4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This chapter describes the environmental consequences of implementing either the Proposed Action or No Action alternative. Since implementation of the No Action alternative would result in an uncertain level of future activity within the CRNGDPA, this alternative is not specifically addressed for each individual resource (see Sections 2.4 and 4.10).

Analysis of each resource will include a discussion of the anticipated environmental consequences (impacts) to the human environment associated with the Proposed Action. Cumulative impacts will also be discussed for each resource and the discussion of cumulative impacts will address trends in existing resource uses within the project area that are likely to continue into the reasonably foreseeable future. Discussion of some resources will include descriptions of mitigation measures which are suggested to reduce the environmental impacts associated with the Proposed Action. The Operator has committed to implement all reasonable mitigation measures discussed in this chapter and summarized in Chapter 5.0.

4.2 AIR QUALITY

4.2.1 Introduction

Air quality impacts are limited by regulations, standards, and implementation plans established under the Federal Clean Air Act and State of Wyoming laws, as administered by WDEQ/AQD. Under FLPMA and the Clean Air Act, the BLM can not conduct or authorize any activity which does not conform to all applicable local, state, tribal or Federal air quality laws, statutes, regulations, standards or implementation plans. An extensive air quality impact assessment was prepared (as detailed in "Cooper Reservoir Technical Support Document: Cumulative Air Quality Impact Analysis."). A copy of the detailed report is available for review at the BLM PRRA, and is incorporated into this document by reference (TRC 1998). This analysis was based on "reasonable, but conservative" assumptions regarding:

1) the amount of additional oil/gas exploration and development in the CRNGDPA;

2) the equipment necessary to produce the resource to its maximum capacity;

3) proposed well spacing; and

4) source locations.

This "reasonable, but conservative" emission scenario represents an upper bound which would not be exceeded. For example, review of current production activities in the area suggests that the level of assumed air emissions and impacts would not be reached. Thus the impacts projected in this report should be viewed as a conservative "upper bound" estimate of potential air quality effects which are not likely to occur. It is important to note that before development could occur, the WDEQ/AQD requires a very specific air quality pre-construction permit review in order to examine emissions from proposed pollutant sources prior to their construction (i.e.; compressor engines or gas plants, etc.). WDEQ/AQD would examine project specific air pollutant emission and potential air quality effects, per requirements of both Wyoming and Federal air quality standards and regulations, and determine which facilities must obtain air pollutant emission permits. For example, individual well sites could be permitted following a limited start-up period, as required by the WDEQ/AQD. Thus as development occurs, site specific air quality analysis would be performed (in addition to this air quality impact assessment), and emission control measures may be required in order to ensure protection of air quality resources.

4.2.2 Significance Criteria

The significance criteria for air quality include both state and federally enforced legal requirements to ensure that ambient air pollutant concentrations remain below specified levels. These include the Wyoming and National Ambient Air Quality Standards, and the Prevention of Significant Deterioration (PSD) Class I and Class II increments (which limit specific air pollutant concentration increases above a baseline value in specific areas), as listed in Table 3.1. Where legal significance criteria have not been established, a review of current scientific knowledge and administrative policies has been conducted.

4.2.3 Direct and Indirect Impacts

4.2.3.1 Emissions Inventory

Near-field air quality impact modeling was used to predict maximum potential concentrations in the vicinity of the emission sources for comparison with applicable air quality standards. This modeling was performed to quantify "reasonable, but conservative" potential impacts from particulate and SO_2 emissions during construction, and CO, NO_x (oxides of nitrogen), VOC (volatile organic compounds; known as ozone precursors), and HAP (hazardous air pollutants) emissions during production. Using the Cooper Reservoir well site design for minimum well site spacing and proposed compression, a representative well field "patch" was used to determine a realistic geometric layout. This "patch" included a group of 9 simultaneously producing well sites, and an individual 5,000 hp compressor engine. The ISCST3 dispersion model was used with meteorological data collected at Casper and Lander, Wyoming, during 1991.

Potential TSP and PM_{10} emissions from traffic on the unimproved lease road, resource road, and during well pad construction, were used to determine the maximum 24-hour TSP and PM_{10} concentrations, and the annual average PM_{10} concentration. These emissions are temporary (occur over a 5-day period) during construction and would occur in isolation, without significantly affecting neighboring well sites. In computing potential TSP and PM_{10} impacts from particulate emissions due to well pad and resource road construction, it is assumed that a 50 per cent control efficiency would be achieved by applying water and/or chemical dust suppressants to minimize fugitive dust emissions.

4.2.3.2 Predicted Impacts

The total maximum potential concentrations at the public access receptors (including representative background values) would be nearly 66 $\mu g/m^3$ (PM_{10} 24-hour), 26 $\mu g/m^3$ (PM_{10} annual), and 135 $\mu g/m^3$ (TSP 24-hour). Therefore, both predicted short- and long-term particulate matter concentrations comply with all applicable Ambient Air Quality Standards; defined as 150 $\mu g/m^3$ (PM_{10} 24-hour), 50 $\mu g/m^3$ (PM_{10} annual), and 150 $\mu g/m^3$ (TSP 24-hour). It should be noted that particulate matter emissions associated with temporary construction activity do not consume PSD increments, therefore the particulate matter PSD increment regulations do not apply.

The predicted maximum 24-hour concentrations are likely to overestimate actual expected concentrations because they assume the maximum modeled concentration would coincide with the maximum measured background concentration. However, these two events would occur under very different meteorological conditions, and are not be expected to coincide.

The maximum short-term (3 and 24-hour) and long-term (annual) SO_2 emissions would occur due to the drilling engines used during the 13-day rig-up and drilling campaign. Although these emissions would be temporary, SO_2 concentrations were predicted for all applicable time periods. The total maximum modeled concentrations (including representative background values) would be nearly 119 $\mu g/m^3$ (3-hour), 43 $\mu g/m^3$ (24-hour), and 4 $\mu g/m^3$ (annual). Therefore, predicted SO_2 concentrations would comply with all applicable Wyoming Ambient Air Quality Standards; defined as 1,300 $\mu g/m^3$ (3-hour), 260 $\mu g/m^3$ (24-hour), and 60 $\mu g/m^3$ (annual); the Federal standards are less restrictive. Again, since the SO_2 emissions would be temporary, the SO_2 PSD increment regulations do not apply.

The maximum direct CO impacts predicted to occur from the compressor engines during the maximum well field production phase are nearly 195 $\mu g/m^3$ (1-hour) and 87 $\mu g/m^3$ (8-hour). When these values are added to the assumed background concentrations, total maximum CO impacts become nearly 3,695 $\mu g/m^3$ (1-hour) and 1,584 $\mu g/m^3$ (8-hour), demonstrating compliance with the applicable CO standards of 40,000 $\mu g/m^3$ (1-hour) and 10,000 $\mu g/m^3$ (8-hour).

Potential maximum NO_2 concentrations (predicted to occur during production) were determined by multiplying maximum modeled NO_x concentration values by 0.75, in accordance with standard Environmental Protection Agency (EPA) methodology (Federal Register 60:153, page 40469, dated August 9, 1995). A realistic "reasonable, but conservative" geometric layout of 9 simultaneously

producing well sites, and an individual 5,000 hp compressor engine, were modeled to determine the potential for interaction of emissions (the greatest potential NO_2 impacts are those associated with the compressor station). The total maximum predicted NO_2 impact (including background) was nearly 21 $\mu g/m^3$, well below both the Wyoming and Federal NO_2 ambient air quality standards of 100 $\mu g/m^3$. In addition, the maximum modeled total NO_2 concentration of 21 $\mu g/m^3$ would not exceed the applicable PSD Class II increment of 25 $\mu g/m^3$ (no PSD Class I areas are likely to be affected by the proposed project). This comparison is not a comprehensive PSD Increment Consumption analysis (which is a regulatory inventory and compliance responsibility of the WDEQ/AQD, with EPA oversight), but is included in this impact assessment in order to indicate a potential level of significance.

In developing the NO_x emission inventory, it was assumed that each compressor engine would apply recent Best Available Control Technology (BACT) measures, reflecting at least 75 per cent control at an emission rate of 2 grams per horsepower-hour (g/hp-hr). Uncontrolled emissions are typically 9-25 g/hp-hr. This reflects the recent WDEQ/AQD BACT determinations for all engines with greater than 250 hp (Dailey 1996). The air quality impact assessment evaluated potential NO_x emission control measures for natural gas fired, internal combustion compressor engines. The evaluation did not rank or identify which technology is most applicable for the proposed compressors; the appropriate level of control would be determined as part of the air quality preconstruction permitting process required by the WDEQ/AQD. Possible NO_x emission control measures include:

- Nonselective Catalytic Reduction. This control technology is applicable to relatively new engines, and requires the installation of catalysts in the engine exhaust. The catalyst removes between 80 to 90 per cent of the uncontrolled NO_x emissions, for an operating emission rate of 1-5 g/hp-hr. Costs are approximately $110-180 per ton removed.

- Lean Combustion. This technology involves the increase of the air-to-fuel ratio to lower the peak combustion temperature, thus reducing the formation of NO_x (new engines and retrofit applications). The controls are between 80 to 90 percent efficient, for an operating emission rate of 1.5-4 g/hp-hr. Costs are $490-690 per ton removed.

- Selective Catalytic Reduction. This post-combustion control technology is only applicable to exhaust streams with significant oxygen content (a lean burn engine). The controls are between 80 to 90 percent efficient, for an operating emission rate of 1-2.5 g/hp-hr. Costs are $750-9,600 per ton removed.

Ozone is formed as a result of photochemical reactions involving ambient concentrations of VOC and NO_x. Because of the complicated photochemical reactions involved with the formation of ozone, a nomograph developed from the Reactive Plume Model was used to predict maximum potential ozone impacts (Scheffe 1988). This involves computing a potential VOC to NO_x emission ratio, and comparing this ratio (plus potential VOC emissions) to the nomograph. At the predicted ratio (3.0), the nomograph estimated maximum potential ozone concentrations of less than 0.02 parts per million (33 $\mu g/m^3$). Therefore, the total predicted ozone impact (including background) of 143 $\mu g/m^3$ would be below the Wyoming Ambient Air Quality Standard of 160 $\mu g/m^3$. The Federal standard is less restrictive. This predicted impact is very conservative since the nomograph was developed using

meteorological conditions more conducive for forming ozone than would occur in the Cumulative Impact Study Area.

In addition, the potential emissions rates of several Hazardous Air Pollutants (HAP) from compression and well production were evaluated, including formaldehyde (approximately 0.14 tons per year) from the 5,000 hp compressor station, and n-hexane (0.27 tons per year), benzene (0.44 tons per year), toluene (0.10 tons per year), ethyl benzene (0.02 tons per year), and xylene (0.27 tons per year) from individual well dehydrators. Potential HAP impacts were predicted using the ISCST3 model and an 8-hour averaging time, then compared to a range of State Acceptable Ambient Concentration Levels (AACL). There are no applicable HAP ambient air quality standards. These data and thresholds are summarized in Table 4.1.

Table 4.1

Potential HAP Concentrations and Comparable State Acceptable Ambient Concentration Levels ($\mu g/m^3$)

Airborne Pollutant	Modeled 8-Hour Concentration	Range of State AACLs
formaldehyde	0.3	4.5- 71
n-hehane	11.6	1,800- 4,290
benzene	19.1	30- 714
toluene	4.4	1,870- 8,930
ethyl benzene	1.0	340-43,500
xylene	11.7	2,170- 4,400

Source: EPA 1997.

Note: These maximum predicted concentrations occur near (100 meters) the well sites and the compressor stations. As the distance from the wells and compressor station increases, the predicted concentrations decrease rapidly.

