5.0 CUMULATIVE IMPACTS ANALYSIS

As defined by CEQ regulations, cumulative impacts result from the incremental impacts of an action when added to past, present, and reasonably foreseeable future actions, regardless of who takes the action (40 CFR 1508.7). Concurrently, the ESA defines cumulative impacts as effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR §402.02). This section applies only to Section 7 analysis and should not be confused with the broader use of this term in NEPA or other environmental laws.

Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. This chapter discusses cumulative impacts as the incremental effect to specific resources or issues that would occur from the Proposed Action, in conjunction with other cumulative actions.

5.1 REASONABLY FORESEEABLE DEVELOPMENT

In support of the cumulative impact discussion, this chapter provides discussion on past and present oil and gas activities in the Uinta Basin, both of which serve as introductions to the outlook for reasonably foreseeable development (RFD) in the RBU Project Area and the greater Uinta Basin. The BLM has carefully monitored industry trends and surmises that the RFD used as an analytical tool in Vernal FO Draft RMP can be considered accurate up to approximately five years from the time the ROD is signed for the Approved RMP (BLM 2008b). Therefore, the cumulative impact and RFD analysis in this EA is based upon the level of activities and actions identified in the Vernal FO Draft RMP (BLM 2005a) which came directly from the Mineral Potential Report for the Vernal Planning Area (BLM 2002). Within the Vernal FO Draft RMP, projected oil and gas activity would be the most significant activity expected in the Vernal FO area. Other significant activities would be livestock grazing and recreational projects. The Cumulative Impact Analysis Area (CIAA) for most resources is the Vernal FO Planning Area which encompasses approximately 5.5 million acres in Duchesne, Dagget, Uintah and Grand Counties. For some resources, the CIAA is specifically defined.

5.1.1 OIL AND GAS

The Uinta Basin is a significant source of natural gas and oil, and it is currently one of the most active oil and gas producing areas in the onshore U.S. In September 2004, the Utah BLM's quarterly oil and gas lease sale broke the record of most acreage, revenues, and bidders for any lease sale. The focus of the bidding seemed to be both on known producing areas in the Uinta Basin and in frontier areas in the central portion of the State. In the case of the Uinta Basin, past exploration has been in shallow areas up to 8,000 feet. Companies are just now beginning to tap the huge gas reserves that are 10,000-20,000 feet deep due to new technology and economics (BLM 2005a).

Oil and gas development is at an all-time high in the Basin, with more rigs operating, and more APDs being processed than ever before. For example, over half of the total oil and gas wells drilled in Utah between 1911 and November of 2000 were drilled within the Uinta Basin. APDs and ROW applications processed by the BLM Vernal FO have illustrated a significant upward trend, estimated to be approximately 15 percent annually. In support of the Vernal FO Draft RMP, a mineral potential report was prepared (BLM 2002). In that report it was estimated that a

total of about 6,530 wells could be drilled in the Uinta Basin by various oil and gas operators over a 15-year period (BLM 2002).

Exploratory drilling is currently proposed in the western and southwestern portions of the Uinta Basin, including BLM, Tribal and National Forest lands. Production of exploratory wells typically lags discovery by many years. These exploratory wells are typically characterized by larger, deeper, more remote locations requiring greater per-well expenditures, potential delays in infrastructure access and, therefore, greater financial risk.

Future oil and gas development in the Uinta Basin would depend upon the feasibility of exploration, as determined by the underlying geology and further infill development projects within the Basin. To a lesser degree, future development would depend on the cost to develop the resources and engineering technological advancements. Development of Tribal lands would continue and perhaps increase as exploratory wells are drilled in the Hill Creek Extension. Drilling in the Ashley National Forest will likely increase as a result of new leasing and management strategies. However, the level of development on Tribal and National Forest System lands is unknown.

The cumulative scenario for this EA is based on the number of existing wells in the Vernal FO Planning Area, as well as the estimated total number of wells anticipated to be drilled over the coming 15-20 years in this same area. As of October 2007, approximately 8,926 wells had been drilled in the Vernal FO Planning Area. Of these wells, 77 percent (6,889 wells) are currently active (i.e., producing; shut-in; drilled commenced; drilling suspended), leaving 23 percent (2,037 wells) that have been plugged, abandoned, and reclaimed (UDOGM 2007). Under the Vernal FO Draft RMP Preferred Alternative, an estimated 6,530 additional oil and gas wells are anticipated in the Vernal FO Planning Area. To estimate surface disturbance regarding past and future oil and gas development in the Vernal FO Planning Area, the following assumptions have been applied:

- Surface disturbance for a well pad: 2.4 acres;
- Surface disturbance for an access road, assuming 0.2 mile/well: 0.73 acres/well;
- Surface disturbance for pipelines and flowlines: 0.47 acres/well.

Based on these assumptions, surface disturbance associated with past, present and reasonably foreseeable oil and gas development would be 48,309 acres, or 0.9 percent of the 5.5 million acre Vernal FO Planning Area. The details are shown in **Table 5-1**.

Table 5-1. Surface Disturbance Associated with Past, Present, and Reasonably Foreseeable Oil and Gas Development in the Vernal FO Planning Area

Existing Active Wells	RFD # Wells	Total # Wells	Well Pads (acres)[1]	Access Roads (acres)	Total Pipelines (acres)	Total Projected Surface Disturbance (acres) in the CIAA
6,889	6,530	13,419	32,206	9,796	6,307	48,309

[1]Well pad disturbance is overestimated because it assumes one well per pad. In some cases, two or more wells may be drilled from a single well pad (i.e., directional drilling may be utilized).

5.1.2 LIVESTOCK GRAZING

Livestock grazing is currently a permitted use of public lands within the Vernal FO Planning Area. Although some minor changes may be expected over the next few years, it is reasonable to

expect that livestock grazing would continue. Allocated AUMs would remain essentially unchanged; however, based on use trends over the past 7 years actual use may decline based on individual grazing permittee's operations and market conditions. The Vernal FO currently administers grazing on 147 allotments. The 147 allotments within the Vernal FO boundary designated for livestock grazing encompass approximately 2,268,120 acres (1,696,416 acres of BLM land; 571,704 acres of private, State, and Tribal lands). Within the grazing allotments managed by the Vernal FO 153,370 AUMs are allocated for livestock.

