturbed soil particles as fugitive dust. Construction or upgrading of access roads can affect visual quality, impact surface water and aquatic habitat at stream crossings, and increase fugitive dust. Potentially, new or upgraded roads can also affect wildlife through increased disturbance (more noise and larger vehicles) and increased habitat fragmentation. Risks of damage to paleontological and cultural resources also increase in proportion to new or upgraded roads.

**Table 4-28. Vehicular Traffic Expected for Oil and Gas Drilling on BLM Lands<sup>1</sup>**

<b>Vehicle Class</b>	<b>Total Number of Trips for One Well<sup>2</sup></b>	<b>Total Trips in One Year (78.5 Wells)<sup>3</sup></b>	<b>Average Daily Trips for 78.5 Wells<sup>4</sup></b>
16-wheel Tractor-Trailers	88	6,908	19
10-wheel Trucks	216	16,956	46
6-wheel Trucks	452	35,482	97
Pickup Trucks	404	31,714	87
<b>Total</b>	<b>1,160</b>	<b>91,060</b>	<b>249</b>

<sup>1</sup> Does not account for efficiencies associated with phased and clustered development under the Proposed Plan.

<sup>2</sup> Trips by different vehicle types are not necessarily distributed evenly during the drilling process.

<sup>3</sup> Number in one year based on 1,570 well in 20 years (avg. = 78.5 per year)(Table 4-2).

<sup>4</sup> Average daily trips based on 30 days to complete a well.

The most important impact on transportation is the addition to the existing network of roads in an area. When new oil and gas development roads are abandoned, BLM may elect to retain some of these roads and open them to public use. Some of the new access roads are likely to provide opportunities for recreational travel into otherwise remote, undisturbed locations. Whether this is viewed as a negative or beneficial impact depends on the perspective of the potential user. Any oil and gas roads that BLM deems inappropriate for retention following abandonment would be reclaimed.

BLM road construction standards are applied in the design of access roads for oil and gas development or other uses. These standards have proven effective in mitigating soil erosion problems related to disturbance from construction operations. Actions such as limiting road grades, providing proper water drainage including ditches and culverts, applying surface materials such as gravel, avoiding excessive earthwork and sidecast of materials, and implementing dust abatement techniques can effectively mitigate adverse impacts. BLM requires that the operator obtain all necessary local permits, including the hauling permits required by Garfield County.

Roads to producing wells are generally maintained periodically by the operator to provide year-round access. Maintenance activities such as surface blading, culvert and ditch cleaning, spot surfacing, and weed control are required to meet road standards and minimize resource impacts. When a well is plugged and abandoned, BLM usually requires the rehabilitation and closure of roads related to the site, unless overriding benefits to the public dictate that a road remain open for travel.

#### **4.4.4.2 Impacts of Proposed Plan**

##### **Direct and Indirect Onsite Impacts**

**Management Actions** — The Proposed Plan would designate the East Fork Parachute Creek and Trapper/Northwater Creek ACECs atop the plateau, the Magpie Gulch and Anvil Points ACECs below the rim, a WMA for the entire Parachute Creek drainage basin on BLM lands, and manage to maintain the WSR-eligible streams. BLM would close and rehabilitate 28 miles of existing roads, including 26 miles above and 2 miles below the rim. Below the rim, 86.5 miles of roads would remain open to motorized or mechanized use. Above the rim, a total of 86.5 miles of road above the rim would remain open to motorized or mechanized travel, and an additional 52 miles would be limited to administrative use. In the short term, BLM would have to pay for rehabilitation of the roads closed above the rim, but maintenance costs would be reduced in the long term.

Despite the limitation of travel on some routes to administrative use, the overall growth in the road system would open previously isolated areas of public land to motorized use. The limitation to

administrative use of new roads would be beneficial but would not eliminate the increased generation of noise and dust, diminution of visual quality, and changes in wildlife use along new roads or existing roads improved for oil and gas access. However, these potential adverse impacts are also expected to be much less under the Proposed Plan than Alternatives I through V, due both to clustered development and to a focus on locating oil and gas facilities along ridgetops in areas atop the plateau. While having a locally greater visual impact along the ridgetop roads in areas of oil and gas development, this focus reduces substantially the number and length of roads within the more sensitive stream valleys.

Traffic on the remaining open roads and trails would increase incrementally over time and might also show increases due to displaced use from closed roads. However, the change in the character of the landscape above the rim, from heavily motorized to a greater emphasis on non-motorized recreation, might in fact reduce overall use of roads above the rim.

Road segments shared by oil and gas lessees, grazing permittees, and recreationists, whether for vehicular or non-vehicular travel, would represent some level of conflict for the latter group in terms of traffic, noise, dust, safety, and the quality of the experience.

**Impacts from Oil and Gas Development** — All BLM lands and Federal mineral estates underlying private surface estates in the Planning Area would be available for oil and gas leasing under the Proposed Plan. Eventually, the road network above the rim might change by the addition of an estimated 16 miles of new or upgraded roads due to oil and gas development. This would add substantially to the 86.5 miles to remain open to public motorized or mechanized use and the 52 miles to remain open only to administrative use above the rim. Below the rim, up to 108 miles of roads might be added to the 86.5 miles to remain open to motorized or mechanized use. These additions would require substantial management by BLM to oversee maintenance, maintain closures, and monitor use.

The primary access routes to the area atop the plateau for oil and gas development is via Cow Creek Road, which enters the area from Rio Blanco CR 5 to the north, or from a route across private land to the west (from the Parachute Creek valley). BLM currently intends to preclude use of the closest direct access from Rifle—JQS Road (CR 242)—for oil and gas activities involving heavy or oversize vehicles. Garfield County may elect to establish other restrictions pertaining to oil and gas travel in pickup trucks or other smaller vehicles. The latter restrictions could be based on safety concerns and interference with other uses such as recreational travel.

The amount of traffic due to oil and gas development would depend on the rate and distribution of development in any one year. However, the estimated 78.5 wells drilled per year under this alternative could result in 249 additional trips per day, mostly by vehicles larger than pickups. If all of the pro-rated portion attributable to development atop the plateau (approximately 33 trips per day) were to travel via SH 13 and CR 5 to Cow Creek Road, the impact would represent an increase of 1.6 to 2.2 percent on SH 13 north of Rifle and approximately 16 to 22 percent on CR 5 (see Table 3-27). These estimates assume that traffic associated with development on BLM lands atop the plateau would be compressed into a 6-month drilling season, consistent with the assumption of the RFD (Appendix H).

If half of the oil and gas traffic were to access BLM lands atop the plateau by a planned new route through private lands to the west (from the Parachute Creek valley), the increase in traffic would be halved to approximately 0.8 to 1.1 percent on SH 13 and 8 to 11 percent on CR 5. However, traffic along CR 215 north of Parachute would increase by approximately 1.3 to 1.8 percent (see Table 3-27).

If all of the pickup truck traffic associated with drilling atop the plateau were to travel via the JQS Road, the impact on that road would be approximately 47 trips per day (assuming a 6-month drilling period), representing an increase of 42 to 56 percent (Table 3-27).

***Offsite and Cumulative Impacts***

Adding an estimated 93 miles of new roads to the existing 259 miles on BLM lands during oil and gas development would be offset to some degree by the closure and rehabilitation of 28 miles of existing roads under the Proposed Plan. New roads or trails built for range improvements would add to the oil and gas total. Oil and gas access roads would have multiple secondary impacts on natural resources and ecosystem values, not only due to physical disturbance but also because the expanded route network would increase vehicular traffic in areas of public and private land that had previously been isolated. Limiting new roads on public lands to administrative access would not eliminate secondary impacts.

It is unlikely that the County road system within the Planning Area will grow, because the dispersed private lands within the Planning Area are already served by County roads. In contrast, the road network on private lands created to serve oil and gas development will continue to grow, with or without implementation of the Proposed Plan or any of the five alternatives analyzed previously. Assuming that the per-well estimate of 0.6 mile used in the RFD (Appendix H) for BLM lands also applies to private lands, approximately 124 miles of new roads might be constructed or upgraded to access development in these areas. The estimate may be high, because the per-well average length of access road is likely to decrease as the number of wells increases through time.

Development of new roads within the Planning Area and increases in traffic on County, State, or Federal highways in response to increased drilling in the Planning Area would be additive to regional increases that are accompanying general population growth and the development of oil and gas resources in nearby offsite areas.

County road maintenance costs would reflect the level of increased activity on County roads.

**4.5 MANAGEMENT ENVIRONMENT****4.5.1 Lands and Realty**

Under the Proposed Plan, as in Alternative II of the Draft RMPA/EIS, BLM would recommend the revocation of the withdrawals for NOSRs 1 and 3. If approved, this would allow entry and patenting under the Mining Law of 1872.

All public lands within the Planning Area, with the exceptions noted below, would be designated Category II and thus subject to multiple-use management and available for exchange. This would include several parcels (12 to 15, 21, and 22) that were identified for disposal (Category I) under the 1984 GSRA RMP. The parcels are now contiguous with a more substantial parcel of public land (NOSR 3) and are no longer considered small or isolated.

Parcel 11 (approximately 40 acres in the NE $\frac{1}{4}$ , SW $\frac{1}{4}$ , Section 21, Township 6 South [T6S], Range 96 West [R96W]) and Parcel 20 (39.98 acres in Lot 10, Section 29, T6S, R94W) would remain Category I because they are small and isolated from other public land. Four other parcels formerly within the NOSR surface or mineral estate would be placed in Category I. They are located in the extreme northeastern portion of the Planning Area near SH 13 (35.28 in Lot 11, Section 6, T5S, R93W); on top of the plateau in the middle of a large tract of private property (39.7 acres in Lot 10, Section 10, and Lot 10, Section 11, T6S, R95W); just north of I-70 in the Cottonwood Gulch drainage (40 acres in the SE $\frac{1}{4}$ , NE $\frac{1}{4}$ , Section 33, T6S, R95W); and in the northwestern portion of the Planning Area (73.38 acres in Lots 5 and 7, Section 4, T5S, R95W).

Some 35,000 acres of the NOSRs and another 5,000 acres would be classified as Category III lands. Their status as lands within one of four ACECs, within areas having wilderness character, would preclude their consideration for exchange or sale.