Long-term (70-year) exposures to suspected carcinogens (benzene and formaldehyde) emissions were calculated to estimate the latent cancer risk. These were calculated from EPA unit risk factors for carcinogenic constituents (EPA 1997). Two estimates of cancer risk were made; one that corresponds to a Most Likely Exposure (MLE) scenario, and one reflective of the Maximally Exposed Individual (MEI). The estimated cancer risks were adjusted to account for duration of exposure and time spent at home. In addition, there would be no further cumulative risk, since no residence would be affected by more than a group of 9 wells and a single compressor at the same time. Under the MLE scenario, the estimated cancer risks associated with long-term exposure to benzene and formaldehyde concentrations are 6e-08 and 4e-10, which are both below the le-06 threshold. The estimated total MLE cancer risk for the inhalation pathway (6e-08) is also less than

le-06. Under the MEI scenario, both the individual cancer risks for benzene and formaldehyde (2e-07 and 1e-09) and the total cancer risk for the inhalation pathway (2e-7) are also below the le-06 threshold range. Overall, the results of the long term risk analysis indicate no potential for concern. In addition, given the conservative nature of the MEI analysis, the exposures in this scenario more than likely overstate what any individual would experience.

4.2.4 Impact Summary

Direct and/or indirect emissions associated with additional exploration and development activity within the CRNGDPA would not exceed applicable State or Federal ambient air quality regulations or standards. Maximum concentrations of potential air pollutants would occur close to and between well locations. As a result, operations associated with additional oil/gas exploration and development within the CRNGDPA would not increase the overall maximum concentration of potential air pollutants due to the overall proximity of the individual wells to each other. Potential HAP impacts would be below significance thresholds.

In reviewing these predicted impacts it is important to understand the assumptions that have been made regarding resource development. The development of this analysis includes a great deal of uncertainty in the projection of specific plans (i.e., number of wells, equipment to be used, and specific locations thereof) for resource development some 30 years in the future (LOP). All of these factors affect air emissions as well as predicted air quality impacts.

4.2.5 Suggested Mitigation Measures

The air quality impact assessment assumes that water and/or chemical dust suppressants would be applied during construction in order to achieve a 50% control efficiency (at an assumed application rate of 0.02 gallons per square yard every 4 hours) in order to minimize TSP and PM_{10} fugitive dust emissions. In addition, roads constructed on soils susceptible to wind erosion could be graveled, or dust inhibitors could be periodically used on unpaved local, collector or arterial roads which present a fugitive dust problem. The operator could also establish and enforce speed limits for all non-surfaced roads within the CRNGDPA.

4.3 CULTURAL RESOURCES

4.3.1 Introduction

Cultural resources, including archaeological and historic sites, on lands subject to federal authority are protected by various laws and regulations commencing with the *Antiquities Act* of 1906. Specific

directives concerning Cultural Resource Management can be found in *Archaeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines* (Federal Register 1983) and BLM Manual Section 8100. Prior to the initiation of any federal action, cultural resources must be inventoried and evaluated to determine their eligibility for inclusion in the NRHP. This evaluation is a comprehensive screening process to determine significance and is designed to protect only the most significant sites. NRHP criteria (36 CFR 60.4) for determining eligibility define four (4) criteria of significance based upon "...the quality of significance in American history, architecture, archaeology, and culture present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association; and that:

- are associated with events that have made a significant contribution to the broad patterns of our society; or
- are associated with the lives of persons significant in our past; or
- embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- have yielded, or may be likely to yield, information important in prehistory or history".

Cultural properties are generally not eligible for inclusion in the NRHP if they lack diagnostic artifacts, subsurface remains, or structural features. Furthermore, sites that cannot be placed in a temporal context or shown to be related to other sites are usually not eligible and therefore are not officially protected.

4.3.2 Significance Criteria

Guidelines for determining adverse impacts to any site currently on, or eligible for, the NRHP have been developed by the Advisory Council on Historic Preservation [36 CFR 800.9 (b)(1),(2),(3)]. These guidelines indicate that significant impacts to cultural resources would include the following:

- destruction or alteration of all or part of an eligible property;
- isolation of a cultural resource from, or alteration of, its surrounding environment;
- introduction of visual, audible, or atmospheric elements that are either out of character with the property or alter its setting; and/or
- neglect and subsequent deterioration thereof.

These adverse impacts could be in the form of either direct, indirect, or cumulative impacts to cultural resources, which are defined below.

1 Direct impacts would result from physical disturbance of the cultural resource, resulting in an adverse effect to the site and its setting. Construction activities would be the primary direct impact affecting identified sites or structures.

2. Indirect effects resulting from implementation of the Proposed Action would not immediately result in the physical alteration of the site or its setting. Construction of an access road into an area containing significant sites or structures would allow public access and the potential for subsequent artifact collection.

3 Indirect activities, such as collection, could ultimately alter the overall composition and contextual integrity of the site, resulting in a cumulative impact over time.

Determining the potential effect(s) of any impact depends upon the level of information available. Should the occasion arise where an unavoidable impact to cultural resources either on, or eligible for nomination to the NRHP was identified, the proponent would be required to develop a mitigation plan designed to minimize disturbance to the site. This mitigation plan would be developed in consultation with both the SHPO and the appropriate SMA. Commencement of construction activities would not proceed until the mitigation plan had been approved by both the SHPO and SMA and subsequently implemented.

4.3.3 Direct and Indirect Impacts

As indicated in Section 3.4 of this document, a total of 408.5 acres have been previously inventoried within the CRNGDPA for cultural resources. A total of 5 cultural properties were identified as a consequence of these inventories, resulting in a site density equal to approximately 1 cultural property per 81.7 acres inventoried. Assuming that future inventories within the CRNGDPA would encounter cultural properties at this average site density, we would expect an additional 19 cultural properties to be identified in conjunction with additional oil/gas activity in the project area for the LOP. However, this assumption is merely an estimate based upon the results of previous cultural inventories conducted in the area to date. Unfortunately, the likelihood of identifying potentially significant cultural resources within those areas to be affected by oil/gas exploration and development activity within the CRNGDPA is unknown at this time. However, we may assume that the probability of encountering cultural resources will increase proportionately as additional acreage within the CRNGDPA is inventoried in connection with future oil/gas exploration and development activities therein.

In response to the *National Historic Preservation Act* of 1966, federal agencies must identify (or cause to be identified) properties which are eligible (or potentially eligible) for nomination to the NRHP within the area of a federal undertaking. As a result of this and other related acts (including interpretations thereof and subsequent regulations pertaining thereto), all surface disturbing activities associated with exploration and/or development activities on federal surface and/or mineral estate within the CRNGDPA would require a cultural resource inventory prior to approval. These inventories would be performed in order to identify and preserve those sites which are culturally or

historically important to our understanding of the history and prehistory of Wyoming. These inventories would generally consist of a 10 acre block surrounding each proposed well location, and a 100 foot corridor along proposed access road routes and pipeline alignments (50 feet either side of centerline) except where there is overlap with previous inventory coverage. Should these inventories fail to identify any potentially significant cultural materials within the impact area, approval of the pending action would be granted by the Authorized Officer. However, should potentially significant cultural resources be discovered as a result of the inventory, measures would be recommended to mitigate impacts to the cultural resource. These mitigation measures would be recommended by the Authorized Officer, in consultation with the SHPO, for the evaluation and/or preservation of the cultural resource as deemed appropriate.

Considering the nature of this resource, the fact that an inventory must be conducted, and that significant cultural resources may require mitigation prior to the approval of any surface disturbing activity on federal surface and/or mineral estate, there would be no significant impact to cultural resources resulting from oil/gas exploration and development activity associated with the Proposed Action.

4.3.4 Suggested Mitigation Measures

1 Any cultural or paleontological resource (historic or prehistoric site or object or fossil) discovered by the Operator, or any person working on his behalf, on public or federal land should be immediately reported to the Authorized Officer (AO). The operator should suspend all operations in the immediate area of the discovery until written authorization to proceed is issued by the AO. An evaluation of the discovery will be made by the AO to determine the appropriate action(s) to prevent the loss of significant cultural or scientific values. The Operator would be responsible for the cost of evaluation and any decision as to proper mitigation measures would be made by the AO after consulting with the Operator.

4.4 GEOLOGY AND MINERALS

Potential oil/gas exploration activities within the CRNGDPA would not have an adverse impact upon other mineral resources and would be consistent with management direction for the area as prescribed in the PRRA RMP. Conflicts which could interfere with the recovery of other mineral resources within the immediate project area, such as mining for gravel or uranium, would be subject to prior existing rights, thereby lessening the potential for future conflict. At this time, there are no other known mineral resources within the project area which are considered to be economically recoverable.

Minimum engineering standards established by *Onshore Oil and Gas Order Number 2* for oil/gas drilling and completion operations would ensure hole integrity and should preclude the possibility of downhole fluid migration between formations.

4.5 HYDROLOGY

4.5.1 Introduction

Hydrologic impacts resulting from surface disturbances associated with additional oil/gas exploration and development within the CRNGDPA would include the removal of vegetation, exposure of the underlying soil surface, and compaction of the soil. These impacts would result in an increased overland flow of surface runoff with subsequent erosion and off-site sedimentation. Consequently, these changes in the local environment could create the potential for increased streamflow, increased sediment loading, and the subsequent degradation of both surface and subsurface water quality below acceptable standards, if they are not properly controlled or occur in close proximity to a perennial stream or aquifer recharge point. Both the magnitude and duration of these impacts depend upon several factors, including:

- slope aspect and gradient,
- degree and extent of soil disturbance(s),
- susceptibility of the soil to erosion, and
- proximity of the disturbance to existing stream channels.

The duration of time within which construction activities take place and the timely implementation and subsequent success (or failure) of applicable reclamation measures would also be factors. These potential impacts would be greatest soon after commencement of construction activities, but would decrease shortly after completion thereof, due to passive stabilization and implementation of erosion and sediment control measures as necessary to control runoff.

For the purposes of this anaylsis, the terms short-term and long-term, as they apply to the reclamation of disturbed areas and the subsequent establishment of vegetative growth sufficient to control excessive erosion, stabilize the soil, provide forage for both livestock and wildlife, and also to provide habitat for small mammals, passerine birds, and herptiles are defined below.

1 Short-term refers to surface disturbances that typically would be reclaimed immediately after exploration and/or development activities have been completed (e.g., non-working areas of the well pad, outslope areas of the access road, pipeline ROW's). In this regard, Section 2.2.7 states that reclamation of areas unnecessary for production operations (approximately 1.50 acres) would be completed within a maximum of 2 years following termination of drilling and completion operations, thereby reducing disturbance at each location to approximately 1.25 acres for the LOP. The establishment of a successful stand of vegetation on these reclaimed areas could be reasonably expected within 3 to 5 years following initial soil disturbance.

2. Long-term loss refers to surface disturbances that typically would not be reclaimed immediately following the completion of exploration and/or development activities (e.g., working areas of producing well locations, access road running surfaces, and ancillary facilities). These areas would not be returned to their original vegetative state within a reasonable period of time (3 to 5 years) but would remain disturbed for the LOP.

The leakage or spillage of liquid hydrocarbons and/or other fluids/chemicals utilized in drilling, completion and/or producing operations could also degrade both surface and groundwater resources. The impact of such an occurrence would depend primarily upon the quantity and chemical composition of the fluid(s) released, and the relative proximity of the spill to the water body potentially impacted.

4.5.2 Significance Criteria

The following criteria were used to determine the significance of impacts to other surface and subsurface hydrologic (water) resources within the project area.

- Degradation of existing surface water quality such that state and/or federal standards are not met.
- Modification of the quantity or quality of stream flows that affect established users such as humans, livestock, fish or wildlife.
- Project activities impact water yield(s) from existing wells or springs.
- Degradation of existing subsurface water quality in aquifers important for agricultural and/or domestic purposes.
- Total disturbance in any watershed is greater than (exceeds) 10 percent.

4.5.3 Direct and Indirect Impacts

4.5.3.1 Surface Hydrology

Because there are no perennial streams or other sources of permanent surface water (stock water reservoirs) known to exist within the project area, the potential for significant degradation of existing surface water quality in or adjacent to the CRNGDPA resulting from implementation of the proposed action is considered to be remote. As indicated in Section 2.3.5, water produced in association with additional oil/gas exploration and development within the CRNGDPA would be disposed of in strict accordance with both WDEQ/WQD and WOGCC rules and regulations for the surface/subsurface disposal of produced water.

A summary of proposed surface disturbance by watershed (as defined in Section 3.6.1 and subsequently illustrated in Figure 3.2) is presented in Table 4.2.