5.1.3 RECREATION

Reasonable foreseeable recreation decisions potentially affecting cumulative impacts in the Vernal FO RMP area could include designation of Backcountry Byways, Areas of Critical Environmental Concern (ACECs), Wild and Scenic Rivers and Special Recreation Management Areas, as well as trail, campground, and cabin development. These designations and developments would have beneficial impacts on recreation, but would also affect the management of other resources in the CIAA.

5.2 CUMULATIVE IMPACTS

Cumulative impacts would occur under all three alternatives presented in this EA (Alternative A – No Action; Alternative B – Proposed Action; Alternative C – Surface Gas Lines).

5.2.1 AIR QUALITY

The cumulative air quality impact assessment evaluates emissions from the Alternatives in addition to the emissions from existing permitted sources and emissions associated with RFD. A BLM-approved air quality impact analysis was recently issued with the West Tavaputs Draft Environmental Impact Statement (WTP DEIS) (BLM 2008). As the RBU Project Area is located in the Uintah Basin in close proximity to the WTP DEIS Project Area, this cumulative analysis incorporates the protocol adopted for the West Tavaputs Air Quality Assessment Technical Support Document (BLM 2006). For proper analysis of cumulative air quality impacts, a regional cumulative inventory and a far-field analysis were conducted. Four pollutants, NO_x, SO_x PM_{10}, and $PM_{2.5}$, were inventoried for the regional cumulative inventory. For the far-field analysis, the CIAA is defined as a grid covering an area of 412 km x 400 km (see **Figure 5-1**). Additionally, this far-field analysis uses the meteorological data files developed for the WTP DEIS analysis. A detailed discussion of the methodology used and the cumulative emissions inventory is provided in the XTO Far Field Air Quality Technical Support Document available at the BLM Vernal Field Office.

The following sources of emissions were gathered for the cumulative analysis:

- Sources permitted by the State of Utah after June 30, 2004.
- Utah sources whose emissions have increased since June 30, 2004.
- Sources permitted by the State of Colorado after June 30, 2004.
- Colorado sources whose emissions have increased since June 30, 2004.
- NEPA projects in Utah and Colorado that have been approved or drafts have been issued.
- Tribal permitted sources in Utah.

The Colorado data was received from the Utah Department of Health and Environment, Air Pollution Control Division (David Thayer 3-12-2008 and 3-26-2008 via email) and the Utah Department of Environmental Quality, Air Quality Division (Teri Weiss 3-18-2008 via email). Additionally, the State of Utah provided the new permit approvals on CDROM. The NEPA projects were mostly gathered from the West Tavaputs cumulative far-field air quality analysis and updated with newer projects. The data was filtered according to the following criteria:

- All sources outside of the domain were eliminated.
- All sources with emissions less than one ton/year were not included.
- Sources with decrease in emissions from 2004 to the most current year of emissions (2005 and 2006) were eliminated.

Stack parameters were generally included by the State agencies. In cases where the stack parameters were not included, the stack parameters were estimated based on the type of equipment listed in the permit files.

Overview of Approach

To assess potential far-field impacts, the CALPUFF set of models were applied. The CALPUFF set of models (CALMET, CALPUFF, CALPOST, and associated utilities) were designed specifically to assess ambient air quality impacts at significant distances from the source and therefore long pollutant travel times. For this analysis, the following versions of the models were applied: CALMET Version 5.53a, Level 040716; CALPUFF Version 5.754, Level 060202; and CALPOST Version 5.6393, Level 060202.

The CALPUFF set of models were applied for meteorological calendar years 2001, 2002 and 2003 and included cumulative impacts from the Proposed Action, permitted and tribal sources, oil and gas well sources, and sources associated with RFD. The predicted pollutant concentrations were compared to the National Air Quality Standards (NAAQS) and (for informational purposes only) to the Prevention of Significant Deterioration (PSD) Class I and II increments. In addition, the predicted concentration and deposition results were processed to evaluate potential visibility and acid deposition impacts for comparison with the Federal Land Manager (FLM) Limits of Acceptable Change (LAC).

Far-field Cumulative Air Quality

For the far-field cumulative impact analysis, emissions the Proposed Action were added to the emissions predicted for RFD, within an area defined as 412 km x 400 km covering sections of eastern Utah and western Colorado. Impacts to air quality and air quality related values were predicted for each of 15 areas of special concern and seven high elevation lakes (**Tables 5-2 and 5-3**)