The utility corridor along the western side of SH 13 and across Hubbard Mesa and Hubbard Gulch to I-70 would be identified as a formal BLM utility corridor for new pipelines and utilities. The 40-acre parcel adjacent to the Rifle Sportsmen's Club would be designated as suitable for expansion of the club under terms of the R&PP.

All direct impacts upon the lands and realty program would be administrative in nature, with no direct environmental impacts. Other programs and resources would be affected by the revocation of the NOSR withdrawals, by the change in land tenure categories, by the availability of land near the Rifle Sportsmen's Club for R&PP lease, and by the designation of formal utility corridors.

This alternative would not result in indirect, offsite, or cumulative environmental impacts on the lands and realty program.

### **4.5.2 Onsite Travel Management**

#### **4.5.2.1 Delineation of Travel Management Areas (TMAs)**

The TMA delineation for the Roan Plateau Area allows muscle-powered (i.e., foot, ski, horse, stock) cross-country travel year-round. Mechanized (wheeled conveyance) travel in the TMA is limited to designated routes year-round.

The Hubbard Mesa TMA delineation (same boundary as the Hubbard Mesa OHV Riding Area) allows muscle-powered (i.e. foot, ski, horse, stock) travel and mechanized (wheeled conveyance) travel cross-country year-round consistent with the "open" OHV designation for motorized use below.

All TMA delineations are subject to additional restrictions (e.g., seasonal, area, type, and number) set forth in the ROD or in subsequent travel planning.

#### **4.5.2.2 Designation of Off-Highway Vehicle (OHV) Management Areas**

Travel management designations vary among the alternatives analyzed, according to the acreage that would be designated as open to motorized cross-country travel, or limited to designated routes, or closed to motorized and mechanized travel. Additionally, the alternatives vary in the degree to which routes in designated "limited" areas are open to public use, versus administrative use only or closed to all use.

The Hubbard Mesa OHV Riding Area is designated as "open" to cross-country motorized travel. In all other portions of the Planning Area, with BLM surface, motorized travel is classified as "limited" to designated routes except snowmobiles which are allowed to travel cross-country if there is at least 12" of snow (see 43 CFR 8342.1). OHV travel and access may also be restricted at: certain times/seasons, in certain areas, and/or to certain vehicular types and numbers.

The designation excludes:

- Any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes
- Any vehicle whose use is expressly authorized by the authorized officer, or otherwise officially approved (e.g., grazing permittee, CDOW personnel).
- Vehicles in official use. Official use means use by an employee, agent, or designated representative of the Federal Government or one of its contractors, in the course of his employment, agency, or representation (43 CFR 8340.0-5(a)(1-5)).

OHV includes any motorized vehicle capable of, or designed for, travel off an improved road and on, or immediately over, land, water, or other natural terrain. Table 4-27 in Section 4.4.3 summarizes the OHV designations and route management for the Proposed Plan, Alternative III (Preferred), and Alternative I (No Action). Over-snow travel by snowmobile would be allowed throughout the Planning Area under all

alternatives (with at least 12 inches of snow cover), except that Alternative II of the Draft RMPA/EIS would limit snowmobiles to designated routes.

Also under all of the alternatives, closure of any routes would include some degree of reclamation, typically consisting of decompaction, recontouring, seeding with an appropriate native seed mix, and (where needed) installing an erosion-control fabric or similar material. Upon abandonment, any new roads constructed for oil and gas development would also be reclaimed, unless BLM determines that a road should be retained for another use. During the period of oil and gas drilling and production, roads constructed for that purpose are to be closed to public use; in most cases. Locked gates would be placed across the roads to safeguard facility investments from damage by vehicles and reduce conflicts between public land users and gas production.

#### 4.5.2.3 Impacts of Proposed Plan

A total of 28 miles of existing routes would be closed and rehabilitated, another 68 miles would be limited to administrative uses, and 2,640 acres would be open to cross-country travel in the Hubbard Mesa OHV Riding Area (Table 4-27 and Map 27). New roads associated with oil and gas development would be designated for administrative use only.

##### Direct and Indirect Onsite Impacts

Impacts are summarized below by resource management program. Programs not described below are not expected to affect the system of roads and trails.

**Recreation** — The public has become accustomed to using the identified route system as open under the interim travel designations. Implementation of the proposed travel designations will cause minor changes in access compared to what is currently available under the interim travel routes. Negligible changes in the current diversity of recreational activity opportunities available to the public will occur.

**Oil and Gas Development** — With the entire Planning Area available for lease, oil and gas drilling is assumed to result in up to 124 miles of new or upgraded roads, including 16 miles atop the plateau. Note that this is substantially less than under the five alternatives analyzed in the Draft RMPA/EIS (Table 4-2), reflecting the requirement for phased and clustered development on top and BLM management toward clustering to a comparable surface density below the rim. All new roads would be designated for administrative access only. Therefore, the public will see no gain in miles of roads for public use.

**Special Management Designations and Restrictions** — Special management emphases associated with designation of four ACECs, the Parachute Creek WMA, and the WSR-eligible streams would affect onsite travel management to the extent that any needed new roads could require special alignment, design, and mitigation measures consistent with the qualities emphasized by the special designations. Restrictions on surface uses, including NGD/NSO and SSR/CSU restrictions for a variety of sensitive resources, would also affect the location or design/mitigation of new roads.

**Visual Resource Management** — The principal VRM component under the Proposed Plan that would affect the system of existing or new routes is the NGD/NSO restrictions for the VRM Class I area of the East Fork Falls and visually highly sensitive areas of the I-70 viewshed (i.e., slopes steeper than 30 percent visible from I-70). These would preclude new road construction unless exception criteria were met (Appendix C). The SSR/CSU restrictions for VRM Class III areas atop the plateau would allow BLM to require relocation of the proposed alignment and/or require special design or mitigation to reduce the visual impacts.

**Livestock Management** — Over the long term, livestock management would require periodic construction of fences, ponds, springs, and other range improvement projects. Each of these could require a new access route for construction and/or long-term maintenance. Any new roads for this use would be open only for administrative uses.

**Wildlife and Special Status Species Management** — Seasonal restrictions to protect wildlife, special status species, or their habitat could temporarily limit construction and certain types of use of roads and trails.

**Weeds and Weed Management** — Roads and trails serve as conduits for the introduction and spread of invasive plants, including State-listed noxious weeds (Section 3.3.1). Noxious weeds and other undesirable invasive plants generally share the ability to become established and proliferate quickly once introduced into suitable environments such as disturbed ground along roads and other travel routes. The spread of weeds is usually at the expense of more desirable native plants (and, indirectly, wildlife). Roads and trails are ideal corridors for weed dispersal because they create long linear disturbances to existing vegetation and soils which are ideal for colonization, result in soil compaction that native species cannot tolerate, change the hydrologic regime by increasing or disrupting runoff, create a zone of warmer temperatures, create zones of dust accumulation, or (if magnesium chloride is used as a dust suppressant) create a zone of saline conditions. Road and trails also serve as corridors along which vehicles, hikers, and livestock serve as vectors to transport weed propagules into uninfested areas.

To reduce dispersal of weeds related to construction of new roads, BLM may require specific abatement or mitigation measures during construction or reclamation of roads in areas of weed infestations.

**Riparian/Wetland Areas** — To maintain or improve the functioning of riparian/wetland areas, existing roads and trails could be rerouted, repaired (e.g., a culvert installed), or removed. In most cases, new routes would be required to avoid or minimize impacts to these habitats.

#### **Offsite and Cumulative Impacts**

A total of 259 miles of existing routes would be closed and rehabilitated for resource reasons, and another 68 miles would be limited to administrative uses. Since the estimated increase of 93 miles of roads would be open only for administrative uses, the cumulative change of all the actions will be a minor loss of publicly accessible routes.

### **4.5.3 Recreation**

#### **4.5.3.1 Introduction**

Public lands are increasingly recognized as crucial to meet the growing recreation demand of the neighboring communities. The activity, setting, and experience/benefit opportunities vary among the alternatives in terms of quantity, quality, and distribution. All of the alternatives analyzed, including the Proposed Plan, offer differing levels of dispersed recreation opportunities consistent with the management of priority land uses. Hubbard Mesa was identified as a SRMA in some alternatives for more structured and focused recreation management.

#### **4.5.3.2 Impacts of Proposed Plan**

Managers must consider the direct and indirect effects, both short-term and long-term, of the Proposed Plan and subsequent implementation actions to determine the impacts on recreation activities, recreation settings, and the recreation experience and benefit opportunities.

#### **Recreation Activities**

The available opportunities for dispersed recreational activity that would remain following implementation of the Proposed Plan would be a consequence of its components rather than a specific management objective. The Consultation and Coordination process, following publication of the Draft RMPA/EIS, did not establish either an identified market for structured recreational opportunities or a need to manage Hubbard Mesa for more than the current activity opportunities associated with OHV driving/riding and mountain biking. To meet the activity opportunity demand, Hubbard Mesa would be designated as the Hubbard Mesa OHV Riding Area but not as an SRMA defined by BLM's *Land Use*

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*Planning Handbook* (BLM 2001a). Hubbard Mesa would be identified for recreation and visitor services with the other public lands as part of the Roan Plateau ERMA. It should be noted that recognition of a singularly dominant activity demand of and by itself, however great, is not a sufficient basis for the identification of an SRMA (BLM 2001a).

Activities, settings, and experience/benefit outcomes are of greatest importance to residents of nearby communities and to destination visitors. Since recreation would not be a management focus but one of several allowable multiple uses, the effects on participants and their recreation opportunities are inconsequential relative to achieving the general management objective of the Proposed Plan.