Table 4.2

Summary of Proposed Surface Disturbance by Watershed

Name of Watershed	Well Locations		Access Roads		Pipelines		Total Disturbance
	Number	Acres	Feet	Acres	Feet	Acres	
Adobe	5	13.75	11,000'	10.10	11,000'	10.10	33.95 acres
Poison Creek Tributary	4	11.00	8,800'	8.08	8,800'	8.08	27.16 acres
Sand Draw	43	118.25	94,600'	86.87	94,600'	86.87	291.99 acres
S. Fork Powder River	18	49.50	39,600'	36.36	39,600'	36.36	122.22 acres
Totals	**70**	**192.50**	**154,000'**	**141.41**	**154,000'**	**141.41**	**475.32 acres**

The above summary of projected surface disturbance in the CRNGDPA does not include the 10 acres associated with ancillary production facilities and the 1.92 acres associated with road reconstruction identified in Section 2.2. These surface disturbing activities would most likely occur in the Sand Draw watershed and would increase the overall disturbance in this watershed resulting from project activities to 303.91 acres. An additional 20.37 acres of surface disturbance (resulting from the remaining 3 wells) would occur in a 337 acre parcel in the extreme northern end of the CRNGDPA, which was not assigned a specific watershed designation for this analysis. This 337 acre parcel was included in the 3,074 acre Upper Sand Draw watershed, which was analyzed in conjunction with the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project (CGBWNGDP) Environmental Impact Statement. No surface disturbing activities were proposed in the 3,074 acre Upper Sand Draw watershed in conjunction with the CGBWNGDP by the project proponents (USDI-BLM 1997). Table 4.3 provides the percentage of surface disturbance in each watershed which would result from additional oil/gas exploration and development activity within the CRNGDPA.

Table 4.3

Percentage of Surface Disturbance in Each Watershed

Watershed Name	Total Acres in Watershed	Acres of Disturbance	Surface Disturbance as Percent of Total
Adobe	767.20	33.95	4.43
Poison Creek Tributary	1,779.57	27.16	1.53
Sand Draw	8,159.74	303.91	3.73
S. Fork Powder River	6,734.94	122.22	1.82
Upper Sand Draw	3,074.00	20.37	0.66
Totals	**20,515.45**	**507.61**	**2.47**

The potential for off-site erosion and sedimentation throughout the CRNGDPA would be further reduced through the incorporation of site specific reclamation requirements directly into the conditions of approval for those actions within the CRNGDPA requiring federal authorization. Typically, these reclamation requirements would be developed during the permit review process (on-site inspection) and would be based upon site-specific concerns identified during the course thereof. Consequently, the potential for increased erosion and sedimentation within or directly adjacent to CRNBGDPA is considered to be insignificant when one considers the following:

- the total amount of surface disturbance which would result over the LOP from additional oil/gas exploration and development activity within the CRNGDPA (507.61 acres of short-term disturbance) represents only 8.08% of the total land area within the CRNGDPA;

- successful reclamation of disturbed areas not required for on-going production operations would result in a 56.6% overall reduction in LOP surface disturbance, thereby further reducing the potential for erosion and off-site sedimentation;

- the implementation of site specific "Best Management" reclamation practices designed to stabilize disturbed areas as quickly as possible, would result in a 78% overall reduction in erosion after the first year and an 81% reduction in erosion after five years (refer to Section 4.7.3); and

- surface disturbance resulting from additional oil/gas exploration and development activity would not exceed the 10 percent significance threshold in any of the 5 affected watersheds.

4.5.3.2 Sub-Surface Hydrology

Section 3.6.2 indicates that the Wind River Formation is the primary near-surface, fresh-water aquifer within the project area and extends from the surface to a depth of approximately 2,000 feet below the natural ground level. The upper portion of the Wind River Formation is comprised of sandstone and conglomerate with minor amounts of lenticular siltstone, claystone, and carbonaceous shales (Crist and Lowry, 1972). The upper Fort Union Formation (UFU) is sandwiched between the Wind River Formation and Waltman Shale member of the Fort Union Formation. The UFU consists of lenticular, vertically stacked, fluvial sandstones, interbedded with coals, siltstones, and shales with some thin conglomerate beds. Below the upper Fort Union Formation is the Waltman Shale member of the Fort Union Formation, which is composed mainly of lacustrine shale and mudstone and attains an average thickness of 800 feet throughout the CRNGDPA (Johnson *et al* 1996).

As indicated in Section 3.6.2, there are only 3 water wells known to exist within the boundaries of the CRNGDPA (including the CRU water supply well), with the deepest of these wells producing from a total depth of 550 feet (Cooper Reservoir Unit #1). Contamination of near-surface fresh water aquifers in the Wind River Formation from deeper geologic horizons penetrated by the well bore would be prevented by:

1) the presence of the Waltman shale between the near-surface fresh water aquifer and the deeper hydrocarbon bearing formations, and

2) casing and cementing programs designed specifically to prevent annular fluid communication between different formations downhole and the potential for contamination of near-surface fresh water aquifers (see Section 2.2.5.2).

Contamination of near-surface fresh water aquifers in the Wind River Formation from surface operations could result from the introduction of contaminated fluids onto the natural ground surface and the migration of these contaminated fluids into the aquifer over time. Intoil is considering implementation of a semi-closed mud system which would eliminate much of the potential for ground water contamination from drilling-related operations. Intoil has not yet determined if this technology will be utilized for drilling operations in the CRNGDPA. Consequently, mitigation measures have been recommended to eliminate the potential for ground water contamination resulting from seepage of either drilling or produced fluids into the subsurface. Moreover, implementation of drilling, completion, and production techniques identified in Chapter 2.0, in conjunction with the mitigation measures identified below should eliminate the potential for surface or subsurface water contamination as a result of oil/gas exploration and development activities in the CRNGDPA.

4.5.4 Suggested Mitigation Measures

1 All drilling operations should be conducted with a lined reserve pit in order to prevent drilling water loss and potential contamination of the aquifers in the Wind River Formation through seepage. The reserve pit should be lined with a vinyl/plastic liner having a permeability less than or equal to 1×10^{-7} cm/sec. The liner should be chemically compatible with all substances which may be put into the pit and should be installed so that it will not leak.

Liners made of any man-made synthetic material should be of sufficient strength and thickness to withstand normal installation and pit use and should be installed with sufficient bedding (either straw or dirt) to cover any rocks, should overlap the pit walls, extend under the mud tanks, and be covered with dirt and/or rocks to hold it in place. No trash, scrap pipe, etc. that could puncture the liner should be disposed of in the reserve pit.

2. Emergency and/or production pits associated with oil/gas production operations should consist of either metal or fiberglass tanks rather than earthen pits. Where these tanks are installed in the ground, a leak detection system should be installed to prevent the potential migration of leaking hydrocarbons into the subsurface. Earthen emergency/production pits should not be allowed within the CRNGDPA.

4.6 RANGE

4.6.1 Introduction

Actual construction of the individual well pads, access roads, pipelines, etc. would result in an overall reduction in livestock and wildlife forage and a subsequent reduction in the available animal unit months (AUMs) in each affected grazing allotment. For the purpose of assessing impacts to range resources, acres of disturbance were converted to a reduction in AUMs based upon an average of 7.5 acres/AUM for the overall project area.

4.6.2 Significance Criteria

Impacts produced by oil/gas exploration activities within the proposed lease option area would be considered significant if:

- AUMs decline by 5% or more in a single year through construction and subsequent disturbance of vegetation;
- project activities resulted in range degradation through the introduction of noxious weeds to the degree that such establishment resulted in listed weedy species occupying more than 20% of a specific vegetation type or hampering successful revegetation of desirable species in disturbed areas; or
- project activities resulted in the destruction of existing range improvements.

4.6.3 Direct and Indirect Impacts

4.6.3.1 Animal Unit Months

The primary impact to range resources would be the initial loss of vegetation and vegetative (forage) production resulting from oil/gas exploration and development activity within the overall project area. As indicated in Section 2.2, routine activities associated with oil/gas exploration and development in the CRNGDPA would result in approximate surface disturbances as follows:

- 200.75 acres associated with the construction of 73 well locations;
- 149.40 acres associated with road construction and reconstruction;

- 147.48 acres associated with installation of the gas gathering system; and
- 10 acres associated with the installation of ancillary facilities in the CRNGDPA

Under these assumptions, the initial loss of approximately 507.61 acres of vegetation over the LOP would result in the short-term loss of 67.69 AUMs, which represents approximately 8.1% of the total AUMs available on surface lands within the CRNGDPA. Reclamation of those areas not required for ongoing production and operations would place approximately 220.36 acres back into forage production within 1 to 2 years following the initial disturbance. Reclamation of these areas would result in a long term loss of 38.3 AUM's, which represents approximately 4.6% of the total AUM's available on surface lands within the CRNGDPA. However, considering that these surface disturbances will occur over a period of 5 to 10 years rather than all at once, the potential loss of forage within the CRNGDPA is not considered as a significant impact upon the range resource.

4.6.3.2 Noxious Weeds

The invasion of disturbed areas by noxious or other undesirable weedy species would be a potential impact resulting from oil/gas exploration and development activity within the CRNGDPA. Several species of noxious weeds have become established on disturbed sites throughout Wyoming and the CRNGDPA. As indicated in Section 3.7, some of the more common weed species which could be expected to invade disturbed surfaces within the CRNGDPA include Canada thistle, musk thistle, Russian knapweed, spotted knapweed, and leafy spurge.

As presented in Section 4.5.3.1, surface disturbances associated with pad and road construction and pipeline installation would affect less than ten (10) percent of the combined surface acreage within the CRNGDPA. Considering the somewhat limited amount of surface disturbance which would be associated with oil/gas exploration and development activities within the overall project area, and that weedy species would not be expected to invade all of the newly disturbed areas, these potentially increased levels of noxious weed species would not be considered as a significant impact.

4.6.3.3 Existing Range Improvements

Range improvements which could be affected by oil/gas exploration and development activity within the CRNGDPA include:

- right-of-way fences along existing federal, state and county roads/highways, and
- water developments (e.g., water wells and stock reservoirs) located within the overall project area.

Existing fences should not be adversely affected by oil/gas exploration and development activity within the CRNGDPA. Potential impacts to these existing fences can either be avoided or mitigated as necessary to preserve the structural integrity and functional reliability thereof.

Potential impacts to existing water wells would be eliminated through implementation of drilling and completion techniques required under both *Onshore Oil and Gas Order Number One* and *Number Two*. The general lack of surface impoundments within the CRNGDPA eliminates concerns regarding sedimentation thereof. However, should surface impoundments be constructed within the CRNGDPA during the life of the project, the potential for sedimentation of these surface impoundments would be eliminated by implementation of sound reclamation practices based upon site specific data included in each individual application and any Conditions of Approval/Stipulations attached thereto by the SMA.

4.6.4 Suggested Mitigation Measures

In order to minimize the overall impact to range resources and existing range improvements within the CRNGDPA which could result from oil/gas exploration and development activity therein, mitigation measures are suggested as follows.

1 To ensure that infestations of noxious weeds are suitably controlled, the proponent should cooperate with the appropriate weed and pest control authority as necessary to implement an integrated pest management program which would be in compliance with all federal and state rules and regulations concerning the application of herbicides or pesticides.

2. In order to maintain the structural integrity of existing fences, wooden "H" braces should be installed on either side of the proposed fence cut and the fence properly tied off, prior to cutting the fence and installation of the required cattleguard.

3 All cattleguards should be routinely maintained for the duration of the project in order to eliminate the potential for any livestock migration to occur.

4.7 SOILS

4.7.1 Introduction

Impacts that could result from additional oil/gas exploration and development activity within the overall project area would include the removal of vegetation, subsequent exposure and disturbance of the soil, mixing of soil horizons, an increase in the susceptibility of the soil to wind/water erosion, loss of the soil resource, and an overall alteration in the topography of the affected area(s). The initial disturbance of the soil, in association with the potential loss of soil through erosion, could ultimately

reduce both the quantity and productivity of topsoil available for reclamation operations. However, all available topsoil would be salvaged during initial construction and stockpiled for later revegetation in order to assure that the natural fertility and reclamation potential of the topsoil resource is not reduced (see Section 2.3.7).