Figure 5-1. Air Cumulative Modeling Domain

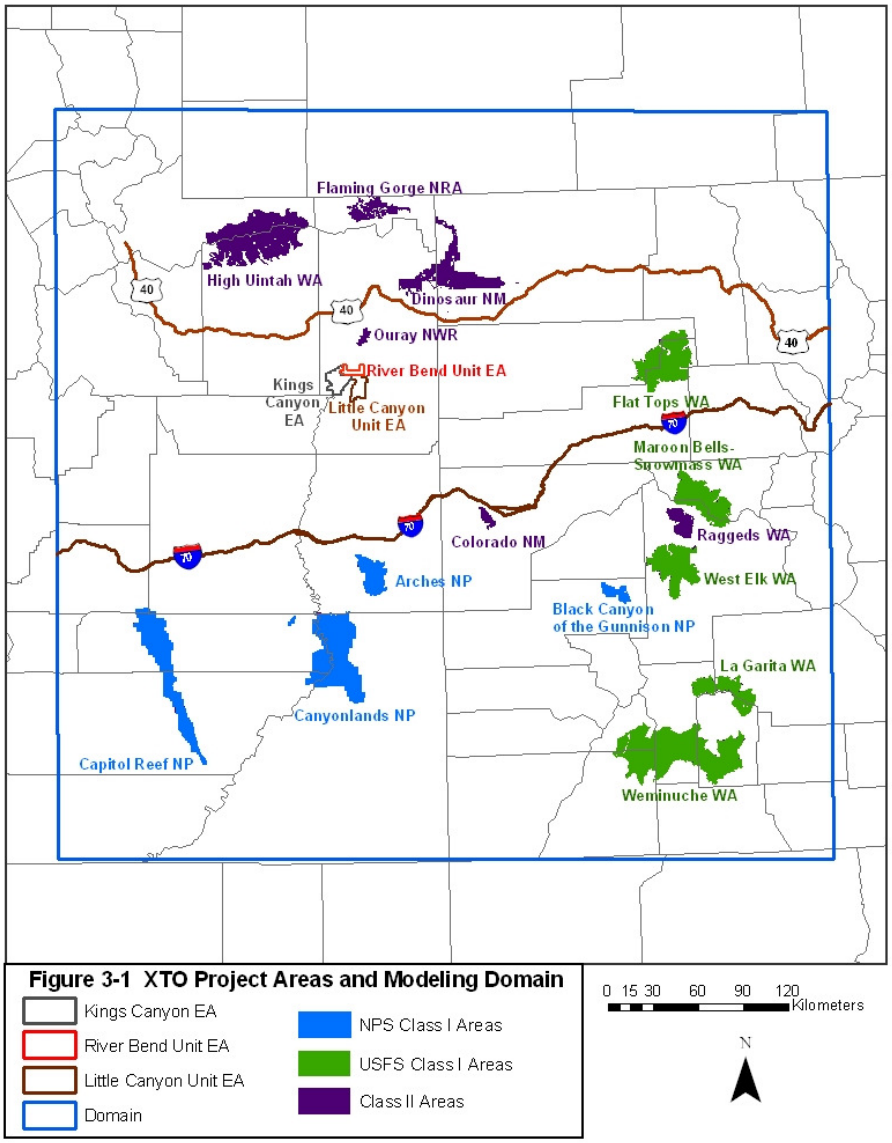

Table 5-2. Class I and Sensitive Class II Areas

Sensitive Area	Federal Land Manager	PSD Designation
Arches NP	NPS	I
Black Canyon of the Gunnison WA	FS	I
Canyonlands NP	NPS	I
Capitol Reef NP	NPS	I
Flat Tops WA	FS	I
La Garita WA	FS	I
Maroon Bells-Snowmass WA	FS	I
Weminuche WA	FS	I
West Elk WA	FS	I
Colorado NM	NPS	II
Dinosaur NM	NPS	II
Flaming Gorge NRA	NPS	II
High Uintas WA	FS	II
Ouray NWR	FWS	II
Ragged WA	FS	II

Table 5-3. Sensitive Lakes

Location	Sensitive Lake
Flat Tops WA	Ned Wilson
Flat Tops WA	Upper Ned Wilson
High Uintas WA	Dean
High Uintas WA	Pine Island
Maroon Bells WA	Moon
Raggeds WA	Deep Creek #1
West Elk WA	S. Golden

Ambient Air Quality Standards

Significance criteria for potential criteria pollutant impacts include the NAAQS. Utah and Colorado have adopted the NAAQS as the standard for the State.

Predicted maximum cumulative pollutant concentrations that could occur as a result of the implementation the Proposed Action in conjunction with cumulative sources are summarized in the following tables and compared with the NAAQS. The values indicate the maximum for the three years (2001, 2002 and 2003) of modeling. As demonstrated, increases in pollutant concentrations are predicted to occur at levels below the NAAQS.

Table 5-4. Cumulative Maximum Pollutant Concentrations for Modeled Years (2001-2003) at Class I Areas (micrograms per cubic meter)

Pollutant	Averaging Period	PSD Class I Increment (ug/m^3)	Arches NP	Black Canyon of the Gunnison WA	Canyonlands NP	Capitol Reef NP	Flat Tops WA	La Garita WA	Maroon Bells-Snowmass WA	Weminuche WA	West Elk WA
$PM_{2.5}$	24-hr	NA	0.228	0.145	0.320	0.184	0.140	0.060	0.172	0.071	0.100
	Annual	NA	0.021	0.009	0.011	0.003	0.025	0.003	0.015	0.002	0.008
PM_{10}	24-hr	8	1.737	1.036	2.377	1.322	1.259	0.430	1.105	0.625	0.698
NO_2	Annual	2.5	0.132	0.066	0.051	0.872	0.118	0.004	0.049	0.003	0.022
SO_2	3-hr	25	0.496	0.122	0.560	0.569	0.419	0.081	0.160	0.078	0.142
	24-hr	5	0.195	0.046	0.233	0.211	0.091	0.025	0.039	0.025	0.030
	Annual	2	0.019	0.004	0.020	0.007	0.009	0.001	0.004	0.001	0.003

Table 5-5. Cumulative Maximum Pollutant Concentrations for Modeled Years (2001-2003) at Class II Areas (micrograms per cubic meter)

Pollutant	Averaging Period	PSD Class II Increment (ug/m^3)	NAAQS (ug/m^3)	Colorado NM	Dinosaur NM	Flaming Gorge NRA	High Uintas WA	Ouray NWR	Ragged WA
$PM_{2.5}$	24-hr [1]	NA	35	0.305	2.264	0.411	0.654	8.059	0.169
	Annual	NA	15	0.023	0.290	0.034	0.028	1.929	0.012
PM_{10}	24-hr	30	150	2.587	16.690	3.220	5.326	61.632	1.078
NO_2	Annual	25	100	0.086	1.364	0.255	0.074	10.318	0.035
SO_2	3-hr	512	1300	3.050	2.063	0.259	0.500	0.578	0.130
	24-hr	91	365	0.457	0.323	0.135	0.153	0.318	0.031
	Annual	20	80	0.035	0.027	0.009	0.011	0.112	0.003

Terrestrial Acid Deposition

Terrestrial acid deposition impacts were predicted for dry and wet nitrogen and sulfur chemical species and compared to the USDA-Forest Service (Fox 1989) threshold values of 3 kilograms per hectare per year (kg/ha/yr) for total sulfur and 5 kg/ha/yr for total nitrogen. The following tables present the cumulative deposition results. Deposition is not predicted to exceed the thresholds at any Class I or Class II area.