### **Recreation Settings**

The physical, social, and administrative characteristics of the recreational setting produces different experience and benefit opportunities for recreation participants. During preparation of the Draft RMPA/EIS, and ROS analysis was used as a basis to assess the character of the recreation setting for each alternative. The ROS classes (shown in Maps 39 through 42 of the Draft) portray the existing character of recreational settings (No Action Alternative) and the possible setting character created by each alternative. The physical ROS classes, and the corresponding extent (in acres) of each on BLM lands under existing conditions, are as follows:

▪ Urban	0
▪ Rural	2,826
▪ Front Country	19,076
▪ Middle Country	24,539
▪ Back Country	20,493
▪ Primitive	0

While the Draft RMPA/EIS determined different acres of the ROS classes to the various alternatives, the Proposed Plan does not emphasize recreation or visitor services. Although public comments on the Draft RMPA/EIS indicated a demand for undeveloped recreation settings, BLM has concluded that management to accommodate substantial oil and gas development precludes maintaining characteristics specific to undeveloped recreation settings. Instead, recreation managers would custodially manage the entire Planning Area as an ERMA. This recognizes that recreation settings under the Proposed Plan would be affected by the development of oil and gas and assumes that recreational users would adjust their activities and patterns of use in response to short-term and long-term changes in the physical, social, and administrative setting. The resulting recreational settings and recreation outcomes are considered consequences of the Proposed Plan and not prescribed as recreation management objectives. As the physical, social, and administrative settings change, some recreational activities, experiences, and benefit opportunities would be lost, and some visitors who prefer those recreation settings would be displaced.

### **Recreation Management**

BLM policy limits recreation program investments and implementation actions in ERMA to those that “take care” of stewardship needs associated with recreation-tourism activity participation. Recreation management within the Roan Plateau ERMA will be limited to custodial implementation actions aimed at (1) providing for visitor health and safety, (2) addressing use and user conflict, and (3) protecting resources. Recreation management guidelines (Appendix E) were developed to help achieve and maintain healthy public lands as defined by the Standards for Public Land Health in Colorado (Appendix F). These guidelines provide implementation methods and techniques that will help custodially manage recreation to meet resource objectives. Thus, the Proposed Plan would not have foreseeable impacts to custodial management of the Planning Area as an ERMA.

**Direct and Indirect Onsite Impacts**

**Oil and Gas Development** — Oil and gas development and production facilities often adversely impact recreation opportunities through physical/visual disturbance, noise, dust, odors, and additional traffic and people. Within appropriate densities, effectively designed and implemented gas development can be compatible with maintaining middle-country, front-country, rural, or urban ROS classes and the connected recreational opportunities. Increasing levels of oil and gas development under any of the alternatives would represent decreased opportunities for people seeking back-country or primitive recreational settings but increased opportunities for people seeking the other settings.

The requirement for phased and clustered development atop the plateau would greatly reduce the extent of any changes in recreational settings, since the number of pads would be relatively small (thirteen anticipated during the 20-year period of analysis) and limited to only one development area at a time. Another component of the Proposed Plan that bears on recreation is the focus on locating oil and gas facilities on ridgetops. While this would tend to make the facilities more visible to travelers along access roads servicing the development area, the ridgetop emphasis would avoid or minimize the amount of activity and setting disturbance to the deeper stream valleys.

An indirect impact of oil and gas development on recreation is the likely displacement of big game and other sensitive species by distances of 0.25 to 0.5 mile from access roads, depending on traffic volumes, road quality, topography, and density of vegetation cover near the road (Noss 2003). Changes in big game habitats and habits would alter the experience or even displace people who visit an area because they enjoy the wildlife, scenery, views, and aesthetics of the area. Onsite outfitter/guide operations would also be affected, although the extent of change cannot be estimated.

**Livestock Grazing and Range Management** — Signs of livestock grazing, such as the presence of cattle or sheep, fences, driveways, stock tanks and ponds, cropped forage, trampled vegetation, or manure affect the natural aesthetics for some recreationists and impair their ability to enjoy the scenery, views, and aesthetics of the area.

**Travel Management** — Recreational roads and trails enhance access to the outdoors. Travel directly affects setting remoteness, naturalness, site management, and social encounters. A system of designated routes would reduce travel-related impacts on recreation settings and could reduce recreational trespass on adjacent private lands. The quality of recreation activities including hunting and wildlife viewing, would be improved by restricting public travel to designated routes that are designed to reduce displacement of big game animals.

For some visitors, the restriction of motorized and mechanized travel to designated routes throughout most of the Planning Area is likely to be positive, since it is intended to reduce the numbers of informal trails that are created and thus to protect visually and ecologically sensitive areas. For some visitors, however, these restrictions may make the affected areas unsuitable for their intended outcomes. It is hoped that the designation of the Hubbard Mesa OHV Riding Area as “open” to cross-country travel by motorized or mechanized vehicles will help offset the restrictions elsewhere on BLM lands in the Planning Area.

**Offsite and Cumulative Impacts**

The diversity recreation settings on public lands administered by BLM in the Planning Area offer a multitude of “close-to-home” recreational opportunities (activity, setting, benefit) not provided by other local recreation service providers (e.g., state wildlife areas, state parks, and community parks). The White River National Forest does manage for some of the same recreation activity, setting, and experience opportunities, but these are more distant from the communities.

The demand for recreation and the associated settings and opportunities in the Planning Area would have individually minor but cumulatively moderate or greater impacts, as follows:

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- Increased traffic on recreation routes
- Population growth, especially in surrounding communities and within easy driving distance (USFS 2002)
- More diverse values within a changing population and less understanding of traditional uses
- Continued changes in land uses and the different expectations of land users
- Potential reconstruction and upgrading of I-70, resulting in increased use
- Increases or decreases in oil and gas development and other activities on public lands
- Recreation management changes, especially OHV restrictions, in the White River National Forest
- Expansion of destination resorts in the region
- Development on adjacent private property and in-holdings
- Continuing changes in recreational equipment that affect where and how people may recreate; of particular concern to those who pursue activities such as hiking or hunting in less developed and less used areas
- Displacement of some recreationists to other public lands or to other regional providers of dispersed recreation opportunities in undeveloped settings, assuming that capacity is available
- Growth in the extent of the economic benefit of tourism, which may cause a demand for increased recreation opportunities on public lands
- Increased public demand to provide motorized trails in suitable areas
- Increased traffic on recreation routes

### Mitigation

Since recreation is not a focus of management but an allowable multiple use within the ERMA, maintaining a specifically identified recreation opportunity is not a management priority, so no mitigation is proposed. If crowding during the hunting season becomes an issue, CDOW has the ability to limit the numbers of hunters in GMU 32, as has been done recently to aid in recovery of mule deer populations following a regional decline.

## **4.5.4 Grazing and Rangeland Management**

### **4.5.4.1 Introduction**

A number of proposed management actions for the Planning Area as part of this RMPA/EIS have the potential to impact livestock grazing and rangeland management and health. Two categories of actions are described and assessed:

1. Management actions specifically directed at rangeland resources in terms of the resources (i.e., range condition) and the grazing permittees who use BLM lands to graze their livestock.
2. All other proposed land uses and management actions that would affect rangeland management and resources, including vegetation management (focused on the ecological aspect of vegetation rather than as forage for livestock), oil and gas development, special land use designations, management of travel and recreation, and actions taken to protect or enhance habitat for fish and wildlife.

Direct impacts to grazing and rangeland management as used in this RMPA/EIS are defined as those that affect the allotment permittees in terms of lease conditions, such as allowable AUMs (Section 4.5.4) and season of use. Direct impacts may affect all three interrelated attributes of rangeland health as defined by BLM: soil/site stability, hydrologic function, and biotic integrity (BLM 1997a). In turn, all of these may

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influence the rangeland condition that most directly and proximately affects the number of domestic grazers that can be supported: forage quality and quantity. Impacts to forage quality and quantity may be negative, such as reduced biomass production and increased prevalence of weeds, or positive, such as increased biomass production and increased prevalence of desirable species.

A number of indirect impacts to rangeland management and health are also possible under any of the alternatives analyzed. Indirect impacts of surface disturbance include a general loss of forage area or availability of forage due to surface occupancy for other uses, construction or widening of roads, direct and indirect damage to soils and vegetation, and closure of specific areas to livestock to protect or enhance one or more other resources. Livestock may be harassed by vehicular traffic, human visitors, and their dogs. Introduction or expansion of noxious weeds through various vectors can poison livestock but more commonly replaces preferred forage with unpalatable and or less-productive plant species.

Impacts to soils or vegetation cover can also result in transport of eroded soils to streams and ponds, where the sedimentation reduces the availability and quality of watering areas. A catastrophic release of a chemical pollutant into a watering source could cause direct harm to livestock or make watering areas unusable; such releases are infrequent, but could occur during oil and gas development or chemical control of noxious weeds or other undesirable plant species.

Cumulative impacts are discussed in terms of past, present, and future actions on private lands within the Planning Area and both public and private lands in nearby offsite areas.

This section discusses vegetation as a forage source in support of ranching operations in the Planning Area. In many cases, the AUMs on BLM lands utilized by the local ranches form a key source of forage in the yearly feed budgets for their operations. However, the vegetation resources in the Planning Area are also managed for their intrinsic values under the Proposed Plan guided by specific objectives for the major natural plant communities in the Planning Area. Land Health Standards for riparian systems (#2) and upland vegetation and animal communities (#3) acknowledge the multiple uses of the vegetation resource by discussing management along a continuum of characteristics. Managing vegetation for one aspect of the resource can result in conflicts with the other. For example, precluding livestock use of sensitive plant communities such as riparian habitats would enhance the vegetation (and associated fish and wildlife) values but would reduce the amount and quality of forage for livestock, require augmented management, and force grazing permittees to provide for additional sources of water.

The converse would also be true. Managing vegetation for maximum livestock productivity, palatability, and nutrition often involves planting non-native forage species to supplement native species suppressed or lost due to prolonged grazing use. Maximizing livestock production generally also means placing these large grazers into plant communities that are less resilient to the impacts of trampling and selective plant removal. This is acknowledged by Stoddart et al. (1975):

“It is impossible to obtain the best use of a range without some disturbance, and the rancher cannot always have climax vegetation as his goal.”

In a more recent edition of their book, the same authors (Stoddart et al. 1975) discuss this point farther. For example, at page 428 is the following statement:

“Grazing...and wildlife production are...legitimate and important uses of rangelands. Since no single use can be maximized without affecting and perhaps negating the other, trade-offs must be evaluated in some sort of optimizing process. In some cases, a landowner or [governmental entity] may unilaterally decide to emphasize a given product at the expense of others. However, this kind of land use is becoming rare, since society demands many goods and services from land whether public or private.”

The conflicts between livestock operations, wildlife management, and other uses are addressed throughout this analysis; additional ramifications to vegetation are discussed in Section 4.3.1.