Increased surface runoff and water erosion would primarily occur in the short-term and would decline over time due to natural stabilization and surface crusting, in conjunction with a direct response to erosion control, reclamation and revegetation techniques to be utilized on disturbed areas in accordance with the provisions of OOGO Number 1 and the approved APD, Sundry Notice, or Right-of-Way Grant, as applicable. Soil and climatic factors in the overall area, combined with utilization of technological and/or mechanical applications designed to enhance revegetation would generally ensure stabilization of each disturbed area within one (1) to two (2) years after initial disturbance.

4.7.2 Significance Criteria

Impacts to soils resulting from additional oil/gas exploration and development activity associated with the Proposed Action would be considered as significant if:

- exploration and development activity resulted in increased soil erosion that cannot be reduced by 50% after 1 year, and 75% after 5 years of soil disturbance; and/or
- reclamation of disturbed areas would not result in the establishment of vegetative cover adequate to stabilize the site to pre-disturbance conditions within 5 years; and/or
- productivity of the reclaimed soil does not equal pre-disturbance productivity levels, as indicated by revegetation success (e.g., vegetal cover), such that levels of pre-disturbance land use can occur.

4.7.3 Direct and Indirect Impacts

Removal of native vegetation and disturbance of the underlying soil material as a result of surface disturbing activities associated with the Proposed Action would increase the potential for loss of the existing soil resource through erosion. This potential would increase proportionately as degree of slope increases. Overall, soils within the overall project area generally have an adequate amount of topsoil available to ensure satisfactory reclamation, assuming the use of proper techniques designed to control erosion and ensure revegetation of the reclaimed areas are utilized in the reclamation process and slopes throughout the project area are relatively gentle. Additional oil/gas exploration and development activity within the CRNGDPA would result in the overall disturbance of approximately 507.61 acres of the soil resource, or less than 10% of the total surface estate included within the

proposed project area (see Section 4.5.3). This level of short-term soil disturbance is not considered as a significant impact upon soil resources within the CRNGDPA.

As indicated in Table 3.6, sensitive soils comprise approximately 1,076 acres or 17.13% of the surface estate within the CRNGDPA. The bulk of these sensitive soils occur in the northeastern corner of the overall project area along Sand Draw and tributary drainages thereof (see Figure 3.2). These soils are primarily loams and clay loams derived from sodic shale which exhibit slow to very slow permeabilities, making them both susceptible to erosion resulting from runoff and poor candidates for reclamation. Fortunately, sensitive soils in the northern portion of the CRNGDPA typically occur on flat to gently sloping terrain, which would minimize the potential for erosion and sedimentation as a result of unchecked runoff and maximize reclamation efforts thereon. Moreover, all of the 1,076 acres of sensitive soils lie outside of the core area proposed for development within the CRU. As these sensitive soils lie outside of the boundaries of the CRU, exploration and development activity on these soils would most likely be limited to a minimum 80 acre spacing pattern. This would greatly reduce the overall potential for disturbance of these soils and a concomitant increase in both erosion and sedimentation resulting therefrom. The small inclusions of sensitive soils located on the west, east, and south sides of the project area could probably be avoided altogether, further eliminating the potential for an increase in erosion and sedimentation attributable to disturbance of these soils. In those instances where surface disturbing activities on these sensitive soils would be unavoidable, special reclamation techniques identified as mitigation in Section 4.7.4 should be employed to prevent undue and unnecessary degradation of the environment.

A detailed analysis of projected soil erosion rates was conducted for the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project (USDI-BLM 1997). The Modified Soil Loss Equation (MSLE) was used to calculate soil erosion. Erosion rates were determined based on general assumptions of conditions and operating procedures for the comparison of alternatives and these values are presented in Table 4.4 (Grah 1997).

Table 4.4

Estimated Erosion Rates per Acre of Surface Disturbance Calculated Both With and Without the Application of Best Management Practices in Tons/Acre/Year

Type of Disturbance	Bare Soil Surface - BMP Not Applied	BMP Applied - Erosion After One Year	BMP Applied - Erosion After Five Years
Individual Well Pads	13.8 tons/acre/year	1.5 tons/acre/year	0.2 tons/acre/year
Gathering Pipelines	73.7 tons/acre/year	1.8 tons/acre/year	0.5 tons/acre/year
Access Roads	5.8 tons/acre/year	2.3 tons/acre/year	0.5 tons/acre/year

Source: Soils, Water, and Vegetation Resources Technical Report. Report prepared for the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project EIS (Grah 1997).

These calculations suggest that soil erosion could be reduced to non-significant levels with the application of Best Management Practices (BMP). A summary of the estimated erosion which would result from surface disturbing activities associated with/arising from additional oil/gas exploration and development activity within the CRNGDPA is provided in Table 4.5.

Table 4.5

Estimated Erosion Rates With and Without Application of Best Management Practices in the Reclamation of Disturbed Soils in Tons per Year

Project Facility	Acres	Year 1				Year 5			
		Without BMP		With BMP		Without BMP		With BMP	
		t/ac/yr	t/yr	t/ac/yr	t/yr	t/ac/yr	t/yr	t/ac/yr	t/yr
Well Pads	200.75	13.8	2,770.35	1.5	301.13	3.1	622.33	0.2	40.15
Gathering Pipelines	147.48	73.7	10,869.28	2.3	339.20	16.4	2,418.67	0.5	73.74
Access Roads	149.40	5.8	866.52	2.3	343.62	1.5	224.10	0.5	74.70
Ancillary Facilities	10.00	13.8	138.00	1.5	15.00	3.1	31.00	0.2	2.00
Totals	**507.61**	—	**14,644.15**	—	**998.95**	—	**3,296.10**	—	**190.59**

t/ac/yr = tons per acre per year
t/yr = tons per year

Implementation of BMP for reclamation and erosion control would result in a 93% reduction in erosion in the first year and a 94% reduction in erosion by the fifth year, with implementation of BMP resulting in an overall 81% reduction in erosion after 5 years. These calculations suggest that soil erosion resulting from additional oil/gas exploration and development activity in the CRNGDPA could be reduced to non-significant levels with the application of BMP for reclamation and stabilization of disturbed soils.

4.7.4 Suggested Mitigation Measures

In order to minimize the overall impact to soil resources within the CRNGDPA which could result from additional oil/gas exploration and development activity therein, the following mitigation measures are recommended.

1 In order to protect sensitive soils, no occupancy or surface disturbance should be allowed on slopes in excess of 25%.

2 The sensitive soils identified in Table 3.7 should be avoided to the greatest extent possible. In those instances where disturbance of these soils is unavoidable, the proponent should prepare a site specific Erosion Control, Reclamation and Revegetation Plan which sets forth the

construction, reclamation, and revegetation techniques to be implemented in conjunction with the proposed surface disturbing activity.

3 All available topsoil (e.g., 6 to 12 inches) should be removed (stripped) from the areas of new construction and stockpiled for future reclamation of these disturbed areas. This stored topsoil, as well as cut and fill slopes on the well pad, should be secured from erosion through mulching and temporary revegetation (hydroseeding) if reclamation is not anticipated within one (1) year following initial construction.

4. Unused areas (borrow ditch) along the proposed access road route(s) which would be denuded of existing vegetation during initial construction should be reseeded in order to re-establish vegetative cover and reduce the overall potential for erosion and off-site sedimentation.

4.8 VISUAL RESOURCES

4.8.1 Introduction

Short-term visual impacts associated with implementation of the Proposed Action would include visual contrasts between the industrial character of the construction and drilling equipment and the somewhat natural surrounding landscape. In addition, potentially heavy volumes of sporadic truck traffic and the fugitive dust created as a result thereof, could produce negative visual impacts beyond the immediate project area (e.g., U.S. Highway 20-26). In this regard, both short-term and long-term impacts to the visual resource would be possible where patterns of line, form, color and texture in the existing characteristic landscape would be visually contrasted by drilling equipment and/or construction related disturbances to the existing topography or other readily visible site features. The severity of this impact would be dependent upon a number of factors including:

- the visual absorption capability of the surrounding landscape,
- distance from the most sensitive viewing area,

  reclamation potential of the landscape to be disturbed, and/or
- the level of disturbance to the visual resource to be created by the Proposed Action.

The duration of the impact would be a function of both the time required to complete the action and the time required for the disturbed site to return to a pre-disturbance condition. In general, the visual impact would be greatest on those sites where mitigation would be difficult and/or where the visual contrast would be highly visible to a potentially large number of viewers.

4.8.2 Significance Criteria

Visual impacts produced by the Proposed Action would be considered significant if:

- Implementation of project activities would violate management direction described and mandated by both the Platte River Resource Area *Resource Management Plan* and the *Oil & Gas Programmatic Environmental Assessment*.

- Alteration of the existing characteristic landscape would produce contrasts beyond the degree allowed for in the stated VRM guidelines, where contrasts would be visible to potentially large numbers of viewers and would appreciably diminish the aesthetic experience thereof.

4.8.3 Direct and Indirect Impacts

4.8.3.1 Introduction

As indicated in Section 3.9, the northern portion of the project area falls within a 3-mile buffer zone along U.S. Highway 20-26 which has been designated as a Class III VRM area. Within this VRM class, changes in the basic environmental (topographic) elements caused by additional oil/gas exploration and development may be evident in the characteristic landscape; however, the changes should remain subordinate to the visual strength of the existing (land) character. The southern portion of the project area has been designated as a Class IV VRM area. Under this VRM Class, changes may subordinate the original composition and character, but must reflect what could be a natural occurrence within the characteristic landscape (USDI-BLM 1982).

The following analysis of visual impacts will focus on a discussion of the visual landscape in terms of viewer proximity to intrusions related to additional oil/gas exploration and development from a foreground, middleground, and/or background perspective. For the purposes of this document, the terms *foreground*, *middleground* and *background* are defined as follows:

Foreground - Generally the area that lies within one-half mile of the viewer.

Middleground The area between the foreground and background in a landscape. The area located from one-half mile to five miles from the viewer.

Background The distant part of a landscape located from five miles to infinity from the viewer.

4.8.3.2 Impacts to Travelers Along U.S. Highway 20-26

The northern boundary of the CRNGDPA is located more than one-half mile south of U.S. Highway 20-26; consequently, oil/gas exploration and development activities within the project area would not affect the foreground perspective of travelers along said highway. From a middleground perspective, activities within the CRNGDPA would be almost completely screened from viewers along U.S. Highway 20-26 by existing topography, particularly from Waltman west along the highway. The most notable exception would be the derrick of both drilling and completion rigs, which would be partially visible to travelers along Highway 20-26 for the duration of drilling and completion operations. This impact would be short-term in nature and would not result in a permanent or long-term alteration in the existing landscape.

Modifications to the landscape created as a result of activities associated with the proposed action would be primarily visible to viewers along U.S. Highway 20-26 only from a background perspective, particularly for those viewers traveling west and looking to the south/southwest. From this perspective, the overall landscape is dominated topographically by the Rattlesnake Hills and Beaver Rim, which would diminish the visual impact of surface disturbing activities within the CRNGDPA. Moreover, the foreground perspective along U.S. Highway 20-26 in this area is dominated by existing facilities along both sides of the highway (see Section 3.9). These facilities would tend to distract the viewer, thereby minimizing the impact of disturbances within the CRNGDPA as these disturbances would only be visible in a background setting. Moreover, mitigation measures identified in association with this project would tend to minimize the visual impacts of additional oil/gas exploration and development to viewers - particularly from a middleground and background perspective.

Considering the magnitude and extent of pre-existing visual intrusions along U.S. Highway 20-26, implementation of the Proposed Action would not violate existing visual resource management direction for the area or produce contrasts beyond the degree allowed for in the stated VRM guidelines.