Table 5-6. Cumulative Nitrogen and Sulfur Deposition Maximum Predicted Potential Impacts from 2001-2003

Area of Special Concern (Class I Areas)	Max. N Dep (kg/ha/yr)	Max S Dep (kg/ha/yr)	Area of Special Concern (Class II Areas)	Max. N Dep (kg/ha/yr)	Max S Dep (kg/ha/yr)
Arches NP	2.50E-02	6.02E-03	Colorado NM (II)	3.28E-02	1.18E-02
Black Canyon of the Gunnison WA	2.44E-02	2.93E-03	Dinosaur NM (II)	2.58E-01	1.35E-02
Canyonlands NP	1.37E-02	5.43E-03	Flaming Gorge NRA (II)	9.51E-02	6.19E-03
Capitol Reef NP	7.04E-03	2.51E-03	High Uintas WA (II)	2.37E-02	8.24E-03
Flat Tops WA	5.58E-02	6.80E-03	Ouray NWR (II)	9.89E-01	2.14E-02
La Garita WA	5.87E-03	1.29E-03	Ragged WA (II)	1.92E-02	2.90E-03
Maroon Bells-Snowmass WA	2.38E-02	3.31E-03			
Weminuche WA	1.45E-02	2.61E-03			
West Elk WA	5.42E-03	1.27E-03			

Aquatic Acid Deposition

Potential acid neutralizing capacity (ANC) impacts were calculated by applying the screening methodology prescribed by the USFS. Predicted impacts at all lakes are less than a 10 percent change in ANC as summarized in the following tables.

Table 5-7. Cumulative Acid Neutralization Capacity Impacts to High Elevation Lakes

Lake of Special Concern	Nitrogen (Dn) Deposition (kg/ha/yr)	Sulfur (Ds) Deposition (kg/ha/yr)	ANC Change (µeq/l)	Percent ANC Change
Ned Wilson	4.025E-02	4.025E-02	1.21	2.1%
Upper Ned Wilson	4.025E-02	1.783E-02	1.33	6.3%
Moon	1.783E-02	1.621E-02	13.69	0.8%
Deep Creek 1	1.621E-02	1.150E-02	21.63	0.9%
South Golden	1.150E-02	1.214E-02	2.21	0.3%
Dean	1.214E-02	1.165E-02	12.78	1.6%
Pine Island	1.165E-02	0.000E+00	14.07	1.1%

Visibility Impairment

The visibility assessment methodology utilized for this analysis utilized the BLM suggested method for performing visibility impact assessments (Archer 2008). This method involved a first level screening analysis for visibility following the recommendations in the FLAG (2000) Guideline document. If the seasonal screening analysis indicated that predicted changes in visibility exceeded the 1.0 deciview LAC on more than one day per year at any mandatory Federal PSD Class I area, a daily refined analysis was conducted based on hourly IMPROVE optical monitoring data measured at Canyonlands National Park for 1987 through 2004 (Archer 2006).

The screening results for the cumulative sources in addition to each alternative are presented in **Tables 5-8 and 5-9**. Since there were changes in visibility that exceeded 1.0 deciview limits of acceptable change (LAC) on more than one day per year at various Class I areas, a refined analysis was performed. Changes in visibility at sensitive Class II for both screening and refined methods are also provided for informational purposes.

It should be noted that the cumulative impacts assume that all RFD development and operation emissions would occur within the same year. While unlikely, this approach is one that is typically followed since there is no way to know how cumulative source will interact. Therefore, it is likely that actual cumulative visibility impacts would be below those presented in the following tables.

Table 5-8. Cumulative Screening Visibility Impacts

Area of Special Concern (Class)	2001		2002		2003	
	Days Δ dV >1.0	Max Δ dV	Days Δ dV >1.0	Max Δ dV	Days Δ dV >1.0	Max Δ dV
Arches NP (I)	2	1.32	26	3.43	27	3.96
Black Canyon of the Gunnison WA (I)	4	1.49	11	2.49	3	2.14
Canyonlands NP (I)	19	3.19	16	4.27	19	3.31
Capitol Reef NP (I)	9	3.76	7	2.69	6	1.57
Flat Tops WA (I)	11	2.11	15	2.17	22	2.50
La Garita WA (I)	0	0.38	2	1.24	0	0.76
Maroon Bells-Snowmass WA (I)	2	1.42	8	2.56	7	2.14
Weminuche WA (I)	0	0.87	7	1.82	3	1.49
West Elk WA (I)	0	0.75	0	0.85	0	0.85
Colorado NM (II)	17	2.82	30	3.33	23	3.99
Dinosaur NM (II)	212	10.46	186	13.58	181	10.80
Flaming Gorge NRA (II)	47	6.07	61	6.49	37	6.14
High Uintas WA (II)	15	2.32	47	9.36	20	8.05
Ouray NWR (II)	347	15.56	361	22.14	353	23.64
Ragged WA (II)	2	1.32	8	2.47	2	1.50

Table 5-9. Maximum of 2001-2003 Cumulative with Alternatives Refined Visibility Impacts for Each Alternative

Area of Special Concern (Class)	2001	2002	2003
	# Days Δ dV >1.0	# Days Δ dV >1.0	# Days Δ dV >1.0
Arches NP (I)	4	5	9
Black Canyon of the Gunnison WA (I)	2	7	6
Canyonlands NP (I)	1	6	5
Capitol Reef NP (I)	1	1	0
Flat Tops WA (I)	11	20	24
La Garita WA (I)	-	5	0
Maroon Bells-Snowmass WA (I)	4	7	11
Weminuche WA (I)	-	-	1
West Elk WA (I)	1	5	5
Colorado NM (II)	3	6	11
Dinosaur NM (II)	197	186	171
Flaming Gorge NRA (II)	43	59	48
High Uintas WA (II)	10	42	20
Ouray NWR (II)	347	353	349
Ragged WA (II)	1	7	8

5.2.2 CULTURAL RESOURCES

The CIAA for cultural resources is defined as the existing RBU Project Area as well as the Hill Creek and Willow Creek areas (to the ridgetops of roads along the creeks leading into the Project Area). Cumulative impacts to cultural resources are defined as any damage to, or destruction of, cultural resources which result from the incremental impact of the action when added to other past, present, and RFD actions (40 CFR 1508.7). The magnitude of the impacts may be greater or lesser depending on 1) the cultural resource site densities present in the areas of project-related activity; 2) the significance of the cultural resources present; and 3) the final magnitude and scope of RFD actions over the next 20 years.