Wild herbivores that rely directly on vegetation for food range from mice to elk. Besides competing among themselves for this resource, wildlife also compete directly with livestock for the forage and thermal cover and hiding cover this vegetation provides, as well as for the other limiting resources of water and space. Any changes in use of vegetation by livestock necessarily affects wild herbivores, and vice versa. Because livestock occupy an area at greater than-sustainable levels (i.e., they are grazed in numbers that exceed the long-term carrying capacity of an area and then removed seasonally or when conditions are poor), the result of the direct competition is generally in favor of livestock and at the expense of wildlife. For example, where focused livestock use of riparian areas is allowed, the quality of the plant community as an intrinsically valuable resource and important wildlife habitat is reduced. Likewise, increased areas of human activity can cause wildlife to avoid an area with suitable forage, leaving more of the resource available to livestock than might otherwise occur. In some locations—not the Planning Area—where native hoofed herbivores (ungulates) are not hunted, they quickly habituate to human presence or occupy the land at abnormally high densities due to the refuge effect (e.g., parks and residential areas on the margins of cities and towns). In these situations, native ungulates can adversely affect ranching operations by removing substantial amounts of forage planted and managed primarily for livestock.

Other land use and resource management considerations would cause BLM to apply various surface-use restrictions and management prescriptions to protect specific resource values. These protective measures are listed and defined in Section 2.2. Note that NGD/NSO restrictions do not affect use of an area for grazing but would affect the ability of a permittee to construct permanent improvement range improvements (e.g., construction of fences, stockpounds, etc. to direct livestock use), except as approved by BLM on a case-by-case basis. This is also true of the SSR/CSU restrictions that give BLM the authority to require relocation of a proposed ground-disturbing activity by more than 200 meters if necessary to protect a specific resource value. Unlike other alternatives, the Proposed Plan also requires any long-term ground-disturbing activity resulting from range improvements to be subject to reclamation guidelines and BMPs to meet resource objectives and standards (Appendices I and L). Such actions are subject to annual monitoring and reporting as a basis for assessing revegetation success and correcting shortcomings (Appendices J and K).

Note that TL restrictions (seasonal restrictions on use) intended to protect raptor nests, waterfowl nests, and big game winter range, do not apply to livestock but could be applied to applications for ground-disturbing activities such as construction of a stockpond, road, fence, or water pipeline.

As with all the considered alternatives, the continuing authorization of livestock grazing in the Planning Area under the Proposed Plan would be managed for conformance with BLM's Colorado Standards for Public Land Health and Guidelines for Livestock Grazing Management (Appendix F). Therefore, categories used to define impacts of specific land use or management actions on range condition and livestock grazing are defined in terms of these standards and guidelines, as follows:

- **None** – Effects are unlikely to impair the resource value, with no amount of physical disruption to the resources. Permittees would see no impacts to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- **Negligible** – Detectable effects could occur but would last no more than one year (that is, not detectable after one full growing season). Anticipated effects are unlikely to result in noticeable impairment or enhancement of the resource value in terms of Land Health Standards. Permittees would see no noticeable impacts to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- **Minor** – Effects are likely to result in noticeable but not substantial impairment of the resource value in terms of Land Health Standards, but the total area of disruption would include less than 5 percent of the resource. Permittees would see less than 5-percent impairment to current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.

- **Moderate** – Effects would be noticeable and could include substantial impairment of the resource value in terms of Land Health Standards. These effects could increase over time, or be long-term or permanent. The total area of disruption would include 6 to 15 percent of the resource. Permittees would see 6- to-15 percent impairment of current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.
- **Major** – Effects would be noticeable and are likely to include substantial impairment of the resource value. These effects may increase over time or be long-term or permanent. Permittees would see more than 15 percent impairment in current lease terms and conditions, allotment sizes, stocking rates, or season-of-use conditions.

Note that the same terms are used, although in a more relative sense, to describe anticipated beneficial impacts. The following subsections describe the anticipated impacts of proposed rangeland management activities, as well as impacts of all other resource values, on rangeland management.

#### 4.5.4.2 Impacts of Proposed Plan

Livestock grazing would be managed under the Proposed Plan to conform to BLM grazing regulations and meet Land Health Standards as well as vegetation community objectives. Allotment management plans, to be developed and reviewed in collaboration with grazing permittees on a regular schedule, would provide a basis for monitoring rangeland health, evaluating existing grazing management, and making necessary grazing management adjustments to meet resource objectives and standards. Regular monitoring would occur on all allotments, using the Glenwood Springs Monitoring Plan (Appendix K).

A combination of administrative solutions (e.g., season-of-use revisions, livestock exclusions, and stocking level adjustments), range improvement projects (e.g., construction of fences or stockpounds to direct livestock use), and application of BMPs and reclamation standards would be applied to meet resource objectives and standards. These would utilize the most recent version of BLM Technical Reference 1734-6 or an equivalent document. As under Alternatives I through V, rangeland projects that do not function to meet resource values and management objectives would be abandoned and rehabilitated.

Provisions would be made for applications of adaptive management of livestock grazing to prevent long-term ecological damage during droughts. Criteria would be identified for determining the beginning and end of drought periods on the basis of scientifically credible methods and data (e.g., Palmer Drought Severity Index, Crop Moisture Index, and soil moisture). Under potential drought conditions, the Field Office Manager would determine the beginning of a drought and assign proactive grazing management measures to be taken to mitigate damage to livestock and ecological values (i.e. season of use adjustments, reduced stocking levels, or complete rest). Upon determination by the Field Office Manager that a drought had ended, gradual restocking and season of use adjustments would be initiated.

#### Direct and Indirect Onsite Impacts

**Grazing and Rangeland Management** — As described above, rangeland management under the Proposed Plan is expected to result in general and gradual long-term improvements to range condition and trend, with minor to moderate positive impacts to rangeland resources.

The Proposed Plan would require regular development and review of AMPs by permittees and BLM and regular monitoring of allotment health. Administrative solutions and/or range improvement projects may be required of permittees to meet resource objectives and standards. BMPs and reclamation standards would apply to range improvement projects, as would monitoring and reporting of revegetation success in such areas. These actions may result in minor negative impacts to some permittees.

**Vegetation Management Actions** — Vegetation would be managed for its intrinsic value, with a focus on achieving specific objectives for the major natural plant communities in the Planning Area as well as a forage base for livestock grazing. These include supporting diverse native community composition and

production on upland sites, using primarily only native species in revegetation seed mixes, and encouraging range, fuels, fire, and vegetation management activities that protect and/or enhance the health and productivity of native plant communities. It is expected that this combination of management actions would result in direct moderate positive impacts to upland vegetation and rangeland resources.

The Proposed Plan includes an emphasis on noxious weed inventory, detection, and monitoring. These actions would allow a more focused and effective application of the current weed management program by providing data and information upon which to base management decisions. These would include incipient population locations, priority-to-control strategies, and the efficacy of different integrated methods for particular species and locations. Over time, this would indirectly provide a minor to moderate positive impact to range resources.

Due to protection of range resources in riparian areas and river corridors, individual grazing permittees may be subject to more administrative solutions than at present. This could result in some minor to moderate impacts to affected permittees from potential adjustments to stock level and/or season of use.

**Travel and Recreation Management** — This alternative would restrict travel to designated routes, except that cross-country travel would be permitted in the Hubbard Mesa OHV Riding Area. When combined with the closure and revegetation of existing routes, these proposed management actions are likely to result in minor improvements to range condition and trend and decreased livestock disturbance.

**Oil and Gas Development** — Development of fluid mineral resources under the Proposed Plan would result in an estimated 193 well pads and an associated 812 acres of new long-term disturbance (1.1 percent of BLM lands in the Planning Area) during the 20-year period of analysis (Table 4-2). An additional 318 acres of temporary impacts are also estimated, for a total disturbance to 1.5 percent of BLM lands in the Planning Area.

Direct and indirect impacts to vegetation above the rim would be reduced by the requirement of phased and clustered oil and gas development atop the plateau and the goal of managing toward clustered development below the rim. Atop the plateau, key components of the Proposed Plan would include a minimum separation of 0.5 mile between well pads, location of pads on ridgetops with slopes of 20 percent or less, limiting development at any one time to a single “development area,” and limiting the amount of “currently disturbed” ground at any time to 350 acres (approximately 1 percent of BLM lands atop the plateau). In this context, “currently disturbed” means areas where vegetation has been stripped or otherwise removed or destroyed, and for which revegetation has not been initiated, has been in progress for less than two growing seasons, and/or is not showing satisfactory progress toward achieving revegetation success standards. If assumed BMPs, reclamation standards, and mitigation monitoring are implemented as described above, impacts to rangeland resources throughout the Planning Area would be minor. Exceptions may include some localized minor negative impacts to upland allotment areas, mostly below the rim, where allowed ground-disturbing activities would be cumulative to habitat degradation from ongoing ground-disturbing activities and drought effects and existing weed infestations. This could result in some negligible to minor impacts to affected permittees from required implementation of potential adjustments to stock level and/or season of use.

**Special Management Designations and Restrictions** — In general, few special resource management actions would result in impacts to rangeland resources. Some indirect benefits may occur as a result of selected ACEC and WMA management prescriptions for vegetation resources (Tables 2-2 and 2-3, respectively). Large and sometimes overlapping, NGD/NSO polygons would indirectly result in reduced loss of forage by limiting long-term ground-disturbing activities for the protection of other resources. Under the Proposed Plan, minor positive impacts to rangeland resources would result from special resource management actions and surface-use restrictions. Negative impacts to permittees as a result of these actions are expected to be negligible.

**Offsite and Cumulative Impacts**

Potential offsite impacts to rangeland resources would generally track those for vegetation resources. Although livestock grazing management under the Proposed Plan is expected to result in improvements to vegetation resources, the same management on private offsite lands cannot be assumed. Therefore, any potential negative impacts from livestock management offsite, including erosion, siltation, and other impacts to streams, as well as general vegetation degradation and noxious weed infestations, could negatively impact lands and forage within the Planning Area.

Negative impacts to forage production from oil and gas development are expected to be negligible to minor. However, in terms of cumulative impacts to vegetation it is important to note that a higher proportion of private lands within the Planning Area are below the rim, where upland habitat is already more degraded than above the rim. This is compounded by an assumed lesser emphasis on clustering (e.g., with an assumed 40-acre surface density throughout, versus a goal of 160-acre surface density on new Federal leases) and the fact that private landowners negotiate their own agreements with oil and gas companies regarding BMPs, reclamation standards, road designs, and other environmentally protective aspects of development. Failure to perform adequate reclamation or avoid riparian/wetland vegetation during offsite development could in turn potentially result in indirect impacts to BLM lands through the increased incidence of noxious weed and other undesirable plant introductions or transport of eroded soils and sediments.