4.8.3.3 Impacts to Travelers Along Natrona County Road 212

Natrona County Road (NCR) 212 is a graveled road which departs U.S. Highway 20-26 at the community of Waltman and serves as the primary access to the Gas Hills Uranium Mining District and to outlying ranches to the south of Waltman. The county road is not classified as a Scenic Byway and probably does not receive a great deal of tourist (non-local) traffic except during the fall hunting season. As shown in Figures 1.2 and 1.3, NCR 212 bisects the CRNGDPA; consequently, intrusions on the landscape resulting from additional oil/gas exploration and development activity within the CRNGDPA would be readily apparent to travelers thereon from both a foreground and middleground perspective. However, considering the degree of visual intrusion which has already occurred within the CRNGDPA (e.g., powerlines and electric substations, pipeline compressor station(s), ranch outbuildings, oil/gas wells, etc.), any additional alterations to the landscape resulting from the

proposed action should not result in a significant degradation of the visual landscape or violate existing management direction for this area. As stated above, mitigation measures identified in association with this project would tend to minimize the visual impacts of additional oil/gas exploration and development to viewers - particularly from a middleground and background perspective.

Considering the magnitude and extent of pre-existing visual intrusions along NCR 212, implementation of the Proposed Action would not violate existing visual resource management direction for the area or produce contrasts beyond the degree allowed for in the stated VRM guidelines.

4.8.4 Suggested Mitigation Measures

While visual intrusions which would result from project activities are not considered as significant, the following mitigation measures are suggested in order to lessen the overall visual impact associated with additional oil/gas exploration and development activity in the CRNGDPA.

1 All permanent (on-site for six months or longer) above-ground structures constructed or installed on the individual well locations (including pumping units, tank batteries, etc.) should be painted a flat, non-reflective, earthtone color to match one of the standard environmental colors as determined by the Five State Rocky Mountain Interagency Committee.

   Those facilities required to comply with *Occupational Health and Safety Act* (OSHA) rules and regulations would be excluded from this painting requirement.

4.9 WILDLIFE

4.9.1 Introduction

The overall project area provides habitat for many species of both game and non-game vertebrates, including mule deer, antelope, raptors, upland game birds, predators and furbearers. The principal impacts likely to be associated with additional oil/gas exploration and development activity within the CRNGDPA would include potential displacement of some wildlife species from preferred habitat and the potential loss of wildlife habitat as a result of project activities. Crucial habitat(s) for either big game or game bird species are not known to exist with the CRNGDPA.

4.9.2 Significance Criteria

Impacts to wildlife species within the project area would be considered as significant if any of the following were to occur:

- project activities impact an officially-designated crucial habitat during an important use period;
- a permanent reduction in the rate of population recruitment for economically important or statutorily protected species occurred as a result of project activities; and
- a "may effect" determination was reached by the cooperating agencies for any wildlife species currently listed as either "threatened or endangered" under the ESA.

4.9.3 Direct and Indirect Impacts

4.9.3.1 Introduction

Impacts on local wildlife populations would result from direct removal or alteration of habitat, increased human presence associated with additional oil/gas exploration and development activity, and direct wildlife/human interaction. Activities associated with additional exploration and/or development activity within the CRNGDPA would temporarily eliminate approximately 507.61 acres of wildlife habitat, consisting mostly of shrubs, grasses and forbs. This would result in a proportionate reduction in the amount of herbaceous and browse forage available to herbivorous species such as antelope and mule deer, as well as a reduction in nesting, feeding and security habitat for game birds (e.g., sage grouse) and those smaller vertebrate species that may inhabit the affected areas. These habitat losses can generally be classified as being either short-term or long-term in duration, with these terms defined below.

1 Short-term loss refers to disturbances that would be reclaimed immediately after exploration and/or development activities are completed.

   Loss or alteration of habitats in grass-shrub meadows and/or on grassy slopes would be considered short-term and are expected to occur in conjunction with lease development.

2. Long-term loss would occur in areas that could not be returned to their original vegetative state within a reasonable period of time (3 to 5 years), such as producing well sites, access roads, and ancillary facilities (e.g., compressor station and/or centralized production facility).

4.9.3.2 Habitat Loss and Displacement

Disturbances resulting from well pad, access road, pipeline, etc. construction associated with additional exploration and development activity within the CRNGDPA would result in the loss of smaller, less mobile species of wildlife, such as small mammals and reptiles until such time as reclamation has been completed. However, considering the relatively small geographic area of disturbance, the actual magnitude of this loss and the subsequent displacement would be minimal. The displacement of more mobile species to adjacent undisturbed habitats, while difficult to predict, would be relatively short-term in nature given the overall duration of intensive activities associated with the proposed project.

Rather than direct habitat loss, the greatest impact on wildlife populations would be from displacement of economically important wildlife species such as antelope and mule deer from preferred habitats as a result of increased level(s) of human activity (including vehicular traffic) and associated noise. The extent of this displacement is difficult to predict when one considers that response to noise and human presence varies from species to species as well as among individuals of the same species. In some cases, wildlife species may habituate to noise and human presence after initial exposure, and begin to re-invade areas that were formerly avoided. It is commonly assumed that these effects are detrimental to individual species and numerous studies have examined the effects of human presence on big game species (Klein 1974; Irwin and Peek 1979; Ward and Cupal 1979; MacArthur *et al* 1982; Brekke 1985). However, research on the relationship between displacement from preferred habitats and increased stress due to human harassment (both intentional and otherwise) on overall population dynamics has been inconclusive to date.

In addition to the avoidance response, an increased human presence intensifies the potential for wildlife-human interactions ranging from the harassment of wildlife to poaching and increased legal harvest. Likewise, increased traffic levels on existing access roads could increase the potential for wildlife-vehicle collisions. These collisions are most frequent where roads traverse areas commonly frequented by game species. Considering the relatively minimal road network to be constructed in association with additional oil/gas exploration and development activity within the CRNGDPA, the generally short duration of intensive field activities (i.e., construction, drilling, and completion operations), combined with the insignificant amount of daily/weekly production traffic expected within the field, the potential for adverse wildlife-human interaction is considered to be minimal.

4.9.3.3 Economically Important Species

The project area includes year-round habitat for several economically important game species including pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and sage grouse (*Centrocercus urophasianus*). While the project area includes year-round habitat for the above species, crucial habitat(s) for these species are not known to occur within the overall project area. Consequently the short-term (initial) loss of 507.61 acres of habitat (8.01% of the CRNGDPA) and the potential long-term loss of 287.25 unreclaimed acres of habitat (4.57% of the CRNGDPA) is

not viewed as significant when one considers the relative availability and abundance of adjacent, undisturbed habitat. Moreover, considering that no crucial wildlife habitat(s) will be affected by implementation of the Proposed Action, the potential for long-term displacement and/or significant individual losses attributable to human activities within the CRNGDPA are considered to be insignificant. The above determination has been made despite the fact that population numbers are currently below objective levels as indicated in Section 3.11.3. Likewise, activities associated with oil/gas exploration and development in the overall project area would result in the loss of smaller, less mobile species of wildlife, such as small mammals and reptiles, from the area(s) of disturbance until such time as these activities ceased and site-specific reclamation had been achieved. Considering the relatively small percentage of total surface disturbance proposed within the 6,282.38 acre project area, the actual magnitude of this loss and subsequent displacement would be minimal. The displacement of more mobile species to adjacent, undisturbed habitats, while difficult to predict, would be relatively short-term in nature given the overall duration of exploration activities associated with the Proposed Action.

4.9.3.4 Raptor Species

As indicated in Table 3.8 (Section 3.11.4), there are currently 14 raptor nests known to exist either within or directly adjacent to the CRNGDPA. Eleven of these nests are within the boundaries of the CRNGDPA, with the remaining 3 nests (140, 143, and 197) located within one-half (1/2) mile of the project area boundary (see Figure 3.4). Nesting activity by ferruginous hawks (*Buteo regalis*) was observed within the CRU in 1996 and again in 1997. Two young were fledged from nest 169 in July of 1997, while nesting activities failed at nest 64 for unknown reasons (AEC 1997). Likewise, nesting activity by a pair of golden eagles was observed in 1996 by BLM personnel at nest 192, with 2 young subsequently fledged from this particular nest that year.

Exploration and development activity associated with the Proposed Action would result in a predicted well spacing of 1 well per 40 acres in both Sections 3 and 10 of Township 35 North, Range 87 West, with the subsequent development completely surrounding ferruginous hawk nests 64, 65, 169, and 170. The fact that these nests are centrally located within the Cooper Reservoir Unit virtually assures that some level of development will occur in close proximity to the nest sites - particularly in the case of nests 64 and 65. The proposed action would also result in a predicted spacing pattern of 1 well per 80 acres around golden eagle nest 192 in Section 33 of Township 36 North, Range 87 West. This particular area of the CRNGDPA is somewhat removed from the center of the gas field as currently defined; consequently, it is difficult to predict if full development of the mineral acreage surrounding nest 192 would ever occur. However, for the purposes of this document, we must assume that implementation of the Proposed Action would result in additional oil/gas exploration and development activity in proximity to the nest.

Surface disturbance and concomitant human intrusion(s) associated with additional oil/gas exploration and development activity within the CRNGDPA could have a negative effect upon raptor nesting success within the overall project area, if these activities were allowed to proceed during the nesting season. Moreover, it is predicted that the 3 pairs of nesting raptors referenced above may be

displaced if the Proposed Action is implemented and the maximum number of wells predicted are drilled and subsequently completed as producing gas wells. In this regard, the mitigation measures suggested in Section 4.9.5 have been specifically designed to minimize impacts to nesting raptors.

4.9.3.5 Threatened and Endangered Species

Section 3.11.5.1 identified two (2) species which have been classified as either threatened or endangered under the ESA and which may occur within the CRNGDPA as follows:

- **Bald eagle** *(Haliaeetus leucocephalus)*

  While the CRNGDPA does not provide suitable perching or roosting habitat for bald eagles, the overall area may receive sporadic use by individual eagles engaged in opportunistic foraging activity during the winter months. However, considering the general lack of suitable habitat (perching and/or roosting areas) within the overall project area, it is unlikely that bald eagles would routinely utilize the project area or be affected by oil/gas exploration activities therein.

- **Black-footed ferret** *(Mustela nigripes)*

  It is well documented that black-footed ferrets depend primarily upon prairie dogs *(Cynomys ssp.)* for food and upon prairie dog burrows for shelter (Hillman and Clark 1980, Fagerstone 1987). Cursory inventories of the CRU and adjacent areas conducted in the spring/summer of 1997 in conjunction with an inventory of raptor nesting therein failed to identify any prairie dog colonies within the inventoried areas. Field work by BLM personnel during the past two years has also failed to locate any prairie dog towns in or adjacent to the project area. While it is possible that small, isolated prairie dog colonies may exist within the overall project area, it is unlikely that these colonies are of sufficient size to support a viable population of black-footed ferrets.

4.9.3.6 Candidate Species

4.9.3.6.1 Swift fox (*Vulpes nigripes*)

Although no swift fox have been documented in the CRNGDPA, there is a possibility that the species may inhabit the overall area. In this regard, investigations of swift fox populations in southeastern Wyoming (SFCT 1996) suggested a minimum density estimated at 1.6 fox per 10 square kilometers (1.6/10 km^2). Likewise, swift fox investigations in South Dakota (Sharps 1984) suggest that swift fox tend to stay within a 1.6 to 3.2 kilometer (km) area during the denning season (April through June), but expand their territory to an 11.2 to 12.8 km (or larger) area during the winter months. This data would suggest that the 6,282.38 acre (9.82 mi^2) project area could support approximately

1.58 breeding pairs of swift fox during the spring and summer months, with the individual foxes expanding their range (territory) considerably during the lean winter months.