Impacts to the cultural resources in the CIAA would primarily result from activities associated with surface and subsurface disturbance. Surface disturbance from previous oil and gas activities in the CIAA have disturbed approximately 1,573 acres. Due to the large amount of existing natural gas development in the RBU Project Area, recreational use in the area is low and fire management activities are not conducted. As such, surface disturbance from these activities in the RBU Project Area is rare. Future impacts to the cultural resources in the CIAA would primarily result from surface disturbance associated with additional oil and gas development projects and increased visitation to the RBU Project Area. Additional surface disturbance associated with oil and gas development in the CIAA would occur based upon the alternative selected (Alternative A = 332 acres; Alternative B = 1,103 acres; Alternative C = 745 acres) for

this EA. Impacts may also result from specific cultural resource management decisions and from non-surface-disturbing activities that create atmospheric, visual, and/or auditory effects. These latter impacts would apply to sites or locations that together comprise the overall cultural experience for all visitors to the area, and especially to those deemed sacred or traditionally important by Native American Tribes and used by these groups in such a manner that atmospheric changes, visual obstructions, and/or noise levels impinge upon that use. These types of impacts cumulatively affect not only the historic setting, feeling, and view shed of cultural properties, but also their eligibility potential for nomination to the NRHP.

As discussed in **Section 3.2.2**, there are 51 known archaeological sites within the RBU Project Area. Specific direct impacts to presently unknown cultural resources as a result of RFD in the CIAA would not be known until surveys are completed for all of the areas proposed for surface disturbance and, if necessary, cultural resource properties are evaluated for their eligibility for listing on the NRHP. While the potential for direct impacts to eligible cultural resources is likely to increase with increased surface disturbance, those impacts can be mitigated by preparation and execution of appropriate mitigation measures, and as approved by the responsible Federal, State, and Tribal agencies. As cultural resource surveys would occur prior to any surface-disturbing activities in the RBU Project Area, and as all significant cultural resources would be avoided or appropriately mitigated, direct cumulative impacts to these resources are expected to be minimal.

The greater cumulative threat to cultural resources would be indirect. When considered in addition to other past, present, and RFD actions, the impacts of the Proposed Action or Alternatives may cumulatively impact unknown cultural resources in the RBU Project Area by introducing atmospheric, visual, and auditory intrusions; increased visitation and pedestrian traffic during well field development and operation; vandalism; OHV and other motorized vehicle use; erosion; and unknown impacts to unidentified TCPs and cultural landscapes of all of these impacts may contribute to an alteration of the overall historic setting and feeling of the CIAA. Generally speaking, project-related activities could incrementally and cumulatively add to the loss of important cultural resources across the CIAA. These types of impacts present consequences for the breadth, completeness, and interpretive value of the archaeological record. Beneficial cumulative impacts would also likely occur as undocumented cultural resources could be discovered and preserved.

As noted in **Section 2.1.16.2** and **Section 2.3**, the Proposed Action and Alternative C incorporate several ACEPMs that are intended to reduce, minimize, or avoid project-specific and cumulative impacts to cultural resources. In addition, many potential cumulative impacts to cultural resources would be reduced or eliminated through the implementation of Federal regulatory laws, actions, and guidelines designed to protect cultural resources, and through the consultation process with the SHPO and Native American Tribal representatives. However, it is anticipated that such measures would not prevent all cumulative impacts from occurring. Under the No Action Alternative, site-specific mitigation measures for cultural resources would be implemented on a well by well basis as part of the APD approval process.

5.2.3 FISH AND WILDLIFE INCLUDING SPECIAL STATUS SPECIES

The CIAA for Fish and Wildlife, including Special Status Species is the Vernal FO Planning Area. Past, present and RFD actions in the CIAA have and will continue to reduce habitat, contribute to habitat fragmentation, displace individual wildlife species, result in collisions between wildlife and vehicles, and potentially contribute to poaching of animals. Past, present and reasonably foreseeable surface disturbance, and thus, wildlife habitat loss, from past and future oil and gas activity in the CIAA would be approximately 48,309 acres. Recreational

activities, livestock grazing, mining activities, and prescribed burns would also contribute to cumulative impacts, but the incremental contribution is difficult to quantify. Future surface disturbance in the CIAA would primarily result from oil and gas development, although livestock grazing, recreation and development of dedicated recreational facilities, and growth of Uinta Basin communities may also remove habitat from use by wildlife. While surface disturbance does correspond to associated wildlife impacts, accurate calculations of cumulative wildlife habitat loss are not determinable because the direct impacts are species-specific and depend on the following: status and condition of the population(s) or individual animals being affected; seasonal timing of the disturbances; value or quality of the project area as well as adjacent habitats; physical parameters of the affected and nearby habitats (e.g., extent of topographical relief and vegetative cover); and type of surface disturbance. On Federal lands, surveys are required in potential or known habitats of threatened, endangered or otherwise special status species prior to project implementation. These surveys help determine the presence of any special status wildlife species or extent of habitat, and protective measures would generally be taken to avoid or minimize direct disturbance in these areas.