Noxious weeds and other undesirable vegetation are assumed to occur at approximately the same densities offsite as onsite. If unmanaged, the offsite populations would serve as a source of continual infestation of the Planning Area, especially where human traffic and livestock or wildlife movement can serve to spread weed seeds, thus offsetting active, coordinated management under the Proposed Plan.

**Summary of Impacts to Grazing and Rangeland Management**

The general condition of rangeland resources would be expected to parallel those of vegetation resources and move in an upward trend under the Proposed Plan. However, this would be somewhat offset by existing fair to poor condition with a declining trend in some upland vegetation areas below the rim. Negative impacts to individual permittees could be negligible to moderate, depending on allotment location, timing of season of use, location, and existing conditions. Table 4-29 summarizes beneficial and adverse impacts to rangeland resources and grazing permittees under the Proposed Plan and five previously analyzed alternatives.

**Table 4-29. Summary of Impacts to Rangeland Resources and Grazing Permittees<sup>1,2</sup>**

<b>Management Action</b>	<b>Alt. I No Action</b>	<b>Alt. II</b>	<b>Alt. III Preferred</b>	<b>Alt. IV</b>	<b>Alt. V</b>	<b>Proposed Plan</b>
Rangeland Management	Resources: Negligible to Minor (+)  Permittees: None	Resources: Minor to Moderate (+)  Permittees: Minor to Moderate (-)	Resources: Minor to Moderate (+)  Permittees: Negligible to Minor (-)	Resources: Minor to Moderate (+)  Permittees: Negligible to Minor (-)	Resources: Minor to Moderate (+)  Permittees: Negligible to Minor (-)	Resources: Minor to Moderate (+)  Permittees: None to Minor (-)
Upland and Riparian/ Wetland Vegetation Management	Resources: Negligible to Minor (-)  Permittees: Negligible to minor (-)	Resources: Minor (+)  Permittees: Minor (-)	Resources: Minor (+)  Permittees: Negligible to Minor (-)	Resources: Minor (+)  Permittees: Negligible to Minor (-)	Resources: Minor to Moderate (-)  Permittees: None	Resources: Moderate (+)  Permittees: None to Moderate (-)

**Table 4-29. Summary of Impacts to Rangeland Resources and Grazing Permittees<sup>1,2</sup>**

<b>Management Action</b>	<b>Alt. I No Action</b>	<b>Alt. II</b>	<b>Alt. III Preferred</b>	<b>Alt. IV</b>	<b>Alt. V</b>	<b>Proposed Plan</b>
Travel and Recreation Management	<i>Resources:</i> Minor (-)  <i>Permittees:</i> None	<i>Resources:</i> Minor (+)  <i>Permittees:</i> None to Moderate (-)	<i>Resources:</i> Minor (+)  <i>Permittees:</i> None to Moderate (-)	<i>Resources:</i> Minor (+)  <i>Permittees:</i> Minor to Moderate (-)	<i>Resources:</i> Minor (+)  <i>Permittees:</i> None to Minor (-)	<i>Resources:</i> Minor (+)  <i>Permittees:</i> None to Minor (-)
Oil and Gas Development	<i>Resources:</i> Minor (-)  <i>Permittees:</i> None	<i>Resources:</i> Minor (-)  <i>Permittees:</i> Negligible to Minor (-)	<i>Resources:</i> Minor to Moderate(-)  <i>Permittees:</i> Negligible to Minor (-)	<i>Resources:</i> Minor to Moderate (-)  <i>Permittees:</i> None to Moderate (-)	<i>Resources:</i> Minor to Moderate (-)  <i>Permittees:</i> None to Moderate (-)	<i>Resources:</i> Minor (-)  <i>Permittees:</i> None to Minor (-)
Special Management Designation and Restrictions	<i>Resources:</i> Negligible (-)  <i>Permittees:</i> None	<i>Resources:</i> Negligible (-)  <i>Permittees:</i> Minor (-)	<i>Resources:</i> Negligible to Minor (+)  <i>Permittees:</i> Negligible to Minor (-)	<i>Resources:</i> Negligible to Minor (+)  <i>Permittees:</i> Negligible to Minor (-)	<i>Resources:</i> Minor (+)  <i>Permittees:</i> Negligible to Minor (-)	<i>Resources:</i> Minor (+)  <i>Permittees:</i> Negligible (-)

<sup>1</sup> Overall impact level after combining adverse (-) and beneficial (+) effects of land uses and management actions and after incorporating mitigation measures described in text.

<sup>2</sup> Impact levels of "None" indicate no impacts. Impact levels with "None" at the lower end of a range indicate that impacts would affect only some of the permittees.

## 4.5.5 Oil and Gas

### 4.5.5.1 Introduction

As described in Section 3.5.5.1, the Planning Area consists of 127,009 acres, of which 73,597 is Federal mineral estate (including split estate) and 53,412 acres of private minerals. Approximately 18,744 acres (25 percent) of Federal mineral estate is currently leased. The estimated technically recoverable gas resource within the Planning Area is 15,416 BCF, with the Federal mineral estate contributing 8,933 BCF of this total. This represents ultimate gas recovery assuming that all land within the Planning Area can be developed. The RFD (Appendix H) estimates actual producible reserves at 6,733 BCF and 14,938 MBO within the Planning Area and 3,632 BCF and 8,066 MBO within the Federal mineral estate for the 20-year planning period.

To help put the natural gas resource in the 73,602 acres of Federal mineral estate in the Planning Area into perspective, consider the following: Based on the estimated RFD production of 6,733 BCF of gas from the Federal mineral estate during the operational life of the field, an average Colorado household size of 2.5 persons (U.S. Census Bureau 2002), and an average annual consumption of natural gas per consumer in Colorado of 94,000 cubic feet (94 MCF)(DOE 2002), this resource is equivalent to the amount of natural gas needed to serve 3.6 million households for 20 years.

In general, the number of potential oil and gas wells drilled under each alternative depends in part on the amount of surface acreage made available for drilling. Areas available for drilling are open to oil and gas development and have no attached NSO stipulation (although fluid minerals beneath NSO areas are available using directional drilling). The length of time required to recover the oil and gas resource fully is unknown. A portion of the 18,744 acres of previously leased Federal mineral estate in the Planning Area is already being developed.

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The Proposed Plan would differ from Alternative I by allowing leasing throughout currently unleased portions of NOSRs 1 and 3, and it would differ from Alternatives II through V by the creation of a Federal Unit atop the plateau. Components of the Federal Unit and accompanying assumptions are described in detail in Section 2.3 and summarized below:

Alternatives I through V

*Atop the Plateau.* Surface density: 40 acres. Downhole spacing: Mesaverde – 40 acres assumed, but closer spacing allowed with directional drilling. Wasatch – 160 acres

*Below the Rim:* Surface density: 40 acres, except 20 acres for wells to drill beneath the cliffs. Downhole spacing: Mesaverde – 10 acres on 80% of pads, 20 acres on 20%. Wasatch – 160 acres.

Proposed Plan

*Atop the Plateau.* Surface density: 160 acres, established by minimum of 2,640 feet (0.5 mile) between pads. Downhole spacing: Mesaverde – 10 acres. Wasatch – 160 acres.

*Below the Rim:* Surface density: Managed for maximum practicable clustering (average of 80-acre surface density on new and existing leases assumed for impact estimation). Downhole spacing: Mesaverde – 10 acres. Wasatch – 160 acres.

To avoid a situation in which oil and gas development precludes or affects future oil shale development, BLM may require that wells drilled on top of the plateau be vertical until a depth below the oil-bearing shale strata is reached.

Table 4-30 compares the estimated number of wells and produced resource assumed to result on Federal mineral estate lands in the Planning Area under the Proposed Plan and other alternatives. Note that some values differ from the equivalent table in the Draft RMPA/EIS. This reflects different assumptions in regrading the downhole spacing (uniformly 10 acres in Table 4-30, but with 20-acre and 40-acre downhole spacings in the analogous table of the Draft).

**Table 4-30. Anticipated Oil and Gas Development in BLM Portions of the Planning Area**

<i>Planning Area Oil and Gas Components</i>	<i>Alt. I No Action</i>	<i>II</i>	<i>Alt. III Preferred</i>	<i>Alt. IV</i>	<i>Alt. V</i>	<i>Proposed Plan</i>
Total Planning Area	127,000 ac					
Federal Mineral Estate	73,602 ac					
Federal Minerals Leased	18,670 ac					
No-Lease Area	44,267 ac	21,382 ac	0 ac	0 ac	0 ac	0 ac
Deferred-Lease Area <sup>1</sup>	0 ac	0 ac	34,758 ac	0 ac	0 ac	0 ac
NSO Stipulations	13,912 ac	31,200 ac	30,928 ac	30,928 ac	21,609 ac	38,411 ac
CSU Stipulations	8,256 ac	7,015 ac	29,594 ac	27,486 ac	21,517 ac	30,833 ac
Standard Lease Terms, including Areas with TLs	7,167 ac	14,006 ac	13,080 ac	15,188 ac	30,476 ac	4,358 ac
Area Available for Surface Facilities <sup>2</sup>	15,423 ac	21,021 ac	42,674 ac	42,674 ac	51,993 ac	35,191 ac
New Wells in 20 Years <sup>3</sup>	855	905	1,324	1,324	1,582	1,570
Recoverable Reserves on BLM Lands	3,632 BCF					
Gas from Wells on BLM	974 BCF	1,031 BCF	1,510 BCF	1,510 BCF	1,803 BCF	1,790 BCF

**Table 4-30. Anticipated Oil and Gas Development in BLM Portions of the Planning Area**

Lands in 20 Years <sup>3,4</sup>						
Percent of Gas Reserves Recovered in 20 Years	27%	28%	42%	42%	50%	49%
Oil from New Wells on BLM Lands in 20 Years <sup>5</sup>	1.9 MBO	2.1 MBO	3.0 MBO	3.0 MBO	3.6 MBO	3.6 MBO
<b>Alternatives I – V</b>			<b>Proposed Plan</b>			
<sup>1</sup> For Alternative III only, leasing and drilling atop the plateau would be deferred until 80% of the total wells anticipated below the rim under Alternative III have been effectively completed to total depth and a production test performed. <sup>2</sup> Leasable area minus areas with NSO stipulations. <sup>3</sup> Natural gas produced over operational life of wells drilled on BLM lands in Planning Area during 20-year period of analysis. Based on RFD (Appendix H). Assumes 1.17 BCF per Mesaverde well and 0.7 BCF per Wasatch well; weighted average approximately = 1.14 BCF per well. <sup>4</sup> Does not include 197 existing BLM wells. <sup>5</sup> Oil recovered at average rate of 0.002 MBO per BCF of gas.			<sup>2</sup> Leasable area minus areas with NSO stipulations. <sup>3</sup> Natural gas produced over operational life of wells drilled on BLM lands in Planning Area during 20-year period of analysis. Based on RFD (Appendix H). Assumes 1.17 BCF per Mesaverde well and 0.7 BCF per Wasatch well; weighted average approximately = 1.14 BCF per well. <sup>4</sup> Does not include 197 existing BLM wells. <sup>5</sup> Oil recovered at average rate of 0.002 MBO per BCF of gas.			