Based upon these estimated densities, it is unlikely that additional oil/gas exploration and development activity within the CRNGDPA would displace individual foxes from preferred habitat or have an adverse impact upon breeding pairs which may inhabit the area due to the low densities thereof. Conversely, additional development within the area could actually enhance swift fox habitat and population recruitment by increasing the available food supply, providing a wider range of denning sites in disturbed areas, and providing some protection from competition and predation by coyotes, which tend to avoid areas of human presence. Available literature on the swift fox (Sharps 1984; Jones, Jr. *et al* 1987; SFCT 1996) suggest that these animals routinely establish dens in areas which are actively used by humans (e.g., cultivated fields, cemeteries, along roads, etc.) and that these sites are probably selected as a function of both burrowing ease (for denning purposes) and proximity to their preferred food supply (primarily small mammals). In this regard, facilities associated with oil/gas production often provide habitat for small mammals such as mice, ground squirrels, and rabbits which take up residence in and around these facilities. During the winter months, these facilities would provide a haven from the harsh winter weather for these small mammals, thereby enhancing the available food supply for foxes foraging in the area. Moreover, surface disturbing activities associated with road/well pad/pipeline construction would also provide the fox with sites which could be easily excavated for use as dens in areas of rocky soil/soil hardpan. It is common knowledge that burrowing animals routinely use disturbed right-of-ways for den construction.

4.9.3.6.2 Mountain plover (*Charadrius montanus*)

As indicated in Section 3.10.5.2 , there have been 8 mountain plover sightings recorded in the 6,084 mi^2 search area since 1981, with one sighting in 1997 made approximately 9 miles northeast of the northern boundary of the CRNGDPA. Table 3.9 provides specific information on these sightings.

Mountain plovers in Phillips County, Montana selectively nest in prairie dog (*Cynomys* ssp.) colonies (Knowles *et al* 1982, Olson and Edge 1985) in vegetative settings that include prickly pear cactus (*Optunia polycantha*), fringed sagewort (*Artemesia frigida*), big sagebrush (*Artemesia tridentata*), western wheatgrass (*Agropyron smithii*) and blue grama. Plover nests in these Montana prairie dog towns typically occur in areas of approximately 27% bare ground (Knopf and Miller 1994). Nesting activity in the Pawnee National Grasslands (southeastern Colorado) tend towards areas of low herbaceous vegetation, reduced shrub cover, near prominent objects such as cow manure piles or similar-sized rocks, (Graul 1975, Olson and Edge 1985). Research conducted by Knopf and Miller (1994) of nest site selection on the Pawnee National Grasslands in 1991 and 1992 suggests that 30% bare ground is a minimal habitat requirement for nest site selection.

Considering that there are no known prairie dog colonies within the CRNGDPA and areas of bare ground or sparsely vegetated soils are extremely limited, it is unlikely that the area supports a breeding population of mountain plovers.

4.9.4 Impact Summary

Disturbances associated with oil/gas exploration and development activity within the CRNGDPA would result in some displacement of wildlife species from preferred habitats. Although these impacts are somewhat difficult to quantify, they increase as the degree of human intrusion increases. This is particularly true when these intrusions encroach upon essential (critical) habitat elements required by wildlife species. However, these impacts are not considered as significant in view of the following:

- the general lack of identified crucial habitat(s) for economically important game species including antelope, mule deer, and sage grouse;

  the relative availability of adjacent, similar habitats which would absorb the mobile species of wildlife displaced from the affected area as a result of oil/gas exploration activities therein;

- the low percentage of surface disturbance and resultant habitat loss which would result from the oil/gas exploration activities associated with the Proposed Action;

- implementation of the Applicant Committed Practices enumerated in Chapter 2.0; and

- implementation of the mitigation measures suggested below.

4.9.5 Suggested Mitigation Measures

As a result of this analysis process, the following mitigation measures are recommended to minimize impacts to wildlife resulting from additional oil/gas exploration and development activity within the CRNGDPA.

1 All project workers should be instructed about the nature of raptor species that occur on the project area, potential impacts to these species, and measures that can be taken to avoid or minimize impacts. They should also be advised of federal and state regulations and laws concerning harassment and illegal kill of raptor species.

2. If above-ground power lines are installed, power pole cross arms should be configured by the owner of the power line according to specifications described in Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996 (Avian Power Line Interaction Committee) so as to eliminate the potential for raptor electrocution.

3 Seasonal restrictions of construction activities within 1/4 mile of occupied raptor nests should be applied. An occupied nest is defined as one where eggs or young are being incubated or tended. Occupied nests should be protected during the nesting period until the young have safely fledged. Normally the exclusionary time window for nesting activities extends from February 1 through

July 31 for golden eagles and from March 15 through July 31 for other species. The AO may modify these dates depending on the specific circumstances surrounding individual nests.

Seasonal restrictions should be applied as follows:

- Any activity initiated prior to February 1 may be completely finished. This means a well may be permitted (casual uses), drilled, completed, and hooked up without restrictions unless activities on the drill site cease for 3 weeks or longer between February 1 and June 1. In the event of such prolonged inactivity, a nest survey must be performed in the 1/4-mile radius surrounding the drill site to determine whether or not an occupied nest has been established during the period of inactivity. If an occupied nest is found, the operation must temporarily cease until the young have fledged.

- Any activity initiated between February 1 and June 1 should require a nest check either by the BLM or an Operator representative approved by the BLM within 1/4 mile; if an occupied nest is present, activity would be restricted during the critical period.

4. Casual use activities away from existing roads and facilities that are scheduled to occur between March 1 and mid-June should be coordinated with the BLM in order to minimize or avoid potential impacts to nesting raptors in the area.

   Casual uses include, but are not limited to, ground activities such as: (1) preliminary scouting of routes or sites, (2) land surveying and staking, and (3) cultural and wildlife surveys. Because casual use is generally not treated as a managed or permitted activity, there is a potential for causing impacts to nesting raptors.

5. Raptor nests that are discovered by the Operator or Operator's representatives should not be approached and should be immediately reported to the BLM. Employees should be directed not to enter buffer zones, established by the BLM to reduce stress to raptor adults or young and to prevent nest abandonment.

6. The operator should construct Artificial Nest Structures (ANSs) in those raptor territories where permanent facilities are established which would/could compromise the functionality of existing nest structures as outlined below. These new nest structures (ANSs) should be installed in areas which are farthest removed from proposed well sites and on-going human activity in order to maximize nest site alternatives within the affected territories. The operator should obtain the necessary authorizations from and coordinate the installation of ANSs with the appropriate federal and state regulatory agencies prior to the installation thereof.

   In order to mitigate impacts to those raptor nesting territories encompassing nest numbers 64/65 and 169/170, the operator should install a minimum of two ANSs per territory as outlined above. As the 1998 nesting season is already underway, these ANSs should be installed subsequent to the 1998 nesting season and prior to November 15, 1998. Pending the results of potential exploration and development activity as proposed in Table 2.1, placement of these nesting structures is tentatively recommended as follows:

a) Ferruginous Hawk Southern Nesting Territory (nests 169 and 170):

Place one structure in the SE¼SE¼ of Section 9, Township 35 North, Range 87 West. This particular location is between two abandoned wells (CRU #1 and CRU #4); consequently, additional exploration and development in this corner of the CRNGDPA is unlikely. The proposed ANS would be located on federal surface at a minimum of 2,000 feet from both Natrona County Road 212 and the existing access into the CRU #6.

2. The second ANS should be placed in the NE¼SW¼SW¼ of Section 11, Township 35 North, Range 87 West on the south side of the South Fork of the Powder River. As above, this area is removed from existing and/or currently proposed development within the CRU and the potential for future development in this corner of the CRNGDPA is considered to be remote.

b) Ferruginous Hawk Northern Nesting Territory (nests 64 and 65):

1 Nest numbers 64 and 65 are located not only in the heart of the proposed CRNGDPA but also within an extensive block of private surface (see Figure 1.4), making placement of ANSs on public lands within a reasonable radius (within the territory) of the existing nests most difficult. Consequently, it is recommended that placement of these ANSs be delayed until after the results of the 1998 drilling season are known. Once a determination of commercial productivity of these wells has been made, Intoil should arrange a meeting with BLM, USFWS, WGFD, and the private surface owners to discuss ANS placement in or adjacent to the CRNGDPA and/or possible alternatives. If for some reason the proposed ANSs can not be located within this particular nesting territory, the structures would be located in an alternate area to be provided by BLM. Conditions of Approval (COAs) would be attached to permits for wells proposed within 1/4 mile of these nests which would require that 2 ANSs be installed after the nesting season and prior to November 15, 1998 if commercial production is achieved.

c) Golden Eagle Nesting Territory (nest 192):

In order to mitigate potential impacts to the golden eagle nesting territory encompassing nest 192, the operator should install a minimum of two ANSs as outlined above. These ANSs should be installed only in the event that commercial production is established by Intoil within a one-half (1/2) mile radius of the existing nest structure and ongoing nesting inventories verify future use of the nest by golden eagles. As nest number 192 is also located in an area of extensive private and/or State of Wyoming surface ownership (see Figure 1.4), a meeting should be scheduled with BLM, USFWS, WGFD, and the private surface owner/grazing lessee to discuss ANS placement as soon as possible after production has been established in proximity to the subject nest. If for some reason the proposed ANSs can not be located within this particular nesting territory, the structures would be located in an alternate area to be provided by BLM. Conditions of Approval (COAs) would be attached to permits for wells proposed within 1/4 mile of these nests

which would require that 2 ANSs be installed after the nesting season and prior to November 15*th* of the following year if commercial production is achieved.

4.10 IMPACTS OF THE NO ACTION ALTERNATIVE

As discussed in Section 2.4, selection of the No Action Alternative would effectively deny further oil/gas exploration and development activity within the CRNGDPA as currently proposed. However, it should be noted that selection of the No Action Alternative is not a denial of all natural gas exploration and development in the area. Under the No Action Alternative, development of lands in the CRU and adjoining areas could occur at levels similar to those which have occurred on the area in the past and could occur as authorized by existing management directives contained in the Platte River RMP, which includes the requirement for a site-specific NEPA analysis. Under this alternative, impacts to the human environment within the overall project area would continue to occur as additional exploration and development activity was authorized, but these impacts would be of an indeterminate nature since the actual level of exploration and/or development would be unknown.

4.11 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

4.11.1 Introduction

The term "Irreversible Commitment of Resources" refers to the loss of future options which would result from additional exploration and development of those lands included within the CRNGDPA and primarily applies to the resultant impacts upon:

- non-renewable resources such as minerals or cultural resources; or to
- processes or factors that are renewable only over long periods of time (e.g., soil productivity).

Likewise, the term "Irretrievable Commitment of Resources" refers to the loss of production, harvest, or use of natural resources. For example, some or all of the forage production from an area is irretrievably lost while the area serves as an oil/gas well pad. Although the production loss is irretrievable, the action is not irreversible and, if the land use changes though subsequent abandonment and reclamation, forage production could resume.

4.11.2 Air Quality

No irreversible or irretrievable commitment of resources would occur to air quality. Short-term impacts to air quality resulting from oil/gas exploration and development within the CRNGDPA

would be reversible. Similarly, these impacts would not be irretrievable since air quality is a transient characteristic subject to improvement through natural meteorological movements within the atmosphere.

4.11.3 Cultural Resources

Should cultural resource inventories fail to identify or inventory all sites and/or artifacts within the proposed area(s) of disturbance, there is a possibility that the cultural resource could be damaged or destroyed during subsequent construction activities. Such an impact would be both an irreversible and irretrievable commitment of the affected cultural resource. Likewise, the loss of contextual information that could have been retrieved from the undamaged cultural site would also be an irretrievable commitment of the cultural resource.

The loss of cultural properties as a result of vandalism or artifact collection would be both an irreversibale and irretrievable commitment of resources as well.

4.11.4 Geology and Minerals

The removal of oil and/or natural gas from the affected geologic formation(s) would be both an irreversible and irretrievable commitment of resources. Once the hydrocarbons have been removed from the formation and put to other uses, the resource has been irreversibly and irretrievably lost.

4.11.5 Hydrology

No irreversible and only a minimal irretrievable commitment of resources would occur to the hydrologic environment of the project area. Water withdrawn from the Wind River Formation and subsequently used during drilling operations would be withheld from other uses and would be irretrievably lost to other uses.

Soil disturbances associated with additional exploration and development activity within the CRNGDPA could result in the discharge of sediments into surface waters and would constitute both an irreversible and irretrievable commitment of resources - both from the standpoint of lost soil resources and subsequent alteration of water quality in the affected drainages.