As shown in **Table 5-10** below, road development and surface disturbance associated with the Proposed Action or Alternatives when added to past, present, and reasonably foreseeable actions would have minimal impacts on wildlife habitats across the CIAA. Yet in the context of cumulative impact analyses each acre of vegetation disturbance increases erosion, which incrementally adds to overall native vegetation loss, and potentially increases invasion of noxious weeds. Ongoing and planned oil and gas activities and other land uses within the CIAA would further reduce the amount of available cover, foraging opportunities, and breeding areas for a wide variety of wildlife trophic levels. Additional development could displace wildlife or preclude wildlife from using areas of more intensive human activity. Although implementation of the Proposed Action or alternatives, in combination with other activities in the CIAA may affect individual wildlife species, it is not likely to result in a loss of viability, nor cause a trend to Federal listing of these species. Water depletions associated with the Proposed Action and alternatives in combination with depletions from other activities in the CIAA would reduce the ability of the Upper Colorado River Basin to create and maintain the physical habitat (areas inhabited or potentially habitable to special status fish for use of spawning, development of fish larvae, feeding, or serving as corridors between these areas) and the biological environment for the Colorado River Endangered Fish Species. As such, these depletions "*may affect, are likely to adversely affect*" these species. Implementation of the Proposed Action or alternatives in combination with other activities in the CIAA could also degrade USFWS-designated critical habitat for the Colorado River Endangered Fish Species utilizing the Green River by increasing erosion and sediment yield. However, these impacts would be minimized by implementation of appropriate erosion control measures.

Table 5-10. Cumulative Impacts of Road Development and Surface Disturbance Associated with the Proposed Action and Alternatives

	Road Development (Miles)	% of Road Development for Past, Present, and RFD in the CIAA	Surface Disturbance (acres)	% of Surface Disturbance for Past, Present, and RFD in the CIAA	Total Reasonably Foreseeable Surface Disturbance in the CIAA	% of CIAA Disturbed By Past Present, RFD, and Alternatives
Alternative A – No Action	15.7	0.6 %	332	0.6%	48,641	0.9%
Alternative B – Proposed	15.7	0.6 %	1,103	2.2%	49,412	0.9%

	Road Development (Miles)	% of Road Development for Past, Present, and RFD in the CIAA	Surface Disturbance (acres)	% of Surface Disturbance for Past, Present, and RFD in the CIAA	Total Reasonably Foreseeable Surface Disturbance in the CIAA	% of CIAA Disturbed By Past Present, RFD, and Alternatives
Action						
Alternative C – Surface Pipeline	15.7	0.6%	745	1.5%	49,054	0.9%

5.2.4 LIVESTOCK GRAZING

The CIAA for livestock grazing is the combined Green River AMP, Sand Wash, and Wild Horse Bench Grazing Allotments. Cumulative impacts from oil and gas development to livestock grazing would include the loss of AUMs during the life of the disturbance. Recreation activities, mining activities, and prescribed burns also contribute to cumulative impacts, but the incremental contribution is impossible to quantify. **Table 5-11** below, displays the amount of oil and gas development associated with each alternative analyzed in this EA, as well as past and reasonably foreseeable oil and gas development in the Green River AMP, Sand Wash, and Wild Horse Bench Grazing Allotments.

Table 5-11. AUMs Lost in the Livestock Grazing CIAA

Alternative	Allotment Name	Total AUMs in CIAA	AUMs Lost from Project Alternative	AUMs Lost from Previous Development	AUMs Lost from Future Action	Total Reasonably Foreseeable AUMs Lost in CIAA[1]	% of Total AUMs in CIAA
A	Green River AMP	554	0.2	0.4	0	**0.6**	0.1
	Sand Wash	5,876	6	183	96	**285**	4.8
	Wild Horse Bench	2,462	18	355	17	**390**	15.8
	TOTAL for CIAA	**8,892**	**24**	**538**	**113**	**675**	**7.6**
B	Green River AMP	554	0.2	0.4	0	**0.6**	0.1
	Sand Wash	5,876	13	183	96	**292**	5.0
	Wild Horse Bench	2,462	133	355	17	**505**	20.5
	TOTAL for CIAA	**8,892**	**147**	**538**	**113**	**798**	**9.0**
C	Green River AMP	554	0.2	0.4	0	**0.6**	0.1
	Sand Wash	5,876	9	183	96	**288**	4.9
	Wild Horse Bench	2,462	82	355	17	**454**	18.4
	TOTAL for CIAA	**8,892**	**92**	**538**	**113**	**743**	**8.4**

Source: UDOGM 2008 (January 2008). Well status categories are as follows: Previous (shut-in, producing, drilling operations suspended, drilling commenced, and plugged and abandoned), and Future (new permit, approved permit). The assumptions discussed in **Section 5.1.1** were applied to number of wells in each category to calculate acreage disturbed (and eventually AUMs lost).

[1] The Reasonably Foreseeable AUMs were calculated by adding the following columns: AUM's lost from Project Alternative, Previous AUMs lost, and Future AUMs lost.

In addition to loss of AUMs, increased road development within the RBU Project Area would cumulatively contribute to difficulties in controlling livestock as more natural barriers to livestock movement are removed, and as more livestock use roads as travel routes. Furthermore, increased road and pipeline ROWs could contribute to changes in water flow, thereby reducing flows to livestock ponds. In addition, loss of vegetation and increased traffic and human activity in the RBU Project Area would cumulatively add to livestock displacement that is occurring throughout the RBU Project Area. These past, present, and future construction activities, and other visual and noise impacts in the RBU Project Area could cause livestock to move to adjacent undisturbed areas, thereby leading to additional livestock impacts on vegetation in those locations.