**4.5.5.2 Impacts of Proposed Plan**

**Direct and Indirect Onsite Impacts**

The currently unleased Federal mineral estate in the Planning Area (about 55,000 acres) is likely to be developed in two groups: about 13,000 acres at lower elevations and 42,000 acres above the rim. It is probable that the latter area would be developed more slowly because of the greater costs of drilling and production associated with longer travel distances, less reliable access (including snow cover), the additional 2,000 to 3,000 feet of drilling depth required, and limitations on directional drilling.

As discussed previously, the top of the plateau would be leased as a Federal Unit. The purpose of this is to provide a mechanism by which BLM can ensure that development occurs in the phased and clustered progression that constitutes the CDNR proposal adopted by BLM as an outgrowth of the Consultation and Coordination process (Chapter 6). With an effective surface density of one pad per 160 acres resulting from the minimum distance of 2,640 feet (0.5 mile) between surface locations (well pads), and a downhole spacing of 10 acres for Mesaverde wells and 160 acres for Wasatch wells, this yields multi-well pads with up to 17 total wells (ten 16 Mesaverde and one Wasatch). By using directional drilling, with a currently assumed lateral reach of 2,500 feet, a GIS analysis of hypothetically located well pads in non-NSO areas, and along ridgetops with slopes of 20 percent or less (another component of the CDNR concept), it is estimated that more than 95 percent of the underlying oil and gas resources could be accessed.

Below the rim, BLM would not require phased and clustered development but would manage toward greater clustering than typifies current drilling in that area. The juxtaposition and irregular boundaries of private lands, leased Federal lands, and unleased Federal lands precludes the more regimented approach atop the plateau.

Under the Proposed Plan, the development scenario presented above is estimated to result in a total of 1,570 wells during the 20-year period of analysis. This number is derived from assumptions used in the RFD (Appendix H) and current drilling levels in the Planning Area. The assumptions used for the purpose of this RMPA/EIS are as follows:

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- **Atop the Plateau** — BLM assumes that for most of the 20-year period, two drill rigs will be operating on Federal lands on top of the plateau. This assumption is based on the much thicker section of bedrock that must be penetrated, combined with difficult access and an assumed 6-month drilling season due to inclement winter weather and snowpack. Additionally, BLM assumes that only one rig will be operating for the first 4 years as part of the initial exploration and “ramping up” phase. Other assumptions, taken directly from the RFD, are that a drill rig can complete 6 wells per year, based on 30 days per well and 6 months of drilling. Together, these assumptions result in an estimated 210 wells atop the plateau during the 20-year period of analysis.
- **Below the Rim** – BLM assumes that seven drill rigs will be operating on Federal lands below the rim for most of the 20-year period. Assumptions taken directly from the RFD include an average of 10 wells per drill rig per year, based on 20 days per well and a 7-month drilling window due to the 5-month TL for big game winter range. BLM also assumes that only six rigs will operate for the first 4 years because of current drilling programs in the area. Together, these assumptions result in an estimated 1,360 wells in 20 years.
- **Combined Area** – Summarizing the analyses presented above for the upper and lower plateau, the assumed development scenario for Federal lands includes one drill rig atop the plateau and six below the rim for the first 4 years, and then two drill rigs on top and seven below for the remaining 16 years. Therefore, an assumed total of 1,570 new wells would be drilled during the 20-year planning period. The actual number and distribution of rigs, and the actual number of wells, may vary from the assumed level due to a variety of factors such as gas prices, drilling costs, rig availability, and success rates that cannot be predicted with complete accuracy. Changes due to currently unanticipated factors associated with other resources, land uses, or management priorities for BLM could also affect future development rates. However, the assumed total is believed to be reasonable for the purposes of analysis of impacts under the Proposed Plan and comparison with the five previous alternatives.

Indirect impacts associated with oil and gas development within the Planning Area under the Proposed Plan and other alternatives are related primarily to reduced habitat quality from erosion and sediment transport to area streams, increased vehicular activity (including much larger vehicles than at present), reduced solitude on Planning Area roads, decreased scenic quality, and reduced opportunities for certain types of recreation. The increased traffic and reduced solitude could result in decreased quality of life for area residents and have adverse economic impacts on local communities that rely heavily on recreational visitors. These impacts are described in other sections of Chapter 4.

### *Offsite and Cumulative Impacts*

Offsite impacts of development of oil and gas resources beneath the Planning Area include impacts associated with increased human population size in the region. This growth would continue with or without additional development in the Planning Area but would be more rapid at the increasing levels of development. Offsite impacts could also include shifting of some recreational use to other areas in the region, potentially affecting those areas adversely.

An estimated 2,121 new wells are assumed to be drilled on the 53,405 acres of private mineral estate within the Planning Area during the 20-year period of analysis, after subtracting areas with slopes steeper than 50 percent and currently developed areas. This level of development would be in addition to the development scenarios for Federal minerals described above (Tables 4-3 and 4-28). The combination of drilling on new and existing Federal lands, plus private lands, would have cumulative adverse impacts resulting from ground-disturbing activities and associated operation of drilling- and production-related vehicles and other equipment. The cumulative impact in terms of additional production of natural gas and petroleum would be beneficial in terms of the National Energy Policy.

### Summary of Impacts of Oil and Gas Development

Due to the phased and clustered development approach of the Proposed Plan, the combined level of oil and gas development would result in the lowest, or one of the lowest, levels of impacts to most other resources among any of the alternatives analyzed. On the other hand, it would represent effective utilization of the recoverable reserves of natural gas and petroleum at a level only slightly below Alternative V. This would result in recovery of an estimated 49 percent of the recoverable gas reserves in BLM portions of the Planning Area during the first 20 years of development following implementation of the RMP Amendment.

#### **4.5.6 Other Minerals**

As described in Section 3.5.6, substantial oil shale deposits are located within the Planning Area (including NOSRs 1 and 3 and areas of private land). While these have been the subject of considerable investigation in the past, the low likelihood of development in the foreseeable future was a major factor in the decision to transfer the former NOSR lands to BLM to make available for oil and gas development and other uses consistent with FLPMA. Extraction of oil from oil shale, such as following development of a cost-effective *in-situ* process, could occur at some point in the future depending on technologies and market factors.

Recently, proposals have been submitted to BLM for research and development projects involving *in-situ* processes. However, none of these was for lands within the Planning Area. In the apparently unlikely event that oil shale development becomes a viable component of multiple use on BLM lands in the Planning Area, the development would be required to comply with the surface-use restrictions (e.g., NGD/NSO and SSR/CSU stipulations) and BMPs required of other ground-disturbing activities. To avoid a situation in which oil and gas development precludes or diminishes the potential for future oil shale development, BLM will require that wells drilled on top of the plateau be vertical until a depth below the oil-bearing shale strata is reached. Because the oil shale is much shallower than the natural gas, this constraint is not expected to hinder natural gas development.

Based on the limited resource potential of other mineral resources (coal, coalbed natural gas, construction materials, and soda ash/sodium bicarbonate), implementation of any of the alternatives is unlikely to adversely affect the potential for development. The exception is that Alternative I (No Action) would retain the current withdrawal of NOSRs 1 and 3 from development of other mineral resources.

Production of coalbed natural gas would also not be precluded by implementation of Alternatives II through V (or Alternative I for areas outside the NOSRs) should future technologies and market factors affect feasibility. Because the oil and gas leases under these alternatives would include coalbed natural gas, it is possible that it could eventually be incorporated into the overall production of natural gas.

Construction materials could potentially become a valuable resource within the Planning Area. However, only certain portions of the site would likely be suitable in terms of materials present, and localized quarries or other mining operations could probably be developed within portions of the Planning Area outside the oil and gas leases. It is also possible that construction materials could be produced following termination of an oil and gas lease upon completion of economic recovery.

Soda ash and sodium bicarbonate do not appear to occur at developable concentrations beneath the Planning Area.

Although no locatable minerals (e.g., metals) are known or believed to occur in the Planning Area, revocation of the withdrawal of NOSRs 1 and 3 from entry under the Mining Act of 1872 could conceivably result in speculative claim filings, including in some sensitive resource areas. This potential is considered remote.

In summary, implementation of any of the alternatives in this RMPA/EIS would not adversely affect reasonably foreseeable development of these other types of mineral resources. Therefore, no indirect, offsite, or cumulative impacts associated with the development, or lack of development, of these other resources is anticipated. However, some land uses and management actions could represent an irreversible and irretrievable commitment of mineral resources (Section 4.6).

#### **4.5.7 Areas of Critical Environmental Concern**

##### **4.5.7.1 Introduction**

The analysis of impacts to ACECs is necessarily an analysis of impacts on the relevant and important values and resources that are given special management attention through the designation of ACECs. This section summarizes the analysis of impacts on the relevant and important scenic, geological, fisheries, wildlife, and botanical values delineated and described in Section 3.5.7. A complete evaluation of impacts to these values is incorporated into the appropriate impact analysis sections addressing geology and paleontology (Section 4.2.1), vegetation and riparian/wetland areas (Section 4.3.1), wildlife and fisheries (Section 4.3.2), special status species and communities (Section 4.3.3), and visual resources (Section 4.4.1).