4.11.6 Range

The only potentially irreversible commitment of range resources would result from the direct mortality of individual plants resulting from surface disturbances associated with oil/gas exploration and development activities, which would translate into a direct reduction of available forage for both livestock and wildlife use. However, plants - both as populations and communities - have the reproductive potential to renew themselves. Consequently, this loss of individual plants would be reversible in the long term as disturbed areas were reclaimed. Likewise, the interim loss of vegetative cover types and associated resources (AUM's) would be a minor irretrievable commitment of resources. As above, this irretrievable commitment of resources (loss of forage) would persist until such time as the disturbed area(s) had been reclaimed and their original productivity restored.

4.11.7 Soils

Any loss of topsoil during oil/gas exploration activities within the lease option area and the subsequent loss or reduction in soil productivity resulting from these activities would be considered as an irreversible commitment of the soil resource. However, this commitment is expected to be quite small when one considers the relatively small amount of soil disturbance that would result from additional oil/gas exploration and development activity within the CRNGDPA. A minimal irretrievable commitment of the soil resource would result from the disturbance of previously productive soils resulting from surface disturbing activities such as road and well pad construction. This commitment of resources would last until final project abandonment and reclamation.

4.11.8 Visual Resources

Visual intrusions resulting from alterations to the natural landscape would represent an irretrievable commitment of resources. However, these visual intrusions on the landscape are not irreversible and would be eliminated upon final abandonment of oil/gas related facilities within the CRNGDPA and subsequent reclamation of disturbed areas associated therewith.

4.11.9 Wildlife

The only irreversible commitment of resources that could occur to wildlife populations within the CRNGDPA would be the direct mortality of individual animals. Wildlife species have the reproductive capacity to renew themselves and thereby maintain their populations, given the overall availability of quality habitat within the general vicinity of the potential impact. Considering both the availability and diversity of wildlife habitat existing throughout the overall project area, no irreversible commitment of resources would be expected to wildlife populations in the affected area.

The loss of habitat use associated with actual oil/gas exploration and development activity due to displacement (alteration of behavioral patterns) resulting from human intrusion would be an irretrievable commitment of wildlife resources; however, with proper timing constraints, the magnitude of such a commitment would be small and the commitment would be reversible upon final project termination and reclamation.

4.12 RESIDUAL IMPACTS

The term "residual impacts" refers to those impacts remaining after all reasonable mitigation has been applied. The disturbance of approximately 507.61 acres of soil and related wildlife habitat resulting from construction associated with additional oil/gas exploration and development activity within the CRNGDPA would constitute a short-term impact, considering that a significant portion of this initial disturbance (220.36 acres) would be reclaimed within a relatively short period of time following initial disturbance. The remaining 287.25 acres of initial surface disturbance would not be reclaimed until termination of the project and would, therefore, represent a long-term (or residual) impact to the affected resources. This long-term impact to both the soil and related resources would also represent a residual loss of both domestic livestock and wildlife forage, as well as associated wildlife habitat for a comparable period of time.

Construction of roads and drill pads, in conjunction with the installation of permanent production facilities (as applicable) on selected well locations would result in a long-term (or residual) impact to the visual resource of the area. Final abandonment of the project, plugging of each individual well, reclamation and revegetation of the remaining 287.25 acres of disturbed surface area and cessation of project related human intrusions into the area would effectively eliminate all of the above-referenced residual impacts associated with this project.

4.13 CUMULATIVE IMPACTS

4.13.1 Introduction

Pursuant to NEPA, the BLM must consider the cumulative impacts of the Proposed Action in conjunction with other ongoing oil/gas exploration and development activity within the general area. In addition, unrelated activities within the overall project area which might have an adverse impact upon existing natural resources in the area and, consequently, which would further contribute to the overall degradation of the human environment must be considered in the analysis of cumulative impacts as well. In this regard, the only major resource development activity within the CRNGDPA consists of past and present oil/gas exploration and development in the Cooper Reservoir Unit and surrounding areas as depicted in Figure 1.3 and outlined in Table 3.3. Considering that the PRRA, BLM has not received any proposals for additional resource development or major surface disturbing

activity (e.g., mines, highways, and/or industrial sites) in or adjacent to the CRNGDPA, the Proposed Action represents the only reasonably foreseeable resource development in the overall project area.

For the purposes of this Environmental Assessment, a Cumulative Impacts Analysis (CIA) area was defined for those resource components potentially affected by additional oil/gas exploration and development within the CRNGDPA. The CIA area was defined by watersheds as depicted in Figure 3.2. These watersheds encompass a total of approximately 17,441.45 acres, 11,159.07 acres (64%) of which are located outside of the CRNGDPA boundary (see Section 4.5.3.1 and Figure 4.1).

Existing surface disturbance within the CIA area was quantified from aerial photographs of the area taken on June 7, 1996. Existing surface disturbance as of June 7, 1996, along with additional surface disturbance which has occurred in the area since the June 7, 1996 overflight are quantified in Table 4.6, while Tables 4.7 and 4.8 attempt to quantify these surface disturbances by disturbance type.

Table 4.6

Summary of Total Surface Disturbance in the Cumulative Impacts Analysis Area by Watershed

Name of Watershed	Facilities (acres)	Co. Road (acres)	Resource Roads (acres)	Pipelines (acres)	2-Tr. Trails (acres)	TOTAL (acres)
Adobe	0.00	0.00	0.00	9.49	3.91	13.40
Poison Creek Tributary	0.00	0.00	0.00	0.00	2.22	2.22
Sand Draw	23.97	24.91	13.96	31.31	25.60	119.02
S. Fork Powder River	2.39	14.18	5.66	32.51	10.44	63.21
Upper Sand Draw	0.00	0.00	0.00	0.00	2.92	2.92
Totals	**26.36**	**39.09**	**19.62**	**73.31**	**45.09**	**203.47**

Table 4.7

Linear Surface Disturbance in the Cumulative Impacts Analysis Area

Disturbance Class	Total Length	Width	Area (acres)
Natrona County Road 212	28,378'	60'	39.09
Pipeline ROW's	21,847'	60'	73.31
Resource Roads	21,376'	40'	19.62
Two-Track Trails	327,367'	6'	45.09
Total			**177.11**

The cumulative impacts analysis area for air quality and raptors coincides with the CIA utilized in the CGBWNGDP EIS (USDI-BLM 1997).

Table 4.8

Non-Linear Surface Disturbance in the Cumulative Impacts Analysis Area

Facility Operator	Facility Name	Facility Description	Area (acres)
Intoil, Inc.	CRU # 1	Injection Well	1.46
Intoil, Inc.	CRU # 6	Shut-In Gas Well	2.39
Intoil, Inc.	CRU # 7	Producing Gas Well	2.10
Intoil, Inc.	CRU # 8	Producing Gas Well	2.56
Intoil, Inc.	CRU # 9	T/A Gas Well	2.32
Intoil, Inc.	CRU #10	Producing Gas Well	2.32
Intoil, Inc.	CRU #11	Producing Gas Well	3.06
Intoil, Inc.	CRU #12	Producing Gas Well	2.32
Intoil, Inc.	CRU #13	Producing Gas Well	2.32
Intoil, Inc.	CRU #14	Producing Gas Well	2.32
Intoil, Inc.	CRU Compressor	Compressor Station	1.00
Warren Enterprises, Inc.	1-4 DS Federal	Shut-In Gas Well	1.27
Warren Enterprises, Inc.	1-33 WS Federal	Shut-In Gas Well	0.92
Total			**26.36**

4.13.2 Air Quality

In conjunction with the air quality modeling discussed in Section 4.1, an assessment of potential cumulative air quality impacts was also conducted in order to predict cumulative air quality impacts at the PSD Class II Cloud Peak Wilderness Area (CPWA). Three different groups of sources were modeled as follows:

) emissions from additional exploration and development in the CRNGDPA (maximum production scenario of 85 wells plus a 5,000 hp compression facility);

2) emissions from 34 other well field sources located within the study area (Johnson, Washakie, Big Horn, Sheridan, and Natrona counties); and

3) other emission sources located within the study area that have been issued WDEQ/AQD air pollutant emission permits (including oil and gas wells that have been permitted by the WOGCC since January 1996).

Modeling of potential cumulative air quality impacts was performed to quantify NO_2, SO_2, and PM_{10} impacts at the CPWA boundary, in order to calculate potential nitrate and sulfate deposition (and related water chemistry impacts) at a U.S.D.A. Forest Service (USFS) identified sensitive lake watershed, and to address potential changes in regional visibility. It is important to place these modeling results into a proper perspective in terms of the level of conservatism factored into this

analysis. The projected impacts reflect "screening" level modeling (a modeling approach that is conservative by design). Therefore, if the modeling results are less than applicable significance criteria there is no need to perform a more refined analysis. There is a great deal of uncertainty in the projection of specific plans (i.e. number of wells, equipment to be used, and specific locations) for resource development for 30 years in the future. The following conservative assumptions have been incorporated into this analysis:

1) For several reasons, the assumed emission rates overstate the actual emissions that are likely to occur. First, these emission rates assume that all of the potential well sites become producing wells; that is, there are no "dry holes" (e.g., wells that deemed to be non-productive). Second, the emission rates assume that all producing wells would produce for 30 years, which will certainly not be the case. Third, these emission rates are predicated on the assumption that all well production activity occurs at the maximum possible emission rate continuously. Fourth, the maximum emissions scenario assumes that all emission sources (well field compression and all 85 wells) are operating at their maximum potential emission rates simultaneously.

   Given the number of sources included in this analysis (approximately 472 emission sources) the co-probability of such a scenario actually occurring over an entire year or over a 24-hour time period is extremely small. While this assumption is typically used in such modeling analyses, the resulting impacts will be overstated. It should also be noted that as the number of sources increases, the level of conservatism also increases.

2) The ISCST3 model utilizes instantaneous straight line plume transport. Thus the model does not account for the actual travel time and distance that a plume would undergo as it is transported from the point of release to the receptors in the PSD Class II Cloud Peak Wilderness Area. Because of this assumption the model significantly overestimates the number of times that a plume actually reaches a sensitive receptor. Also, because the model cannot predict the varying route of an actual plume, the travel distance is underestimated and the concentration is overstated. For near field impacts this limitation is not very important, however, for travel distances greater than 50 kilometers this assumption becomes very conservative.

3) The complex terrain treatment in the ISCST3 model also conservatively addresses plume transport for elevation increases of greater than 3,000 feet. Even though a trajectory could transport the plume toward the sensitive receptor, it is doubtful that it would climb the 3,000 feet necessary to reach the sensitive receptors.

Although it is unlikely these assumptions would actually occur, it is appropriate to include them in order to perform a "reasonable, but conservative" cumulative air quality impact assessment. Since there are no Federal or state atmospheric deposition or visibility regulations for PSD Class II wilderness or for wilderness study areas (WSAs), the air quality impact assessment did not estimate potential impacts at BLM-administered WSAs. However, at the request of the USFS, estimates of potential atmospheric deposition and visibility impacts were made for the CPWA (Blett 1998).

Water samples collected at Florence Lake (located within the CPWA) by the USFS between 1994 and 1996 indicated a range in acid neutralizing capacity (ANC) from 27.8 to 64.7 microequivalents

per liter (μeq/l). Maximum cumulative atmospheric deposition at Florence Lake was predicted to be 0.02 kilograms per hectare-year (kg/ha-yr) of nitrogen and 0.005 kg/ha-yr of sulfur. The potential ANC change at Florence Lake was predicted to be 0.5 percent, while the maximum predicted change in pH was 0.002. These potential impacts are all well below the USFS's "Limit of Acceptable Change" threshold values of 3 kg/ha-yr (aquatic nitrogen), 5 kg/ha-yr (terrestrial sulfur), 10 per cent change in ANC (for lakes with a minimum ANC greater than 25 μeq/l, such as Florence Lake), and 0.1 pH units (Fox *et al* 1989). Since cumulative emission sources constitute many small sources spread out over a very large area, discrete visible plumes are not likely to be created or to impact the CPWA. However, the potential for cumulative increased regional haze and visibility degradation is a concern. Regional haze is caused by fine particles and gases scattering and absorbing light. Changes to regional haze are measured in terms of visibility differences relative to background (existing) conditions.