5.2.5 PALEONTOLOGICAL RESOURCES

As potential impacts to paleontological resources across a geographic landscape are not additive, the CIAA for paleontological resources is defined as the existing RBU Project Area. Cumulative impacts to the paleontological resources in the CIAA would primarily result from activities associated with surface and subsurface disturbance. Surface disturbance from previous oil and gas activities in the CIAA have disturbed approximately 1,465 acres. Due to the large amount of existing natural gas development in the RBU Project Area, recreational use in the area is low and fire management activities are not conducted. As such, surface disturbance from these activities in the RBU Project Area is rare. Future impacts to the paleontological resources in the CIAA would primarily result from additional oil and gas development projects and increased visitation to the RBU Project Area. Additional surface disturbance associated with oil and gas development would occur based upon the alternative selected (Alternative A: 332 acres; Alternative B: 1,103 acres; Alternative C: 745 acres) for this EA. These activities could have short- and long-term cumulative effects on paleontological resources in the CIAA. Surface-disturbing activities could affect paleontological resources by damaging or destroying fossils. Adverse effects include physical damage to or destruction of fossils, as well as increased vandalism and theft that result from improved access to fossil localities. However, as site-specific paleontological surveys would be conducted prior to surface-disturbing activities in the RBU Project Area, and as all identified paleontological resources would be avoided or impacts mitigated, cumulative impacts associated with the Proposed Action or alternatives would be reduced.

Surface-disturbing activities could also have a beneficial effect on paleontological resources by drawing the attention of a qualified paleontologist to areas that are not currently being researched, resulting in the collection of specimens and data that would not otherwise be recovered.

5.2.6 SOIL RESOURCES

The CIAA for soil resources is the Vernal FO Planning Area. Under the RFD scenario, 24,800 acres of soils are expected to be disturbed in addition to the current estimated 23,509 acres of soil disturbance from existing active oil and gas activities in the CIAA. Any land-disturbing activity that removes native vegetation and topsoil can result in an increase in erosion rates and sediment yield. Authorized actions that could result in increased erosion and sediment yield within the CIAA include oil and gas development, livestock grazing, recreation, mining activities (Gilsonite, sand and gravel, and, potentially oil shale), and county and private road construction. Of these potential soil-disturbing activities, existing and proposed roads are the features of highest concern. Unlike surface and buried pipelines, active roadways and well pads would not reclaimed, thus sediment yield from roads could continue at rates two to three times above background rates into the indefinite future.

Compaction due to construction activities at well pads, along access roads, and in other disturbed areas would result in a small increase in surface runoff from the area. This increased runoff could in turn cause increased sheet, rill, and gully erosion. The construction and operation of each well would incrementally increase the chance that leaks or spills of saline water, hydro-fracturing chemicals, fuels, and lubricants would occur within the CIAA. Spills of this nature could increase the loss of soil productivity within the area.

As shown in **Table 5-10** above, road development and surface disturbance associated with the Proposed Action and alternatives when added to past, present, and reasonably foreseeable actions would have minimal impacts on soil resources across the CIAA. In addition, design features including berms, sediment control structures, and proper grading of well pads and access roads, would reduce the impacts of the Proposed Action and Alternative C on soil resources by minimizing soil erosion, and by reducing the potential for soil contamination. Under the No Action Alternative, site-specific mitigation measures for soil resources would be implemented on a well by well basis as part of the APD approval process.

5.2.7 VEGETATION INCLUDING SPECIAL STATUS PLANT SPECIES AND INVASIVE OR NOXIOUS WEEDS

General Vegetation

The CIAA for general vegetation is the Vernal FO Planning Area. Past and RFD oil and gas projects in the CIAA would potentially disturb 48,309 acres of vegetation. In addition to vegetation lost from oil and gas developments, past, present, and reasonably foreseeable forage use by livestock grazing, wild horses, and wildlife, and additional recreational use of habitats would also affect the productivity, composition, and community structure of vegetation throughout the CIAA. The most common vegetation types to be disturbed would primarily include pinyon-juniper, sagebrush, and mountain shrub. Impacts within the CIAA may include fragmentation of plant communities, competition with noxious weeds, soil compaction, accidental spills of fuels and lubricants, and fugitive dust.

As shown in **Table 5-10** above, road development and surface disturbance associated with the Proposed Action and alternatives when added to past, present, and reasonably foreseeable actions would have minimal impacts on vegetation across the CIAA. In addition, interim and final reclamation, in combination with mitigation measures including noxious weed management would reduce the cumulative impacts of the Proposed Action and Alternative C on vegetation. Under the No Action Alternative, site-specific mitigation measures for soil resources would be implemented on a well by well basis as part of the APD approval process.

Invasive and Noxious Species

The CIAA for invasive and noxious weeds is the Vernal FO Planning Area. Past and RFD oil and gas projects in the CIAA would potentially include the construction or upgrade of approximately 2,684 miles of road, and disturbance of approximately 48,309 acres of existing vegetation. As mentioned in **Section 3.2.7.2**, roads provide a major conduit for the spread of noxious and invasive weeds into natural areas, especially in areas where soil disturbance occurs. In addition to vegetation lost from oil and gas development, past, present, and reasonably foreseeable forage use by livestock grazing, wild horses, and wildlife, and additional recreational use of habitats would also potentially increase noxious and invasive weeds throughout the CIAA. Specific negative effects of invasive plants and noxious weeds associated with the proposed development in the CIAA could include 1) reduction in the overall visual character of an area; 2)

competition with, or elimination of native plants; 3) reduction or fragmentation of wildlife habitats; and 4) increased soil erosion.

As shown in **Table 5-10** above, the amount of proposed road development would be equal under all alternatives (15.7 miles). This development would consist of 0.6 percent of the reasonably foreseeable total amount of road development in the CIAA. In addition, surface disturbance would be added to the cumulative total of reasonably foreseeable disturbance in the CIAA under each alternative (Alternative A = 332 acres; Alternative B = 1,103 acres; Alternative C = 745 acres). With the implementation of ACEPMs implemented under the Proposed Action or Alternative C, it is expected that noxious weeds in the RBU Project Area would be reduced. Under the No Action Alternative, site-specific mitigation measures for noxious weed management would be implemented on a well by well basis as part of the APD approval process.