##### **Impacts of Proposed Plan**

The Proposed Plan provides an intermediate level of protective management for relevant and important values between Alternative II and the Preferred Alternative. Four ACECs would be designated, but their footprints would be reduced from those in Alternative II, comprising 21,034 acres instead of 36,184 acres. Even this smaller area, however, represents almost 29 percent of the Planning Area. Management of the four designated ACECs would also differ from that under Alternative II. The four ACECs would no longer be covered by NGD/NSO restrictions specific to relevant and important values. Rather, these values would be protected from surface disturbance by the restrictions discussed for the specific resources in earlier sections. Relevant and important scenic, geological, fisheries/wildlife, and botanical/ecological values to be given special consideration in management of the four ACECs are detailed in Tables 2-2a-d.

##### **Direct and Indirect Onsite Impacts**

Under the Proposed Plan, large portions of the ACECs would be provided protection from long-term ground-disturbing activities through various resource-specific NGD/NSO and SSR/CSU restrictions. These include the entire Parachute Creek watershed, areas along streams and adjacent or upstream areas critical to ecosystem processes, and large blocks of sensitive habitats for certain types of vegetation and wildlife. Consequently, most direct negative impacts to these values within the ACECs would be prevented.

The same protective restrictions, and especially those related to minimizing soil loss and erosion and maintaining watershed processes, would also limit the potential for indirect impacts to relevant and important criteria for each ACEC. An exception to this generalization is that some indirect impacts to wildlife from disturbance, and to vegetation from dust generation, could result in portions of the ACECs available for oil and gas development or used for access to oil and gas development.

Direct positive impacts to some relevant and important resources in the ACECs would result from some aspects of the Proposed Plan, primarily the restriction of motorized and mechanized travel to designated routes throughout most of the Planning Area and measures to more rapidly control weeds and improve areas of degraded rangeland.

A complete evaluation of direct and indirect impacts to specific relevant and important values under this alternative is provided in the individual impact analysis sections.

**Offsite and Cumulative Impacts**

Negative impacts to relevant and important resources are likely to occur from ongoing human development throughout the general region, which will occur regardless of management actions within the Planning Area. This development results in a number of activities that directly and negatively impact these resources, including new roads, housing projects, commercial development, and increased recreational use of wildlands. A number of indirect impacts are also expected as a result. These impacts will continue to occur on a regional scale and will have an additive relationship to the impacts expected from management activities within the Planning Area. If negative impacts continue to increase as expected, their condition on public lands becomes even more important in terms of their contribution to global species viability, as well as their intrinsic value and the biodiversity they represent.

Most resources defined as relevant and important values will experience positive impacts as a result of the cumulative actions and protections contained in the Proposed Plan in addition to those special management prescriptions for ACEC management.

A positive impact to offsite areas could occur should some or all existing populations of special status plant species within the Planning Area expand, or new populations be recruited, as a positive result of management actions. These populations could potentially serve as larger sources for propagation into new offsite areas. In addition, information collected from monitoring these species could be useful to management on other sites. Similar positive offsite impacts could potentially occur if populations of sensitive wildlife species on the Planning Area increase due to special management; they could emigrate out of the Planning Area to establish new populations offsite. In the case of the Colorado River cutthroat trout, should populations expand due to protection and enhancement of habitat under ACEC management, individuals from streams on the Planning Area could be used to establish new populations in designated restoration sites.

**4.5.8 Areas Managed to Protect Wilderness Character or Specific Wilderness Values**

Inventories for wilderness characteristics within the Planning Area were conducted following the transfer of NOSRs 1 and 3 (Section 3.5.8.1). The Draft RMPA/EIS included an analysis of alternative management prescriptions for three areas (19,322 acres) found to contain wilderness characteristics. However, on April 14, 2003, a settlement agreement was reached between USDI and the State of Utah, Utah School and Institutional Trust Lands Administration, and Utah Association of Counties. Consistent with that settlement and subsequent policies issued by BLM, neither the Draft RMPA/EIS nor the Proposed Plan considers the designation of new WSAs or the classification or management of BLM lands as if they are, or may become, WSAs. Unlike Alternatives II and III of the Draft RMPA/EIS, the Proposed Plan would not apply management prescriptions specific to the protection of roadlessness, naturalness, and outstanding opportunities for solitude and primitive and unconfined types of recreation, and values identified in the wilderness inventories would not be protected. Although some of these characteristics may benefit from protection of other resources in areas with NGD/NSO stipulations, no contribution would be made toward preservation of wilderness characteristics.

**Direct and Indirect Onsite Impacts**

While pockets of naturalness and opportunities for solitude and primitive and unconfined types of recreation may be protected with NGD/NSO stipulations for other resources, they would be fragmented and smaller than 5,000 acres in size. This would effectively eliminate wilderness character in the three inventory units as a whole. An increase in development such as road and pipeline construction, development of drill pads, and increased human activities would substantially degrade all wilderness characteristics within the Planning Area.

**Offsite and Cumulative Impacts**

Opportunities for primitive and unconfined types of recreation, naturalness, and solitude would not be preserved under the Proposed Plan. The resultant decrease in lands having wilderness values would be cumulative to other such losses in Garfield County and the region. Some of the areas of cumulative offsite losses are Federal lands, including areas managed by BLM and USFS. These lands are subject to increasing levels of oil and gas development, possible future mining operations, and other changes in land use.

In comparison to the 19,322 acres found to contain wilderness characteristics within the Planning Area, a total of 41 wilderness areas have already been designated in Colorado, variously managed by BLM, USFS, USFWS, and NPS. Of the more than 66 million acres of total land area in Colorado, the designated wilderness areas represent 3.4 million acres, or approximately 5 percent. In addition to designated wilderness areas, BLM lands in Colorado contain 54 WSAs with a total area of approximately 622,000 acres. An additional 4.4 million acres of lands managed by USFS in Colorado are designated as roadless; this represents nearly one-third of the total National Forest lands in the state.

**4.5.9 Wild and Scenic Rivers****4.5.9.1 Introduction**

The process of designating a WSR under the authority of the WSRA involves a threshold determination of eligibility, a further assessment of suitability of eligible rivers, and Congressional action. BLM has already assessed the eligibility and classification of rivers and streams found in the Planning Area and described its findings in the Roan Plateau Eligibility Report for the National Wild and Scenic Rivers System (BLM 2002e)(Section 3.5.9 and Map 16).

BLM's policy is to protect the values contained within the eligible stream segments until the suitability analysis has been completed. All alternatives except the no action alternative contain measures to protect the 7,883 acres and 24 miles of stream corridors found to be eligible. The Proposed Plan would protect the identified ORVs and the identified preliminary stream classifications with a specific NGD/NSO restriction. This restriction would apply to all long-term ground-disturbing activities within an area of a 0.25 mile-wide buffer on either side of stream centerlines within WSR-eligible corridors until a suitability analysis has been completed.

As with ACECs, the analysis of impacts to WSR-eligible streams is necessarily an analysis of impacts on identified ORVs. These include scenic values, fishery values, and botanical ecological values. These values are described in Section 3.5.9. A complete evaluation of impacts to these values is incorporated into the appropriate impact analysis sections addressing visual resources (Section 4.4.1), wildlife and fisheries (Section 4.3.2), special status plant species and significant plant communities (Section 4.3.3), and vegetation and riparian/wetland areas (Section 4.3.1).

**4.5.9.2 Impacts of Proposed Plan**

Impacts to the WSR-eligible stream corridors under the Proposed Plan are summarized below by specific ORVs.

**Direct and Indirect Onsite Impacts**

**Scenic Values** — East Fork Parachute Creek, including the falls and box canyon, would retain its outstanding scenic quality under the Proposed Plan. Due to overlapping protections under the Proposed Plan no direct impacts are expected. However, it is reasonable to expect that indirect effects have the potential to degrade the overall ORV scenic value. This indirect effect would result from management activities on adjacent private lands on the western end of the viewshed.

**Fisheries Values** – Direct effects to populations of genetically pure Colorado River cutthroat trout in five of the streams that were found to be eligible (Trapper, Northwater, East Fork Parachute, East Middle Fork Parachute, and JQS) would be minimal and at a reduced risk under this alternative. Overlapping NGD/NSO restrictions on the WSR-eligible stream corridors would prevent long-term ground-disturbing activities in those corridors. Supporting management of livestock grazing and motorized and mechanized travel would improve fish habitat both directly and indirectly by reducing impacts to soils and vegetation in the corridors. Under the Proposed Plan, watersheds adjacent to WSR-eligible streams would receive surface protection from a number of overlapping surface-use restrictions as well as special management prescriptions due to ACEC designation (Table 2-2) and the Parachute Creek WMA (Table 2-3). Indirect effects to the cutthroat trout may occur due to increased recreational demand (specifically fishing) and other human activities within the Planning Area. These effects would result from increased public awareness of the plateau, workers in the oil and gas industry, and from the expected population growth occurring in adjacent communities.

**Botanical/Ecological Values** – No direct effects are expected to the seven WSR eligible stream segments with special status plants and/or significant plant communities. These ORVs would be largely protected under the Proposed Plan by overlapping surface-use restrictions and special management prescriptions. Those measures and supporting management of livestock grazing, restrictions on motorized and mechanized travel, and protective aspects of oil and gas development would combine to ensure the long-term viability of these resources. It is anticipated that small incidental indirect effects may occur over time due to increases in human activities within the Planning Area. While the effects are anticipated to be minor, monitoring of the sites should be conducted to establish damage thresholds and any subsequent management actions needed to protect the specific ORVs if thresholds are exceeded and preliminary classifications threatened.

#### **Offsite and Cumulative Impacts**

Overall regional growth and human-related activities will place increasing demands on the area, irrespective of any changes resulting specifically from implementation of any of the alternatives. Cumulative effects that would degrade the ORVs and potentially change the preliminary classifications could occur over the life of the Plan and may affect the suitability determination. Removal of the WSR-eligible streams in the Planning Area from the inventory of such streams in the region would be cumulative to any other losses on offsite Federal lands, including those managed by BLM and USFS in the region. The offsite losses to which the onsite losses would be cumulative could result from oil and gas development, potential future mining operations, and other changes in land use.