The Interagency Workgroup on Air Quality Modeling (IWAQM) has prepared a very conservative screening method to estimate potential, regional haze impacts (IWAQM 1993). This method involves modeling SO_2, NO_2, and particulate emissions to estimate fine particle concentrations at the area of concern and to compute the potential visibility reduction which is defined in terms of "deciview" change. The magnitude of deciview change, its frequency, time of the year and meteorological conditions during times when deciview thresholds are above 1.0, as well as the inherent conservatism of the analyses, must be considered when assessing the significance of potential visibility impacts. The ISCST3 model was used to estimate the maximum cumulative 24-hour air quality impacts along the CPWA boundary. For this analysis, NO_2 is the only pollutant of concern since sulfur emissions are unlikely as natural gas produced from the Lower Fort Union and Lance Formations is "sweet," and direct PM_{10} impacts are negligible.

Background visibility was assumed to be 327 kilometer (km) Standard Visual Range (SVR) based on data provided by the USFS monitoring program (Blett 1998). This represents a 90*th* percentile, best-case visibility for every day in a year. This is a very conservative assumption since the theoretical maximum possible visibility is 391 km SVR. Conservative assumptions also were made about plume transport time, the conversion efficiency of NO_x to ammonium nitrate, and the improbable coincidence of a 327 km visibility condition occurring with an atmospheric relative humidity of 90%.

Based on these very conservative analysis assumptions, the maximum predicted reduction was 0.3 deciview; actual reductions in visibility would be significantly less. The BLM considers a change of 1.0 deciview as potentially significant. This criteria was proposed by Pitchford and Malm (1994) and has been adopted by the Grand Canyon Visibility Transport Commission. A 1.0 deciview is defined as "about a 10 percent change in extinction coefficient, which is a small but perceptible scenic change under many circumstances." The USFS has established a more restrictive 0.5 deciview as the "Limit of Acceptable Change" to evaluate potentially significant visibility impacts in the CPWA. But based on either criteria, the Proposed Action and project alternatives would not result in any perceptible visibility impact (even on the cleanest days) in the CPWA.

4.13.3 Cultural Resources

Significant cultural resources or sites on, or eligible for nomination to, the NRHP would not be affected by the Proposed Action. Consequently, we would not anticipate the occurrence of any significant cumulative impacts to cultural resources within the project area as a result of activities associated with either the Proposed Action or other proposed/ongoing activities within the CRNGDPA.

4.13.4 Geology and Minerals

As indicated in Section 4.13, the PRRA, BLM has not received any proposals for additional resource development in or adjacent to the CRNGDPA; consequently, the Proposed Action represents the only reasonably foreseeable resource development in the overall project area. Therefore, we do not anticipate the occurrence of any significant cumulative impacts to existing mineral resources within the CIA as a result of activities associated with the Proposed Action.

4.13.5 Hydrology

4.13.5.1 Surface Hydrology

Additional oil/gas exploration and development activity within the CRNGDPA would not result in a significant impact upon either surface water or watersheds within the CIA area. In this regard, Table 4.9 presents a summary of the cumulative surface disturbance which would be expected within each individual watershed. As indicated therein, implementation of the Proposed Action would not increase the total surface disturbance in any of the affected watersheds above the 10% threshold of significance identified in Section 4.5.2. Surface disturbing activities associated with the Proposed Action would increase total surface disturbance in the 20,515.45 acre CIA by approximately 1% from 2.47% to 3.45%. A 1% increase in overall surface disturbance within the CIA area can not be considered as a significant impact upon the affected watersheds.

As stated in Section 4.5.3.1, a review of aerial photographs taken on June 7, 1996 of the general area failed to reveal any sources of permanent surface water in either the CRNGDPA or the CIA area. Consequently, we do not anticipate any significant cumulative impacts to surface waters or the surface hydrology of the CIA area resulting from surface disturbing activities associated with the Proposed Action.

Table 4.9

Summary of Existing and Proposed Surface Disturbance by Watershed

Name of Watershed	Total Acres in Watershed	Existing Disturbance		Proposed Disturbance		Total Disturbance	
		acres	percent	acres	percent	acres	percent
Adobe	767.20	33.95	4.33	13.40	1.75	47.35	6.17
	1,779.57	27.16	1.53	2.22	0.13	29.38	1.65
	8,159.74	303.91	3.73	119.02	1.46	422.94	5.18
	6,734.94	122.22	1.82	63.21	0.94	185.44	2.75
Upper Sand Draw	3,074.00	20.37	0.66	2.92	0.10	23.29	0.76
Totals	**20,515.45**	**507.61**	**2.47**	**203.47**	**0.99**	**708.40**	**3.45**

4.13.5.2 Sub-Surface Hydrology

There are no activities (either currently ongoing or proposed) within the CIA area which would result in a significant cumulative impact to the ground water resources thereof.

4.13.6 Range

Existing surface disturbance (203.47 acres) within the CIA area has resulted in the loss of approximately 27.13 AUMs (calculated at 7.5 acres/AUM) to date. The long term disturbance of an additional 287.25 (post reclamation) acres within the CRNGDPA over the LOP would result in the loss of an additional 38.3 AUMs within the CIA area, resulting in the cumulative loss of 65.43 AUMs in the 20,515.45 acre CIA area. This cumulative forage loss represents a 2.39% reduction in available AUMs in the CIA area - which would occur over the life of the project rather than in any single year. The loss of 65.43 AUMs and the subsequent 2.39% overall reduction in available AUMs over the LOP is not considered as a significant impact upon forage availability within the CIA area.

4.13.7 Soils

The discussion of cumulative impacts contained in Section 4.13.5.1 would apply equally to soils within the CIA area as watersheds were used as the basic unit of comparison for soils in this analysis. As indicated in Table 4.9, implementation of the Proposed Action would not increase the total surface disturbance in any of the affected watersheds above the 10% threshold of significance identified in Section 4.5.2. Surface disturbing activities associated with the Proposed Action would increase total surface disturbance in the 20,515.45 acre CIA area by approximately 1% from 2.47% to 3.45%. Considering that sensitive soils within the overall project area will be avoided to the greatest extent

possible, a 1% increase in overall surface disturbance within the CIA area can not be considered as a significant impact upon the affected soils within these watersheds.

4.13.8 Visual Resources

As indicated in Section 3.9, the viewshed(s) along both U.S. Highway 20-26 and Natrona County Road 212 have been substantially altered by previous human activity in this area. While implementation of the Proposed Action would increase the overall number of facilities within these viewsheds, the cumulative impact of these facilities upon the landscape would remain consistent with the stated VRM designation for the area.

4.13.9 Wildlife

Table 4.6 indicates that there are currently 203.47 acres of existing surface disturbance within the CIA area. This total includes short-term disturbance associated with oil/gas exploration and development activity which was conducted by Intoil in the CRU during 1997. These disturbed areas will be subjected to an indeterminate amount of reclamation in the near term resulting in an overall reduction in the amount of surface disturbance remaining over the long term (post reclamation disturbance) for the LOP. However, for the purposes of this analysis we will assume that this 203.47 acres of surface disturbance represents post reclamation (or long-term) disturbance. In this regard, post reclamation disturbance under the Proposed Action would add an additional 287.25 acres of disturbance to this existing total, resulting in cumulative surface disturbance of approximately 490.72 acres for the LOP in the CIA area.

4.13.9.1 Economically Important Species

As indicated in Section 3.10.3, Natrona County Road 212 splits the CRNGDPA and also serves as the dividing line between the Rattlesnake and Beaver Rim Antelope and Mule Deer Herd Units. Combined, the Rattlesnake and Beaver Rim Antelope Herd Units encompass approximately 3,538,560 acres in Natrona and Fremont Counties (656,000 and 2,882,560 acres respectively). Likewise, the combined Rattlesnake and Beaver Rim Mule Deer Herd Units encompass approximately 1,693,440 acres in Natrona and Fremont Counties (788,480 and 904,960 acres respectively) (USDI-BLM 1997). The cumulative, long-term loss of 409.72 post reclamation acres in the combined herd units for antelope and mule deer represent less than 0.012% of the total antelope habitat and less than 0.024% of the total mule deer habitat. Direct habitat loss on an individual herd unit basis (assuming that all disturbance occurred in a single herd unit) would represent less than 0.06% and 0.05% of antelope and mule deer habitat in the respective Rattlesnake Herd Units, 0.01% and 0.05% of antelope and mule deer habitat in the respective Beaver Rim Herd Units. Considering

that no crucial habitat(s) would be impacted by additional oil/gas exploration and development in the CRNGDPA, this direct habitat loss is insignificant.

Cumulative levels of human intrusions into the periphery of these two big game herd units would probably not increase dramatically beyond current levels being experienced therein in association with past and present oil/gas activity in the CRU. Consequently, considering the relative availability of quality, undisturbed wildlife habitat currently existing throughout the Rattlesnake and Beaver Rim Antelope and Mule Deer Herd Units, the fact that the Proposed Action sits on the boundary between the two areas (and that boundary is a fairly well traveled public road), the relatively small amount of habitat to be lost therein, and the lack of any disturbances to critical/crucial wildlife habitat(s) within the CRNGDPA; cumulative impacts to big game populations resulting from activities associated with the Proposed Action and other proposed/ongoing activities within the CRNGDPA can not be considered as significant.

Likewise, as there is no evidence that sage grouse nest or strut within the overall project area, cumulative impacts to this economically important game species are not expected.

4.13.9.2 Raptors

A comprehensive analysis of the cumulative impacts to nesting raptors was conducted in conjunction with the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project Environmental Impact Statement (USDI-BLM 1997). The resultant impact analysis considered the cumulative impacts of human activity on raptor nesting in a 273-square mile area surrounding the Cave Gulch-Bullfrog-Waltman Natural Gas Development Project Area (CGBWNGDPA). The CRNGDPA is completely contained within this 273 square mile CIA area. The CIA for the CGBWNGDPA utilized data collected by Hayden-Wing Associates (HWA) in the 273 square mile Greater Cave Gulch Raptor Analysis Area (GRAA) during the 1996 nesting season. Additional data were collected by HWA in the GRAA during the 1997 nesting season and this data has been incorporated into the discussion below.

Inventories of raptor nesting activity conducted by BLM and HWA in 1996 resulted in the identification of 171 individual nests representing 5 different species of nesting raptors within the GRAA. Of the 171 total nests inventoried in 1996, only 20 were determined to be occupied, with 2 of these active nests located within the CRNGDPA (see Table 3.8). Both of these nests successfully fledged young in 1996. Inventories of raptor nesting activity conducted by AEC, BLM, and HWA in 1997 resulted in the identification of 23 additional nests within (or directly adjacent to) the GRAA and the loss of 14 nests previously identified in 1996 due to various natural causes (HWA 1997). Twenty of the nests inventoried in 1997 were active, with 2 active nests located within the CRNGDPA (one of which subsequently failed).

Disruption of nesting activities in or displacement of nesting raptors from the CRNGDPA would result in an average 10.0% decline in raptor nesting activity in the GRAA, based upon observed nesting activity for 1996 and 1997. Loss of the ferruginous hawk nest which successfully fledged

young in 1997 (nest 169) would have translated into a 16% reduction in population recruitment for this species within the 273-square mile GRAA for the 1997 nesting season. As the number of active nests observed in both the 1996 and 1997 nesting seasons appears to be fairly constant, these percentages would probably apply to nesting activities in subsequent years as well.

The cumulative impact analysis for the CGBWNGDPA predicted that 3 to 7 pairs of raptors would be displaced in the GRAA without the installation of ANSs. The referenced CIA concluded that "...it is likely that no significant long-term cumulative impact to raptor population production on the GRAA will result from implementation of any of the alternatives" given the application of mitigative measures prescribed therein (USDI-BLM 1997). This document has recommended raptor mitigation measures similar to those recommended in the CGBWNGDPA EIS. Consequently, we must assume that the application of the mitigation measures prescribed in Sections 2.3.9 and 4.9.5 of this document would correspond to the conclusions reached in the CGBWNGDPA EIS regarding cumulative impacts to raptors in the GRAA.