Special Status Plant Species

The CIAA for special status plant species is the Vernal FO Planning Area. Public lands involving special status plant species habitats have been leased with terms and conditions to protect these species and their habitat. However, continued encroachment on these habitats could impact species sustainability in these areas. To prevent or reduce the negative impacts of habitat encroachment on special status plant species, the BLM in cooperation with the USFWS drafted a list of species specific conservation measures that would moderate development in these areas and afford protective distances from proposed development to plants and/or their occupied habitats. As these measures (see **Appendix D**) would be implemented under the Proposed Action and Alternative C, impacts to special status plant species would be minimized and monitored. As such, the Proposed Action and Alternative C in combination with other activities in the CIAA, "***may affect, are not likely to adversely affect***" the Uinta Basin hookless cactus and the clay-reed mustard. Under the No Action Alternative, site-specific mitigation measures for special status plant species would be implemented on a well by well basis as part of the APD approval process.

5.2.8 WATER RESOURCES

The CIAA for water resources including floodplains is the BLM Vernal FO Planning Area. In the CIAA, construction of oil and gas facilities and associated infrastructure would likely have the greatest potential impact on water resources due to increased erosion and sedimentation rates and an increased number of road/pipeline water crossings. As described in **Section 5.1.1**, a cumulative total of 48,309 acres of land would be disturbed in the CIAA due to oil and gas activities over the next 15 to 20 years under the Proposed Action. This total would include an additional 1,103 acres of surface disturbance above that already authorized by previous actions. Soils compacted on existing roads, new access roads, and well pads contribute slightly greater runoff than undisturbed sites. The Proposed Action would add approximately 15.7 miles of new access roads and co-located roads and pipeline in the CIAA. The increased runoff could lead to slightly higher peak flows in the CIAA river system, potentially increasing erosion of the channel banks. The increased erosion, combined with increases associated with recreational activities including OHV use, and livestock grazing, could have negative impacts on aquatic habitat within affected drainages and on the proper functioning condition of floodplains. These impacts include increased turbidity and salinity, the covering of stream substrates with fine sediment and clogging of the interstitial pores of the substrate, increased transport of pollutants, including trace metals, herbicides, and petroleum constituents, and increased down-cutting of the channel and bank destabilization. In addition, past and RFD activities would increase the chance that accidental spills of fuels, lubricants, and other petroleum products, which would contaminate surface water or groundwater within the CIAA. Spills of fuels or produced fluids from well pads, pipelines,

and compressor stations also have the potential to contaminate the shallow alluvial groundwater. Recreation and livestock grazing activities also contribute to cumulative impacts, but the incremental contribution is impossible to quantify.

Under the No Action Alternative, an additional 332 acres of surface disturbance would occur above that already authorized, or about 30 percent of the additional disturbance that would occur under the Proposed Action. The increased runoff, erosion, and risk of spills would be smaller by a similar amount. The cumulative total disturbance within the CIAA from oil and gas activities would be reduced to about 47,538 acres. Under Alternative C, all pipelines would be surface-laid, thus reducing the additional surface disturbance to about 745 acres, or about 68 percent of the new surface disturbance expected under the Proposed Action. The cumulative total disturbance within the CIAA from oil and gas activities would be about 47,951 acres under Alternative C. The No Action Alternative and Alternative C would each add about 15.7 miles of new access roads and co-located roads and pipelines to the CIAA.

5.2.9 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

According to the Vernal Mineral Potential Report, an estimated 6,530 additional oil and gas wells are anticipated in the Vernal FO Planning Area over the next 15 to 20 years. Natural gas development within the Uinta Basin has had a substantial impact on taxes and royalties collected by the State of Utah, many of which are reallocated to Uintah and Duchesne Counties. Each of the alternatives would add, incrementally, to the oil and gas development in the Basin (Alternative A: 128 previously approved new wells, Alternative B: 484 new wells, Alternative C: 484 new wells)

As a result of the ongoing oil and gas growth in the Uinta Basin, the rural communities in Uintah and Duchesne County have experienced considerable population growth. Research suggests that dramatic increases in population can have a disruptive effect on the social well-being of some segments of the local population within a rural community. Negative social consequences could include: a collapse of informal social structures; conflict and tension between advocates and opponents of growth; the absence of social integration; changes in neighboring ties; decreases in community satisfaction, and deteriorating quality of life. Rural communities impacted by boom periods can experience increases in school drop out rates, juvenile delinquency, criminal activity, domestic/family violence, and drug and alcohol problems, which can in turn affect police and social services (Smith et al 2001).

Because energy-related population growth and decline can be sudden and/or unexpected, it is difficult for rural communities with limited resources to prepare for these cycles (GOED 2006). Increased population growth can increase the demand for government services. Even if revenues from oil and gas development within Uintah and Duchesne Counties would eventually exceed the costs of providing these services, impacts associated with the immediacy of these issues would not be resolved.

Because the energy-related boom is often characterized as “overnight expansion,” little if any research has been conducted on how the current boom has impacted communities within the Uinta Basin. However, empirical observations by Uintah County officials suggest that there is a shortage for both short- and long-term housing. Uintah County is in the process of conducting a formal study on the availability of both short- and long-term housing and impacts that changes in the housing market have had on local residents as well as temporary employees (Hoyt 2006).

The Natural Resource Extraction Impact Working Group (Working Group) was organized by the Utah Governor's Office of Economic Development to discuss the impacts of natural resource extraction on rural counties in Utah including Uintah and Duchesne Counties. The Working Group concluded that the primary impact of resource extraction activity is the need for construction, upgrading, and maintenance of roads. According to this working group, a mechanism for addressing transportation needs currently does not exist (GOED 2006).

Literature suggests that social disruptive effects in rural communities that have experienced extremely rapid growth due to energy-related development in the past, may not be permanent. Rather, the disruptive effects associated with boom growth dissipate in the years after the boom phase has ended, with no evidence of lasting disruption (Smith et. al 2001). Vernal, and other communities within the Uinta Basin that have experienced rapid population change from energy development in the past may also respond to these changes more favorably than a communities that have not experienced boom and bust cycles (Smith et al 2001).

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