#### **4.5.10 Forest Products**

This RMPA/EIS assumes no management actions for forest products. All alternatives, including the Proposed Plan, anticipate management to maintain and promote forest health, consistent with other resource objectives. Because demand for forest products from the Planning Area is apparently low or non-existent, and no forest management activities are proposed, anticipated impacts on forest products are considered none to negligible under each alternative.

The only recognizable impact is the possible access limitation to forest stands for implementation of pest control, thinning operations, or potential future harvesting due to varying combinations of road closures, timing limitations, and other measures. If timber harvesting were to become economically viable, the approximately 11,000 acres of mature aspen atop the plateau would be the resource most likely to be sought. Old-growth Douglas-fir generally occurs in relatively rugged and inaccessible areas. However, if this resource was sought, the Proposed Plan and Alternatives III, IV, and V would allow up to 10 percent of these trees to be removed, with restrictions on the harvest pattern and method to reduce other impacts.

See the Fire Management discussion below concerning the potential need for fire suppression or vegetation treatments (e.g., fuel load reduction) as a result of increased oil and gas development.

## 4.5.11 Fire Management

### 4.5.11.1 Introduction

Public lands are managed under one of four management categories for the purposes of wildland fire management and prescribed vegetation management. Due to different management goals and objectives proposed under the five alternatives in this RMPA/EIS, modifications to the FMP, including reclassifying some of the existing fire management units to different FMZs, would be necessary to help meet vegetation management goals that ultimately support the goals and objectives of each alternative. Definitions of FMZs A through D are provided in Table 3-36 in Section 3.5.11.3. The FMP for the GSFO is cited in this document as BLM (2002f).

### 4.5.11.2 Impacts of the Proposed Plan

Approximately 25 percent of BLM lands in the Planning Area would be managed as FMZ B and 75 percent as FMZ C. FMZ B consists of lands where unplanned wildland fire is not desired, with a high priority of suppression using aggressive suppression techniques. FMZ C consists of lands where wildland fire is desired, but with a moderate level of suppression because of ecological, social, or political constraints. This classification would be the same among all of the alternatives and not only for the Proposed Plan.

#### Direct and Indirect Onsite Impacts

**Roan Plateau** — Fire is considered a desirable component of the ecosystem under the GSFO FMP, as emphasized by the prior classification of this portion of the Planning Area as FMZ D (fire desirable, with a low priority on suppression). However, BLM had determined that reclassification and management of this area from FMZ D to FMZ C is more appropriate because of the constraints of oil and gas development and the high resource values associated with the existing forest, riparian/wetland and aquatic habitats. These high resource values include wildlife, water quality, visual quality, and recreation as well as the vegetation.

**Roan Cliffs** — The Roan Cliffs will continue to be managed as FMZ C. The GSFO FMP acknowledges that fire is a desirable component of the ecosystem. However, this is balanced by constraints such as private lands and homes, rugged topography, archaeological and historical sites, visual aesthetics, wilderness characteristics, rare plants, the old-growth Douglas-fir community, high-quality pinyon/juniper communities, and associated sensitive wildlife. Wildland fires will continue to be managed using the appropriate management response commensurate with predetermined constraints. Management strategies are intended to ensure that wildland fire is contained within natural or man-made barriers/firebreaks. FMZ C areas have a lower suppression priority in multiple wildland fire situations than FMZs A or B but the same goal of no more than 50 percent of the unit burning over a 10-year period.

**1-70 Corridor** — Lower elevations along the I-70 corridor will continue to be managed as FMZ B. The higher prioritization for fire suppression associated with FMZ B is needed due to the combination of intensive oil and gas development, the commingling of Federal and private lands, and the proximity to human population centers. The GSFO FMP recognizes that fire plays a natural role in the function of the ecosystem. However, an unplanned ignition in this area could have negative effects until mitigation takes place. Suppression of all wildland fires, regardless of ignition source, will be a high priority to protect human health. Fire suppression will usually be aggressive to minimize spread. Wildland fire suppression guidelines apply for bald eagle winter range, Federally listed Colorado River fishes, and the Great Basin spadefoot toad and northern leopard frog. Managers emphasize prevention/mitigation programs that reduce unplanned ignitions and threats to life, property, and natural and cultural resources.

#### 4.5.12 Renewable Energy

No development of renewable energy is currently anticipated for the Planning Area. Section 3.5.13 includes a discussion of the low potential of the Planning Area for wind generation. However, thinning of timber for fire risk management or removal of timber in conjunction with construction of oil and gas well pads, pipelines, and new or widened access roads could be used as a fuel source if biomass energy generation becomes a reality during the life of this RMP Amendment.

### 4.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Any project involving significant changes in land use and management results in the consumption of one or more resources — materials, fuel, and monies — during and after its implementation. Thus, the land use and management activities incorporated into the alternatives analyzed would result in permanent loss of resources within or intricately related to the Planning Area. Potential irreversible and irretrievable commitments are noted throughout the appropriate sections of the impact analysis in this chapter and are summarized below.

Although the various resource-specific sections of Chapter 4 use quantitative measures to assess anticipated impacts, these are only estimates. The exact nature and extent of any irreversible and irretrievable commitment of resources cannot be defined due to uncertainties about its location, scale, timing, and rate of implementation, as well as its relationship to other actions and the effectiveness of mitigation measures. Therefore, the summary below is qualitative only.

- **Mineral Resources** – Future oil and gas development anticipated under all alternatives would result in capture of a portion of the total reserves underlying Federal lands in the Planning Area. These captured resources are non-renewable and would be unavailable for extraction and use by future generations. Portions that would not be recovered during the 20-year period of analysis, given the surface and downhole spacing assumed in the RFD (Appendix H), the current recovery efficiency, and the limitations on leasing and surface occupancy, would remain available for future extraction.

Other energy resources within the Planning Area, including oil shale, coal, and coalbed natural gas, are not expected to be developed during the 20-year period of analysis of this RMPA/EIS (Table 2-1). It is not known to what extent the construction of 855 to 1,582 wells under Alternatives I through V (1,570 under the Proposed Plan) would interfere with future (post-oil and gas) development of these other resources. It is expected that the presence of the wells would complicate but not prevent future development.

- **Paleontological Resources** – Future oil and gas development and other ground-disturbing activities could result in permanent destruction of some fossil resources. However, special stipulations to protect high-value resources, and monitoring and mitigation requirements outlined in this RMPA/EIS would reduce the potential extent of this impact and could bring additional fossil resources to light.
- **Recreation** – The physical recreation settings as defined by the ROS classes would be changed and permanently altered due to construction of roads and oil and gas wells, and other ground-disturbing activities. Special stipulations for visual resources would indirectly reduce these losses. However, the losses would be essentially permanent, even with the best currently available habitat restoration technology and funding levels.
- **Vegetation Resources** – Some areas of essentially native vegetation would be lost or permanently altered during construction of roads, oil and gas wells, and other ground-disturbing activities. Special stipulations to protect high-value resources, and monitoring and mitigation requirements outlined in this RMPA/EIS, would be implemented to reduce these losses. However, any unavoidable losses would be essentially permanent, even with the best currently available revegetation technology. This

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is due to long time period (many decades to centuries) required for full recovery of the natural assemblage of species, habitat components, and ecosystem functions that make specific resource areas unique. Some of these impacts could never be reversed, especially those that eliminate genetically unique resources represented by local populations of rare or disjunct species.

- **Fish and Wildlife Resources** – Some areas of high-quality wildlife habitat would be lost or permanently altered during construction of roads and oil and gas wells, and other ground-disturbing activities. Special stipulations to protect high value resources, and monitoring and mitigation requirements outlined in this RMPA/EIS, would be implemented to reduce these losses. However, any unavoidable losses would be essentially permanent, even with the best currently available habitat restoration technology, because of the long time period (many decades to centuries) required to restore the natural assemblage of species, plant-soil and plant-animal interactions, and ecosystem functioning that make specific resource areas unique. Some of these impacts could never be reversed, especially those that eliminate genetically unique resources represented by populations of rare or disjunct species such as genetically pure Colorado River cutthroat trout.
- **Visual Resources** – Some high-quality scenery and views would be lost or permanently altered due to construction of roads and oil and gas wells, and other ground-disturbing activities. Removal of vegetation, creation of artificial lines, and dramatic changes in color, form, and texture would be unavoidable. Special stipulations and the mitigation requirements outlined in this RMPA/EIS would be implemented to reduce these losses. However, any unavoidable losses would be essentially permanent, even with the best currently available habitat restoration technology.
- **Cultural (Archaeological) Resources** – Future oil and gas development and other ground-disturbing activities could result in permanent destruction of some cultural resources. Special stipulations to protect high value resources, and the monitoring and mitigation requirements outlined in this RMPA/EIS would reduce the potential extent of this impact and could bring additional cultural resources to light.
- **Sociologic and Economic Resources** – Implementation of any of the five alternatives would result in a permanent commitment of monies, in both the public and private sectors, in pursuing the objectives of each alternative and providing the infrastructure needed to serve the resultant population growth. Once spent, these monies are not available for other uses.

Implementation of Alternatives II through V or the Proposed Plan (and, to a lesser extent, Alternative I) would cause an irreversible and irretrievable change in aspects of the environment, affecting quality of life. The anticipated changes, including loss of solitude and rural character, are not viewed as uniformly “good” or “bad” by individuals interviewed as part of this RMPA/EIS. However, all individuals contacted agreed that change would occur beyond that likely without the RMP Amendment. That is, the amendment would hasten quality-of-life impacts that are occurring anyway. Certainly the deferral of oil and gas leasing and development on top of the plateau under Alternative III would delay the onset of change in the portion of the Planning Area that is of greatest overall concern to most interviewees and local governments.

- **Wilderness Characteristics** – Future oil and gas development and other ground-disturbing activities could result in permanent loss of individual wilderness characteristics and would be a permanent loss of wilderness character as a whole. Roadless areas over 5,000 acres, naturalness, outstanding opportunities for solitude and primitive and unconfined recreation would be irretrievably compromised within the units analyzed in this RMPA/EIS. Any losses would be essentially permanent even with the best currently available restoration technologies.

Other types of impacts — both negative and positive — would result from implementation of one or a combination of the alternatives analyzed. However, these other impacts would involve renewable resources such as air and surface water and would occur with or without the selected RMP Amendment

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(grazing, recreational use) or would not be permanent (e.g., precluding leasing for oil shale during the life of the Plan).

