August 1991

# Environmental Assessment
# EA-0531

# Proposed Natural Gas Protection Program for Naval Oil Shale Reserves Nos. 1 and 3

## Garfield County, Colorado

DISCLAIMER

U.S. Department of Energy
Naval Petroleum Reserves
in
Colorado, Utah, Wyoming

DOE/EA--0531

DE92 002249

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# List of Acronyms and Abbreviations

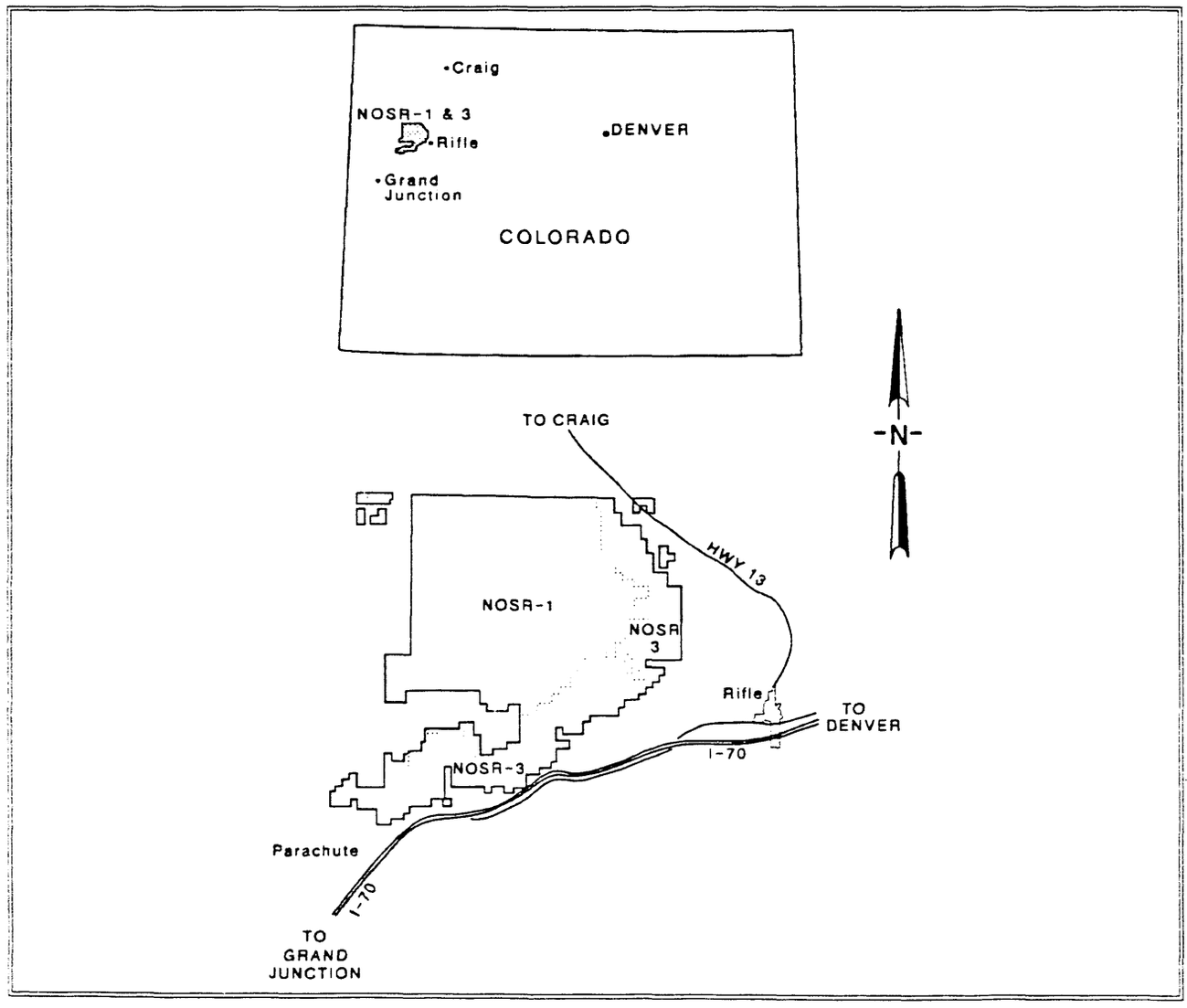
| | |
|---|---|
| C | Degrees Centigrade |
| F | Degrees Fahrenheit |
| BLM | Bureau of Land Management |
| COGCC | Colorado Oil & Gas Conservation Commission |
| CRC | Cultural Resources Consultants |
| DOE | Department of Energy |
| EA | Environmental Assessment |
| EIS | Environmental Impact Statement |
| ESA | Endangered Species Act |
| g/mi | Grams per Mile |
| lbs/hr | Pounds per Hour |
| MTF | Memorandum to File |
| NEPA | National Environmental Policy Act |
| NOSR 1 | Naval Petroleum Shale Reserve No. 1 |
| NOSR 3 | Naval Petroleum Shale Reserve No. 3 |
| ppm | Parts per Million |
| $\mu g/M^3$ | Micrograms per Cubic Meter |
| VRM | Visual Resource Management |

# *Section I*
# *Summary*

## Project Location and Description

Naval Oil Shale Reserves Nos. 1 and 3 (NOSRs-1 & 3), located in Garfield County, Colorado (Figure 1), were established in the early 1900s as a future source of fuel supplies for the United States Navy and to provide appropriate working areas and access to water for such activities. With the exception of sporadic small-scale experimental oil shale mining and retorting efforts, the Reserves have remained essentially inactive. NOSRs-1 & 3 are situated on the north and northwest flanks of three large natural gas producing fields, the Parachute, Rulison, and Grand Valley.

**Figure 1**
Location of NOSRs-1 and 3



As a result of U.S. Department of Energy (DOE) monitoring activities, it was determined in 1983 that the potential existed for natural gas resources underlying the Reserves to be drained by privately-owned gas wells that were being drilled along the Reserves' borders. Since that time, commercial drilling activities along the NOSRs' boundaries have increased. In 1985, DOE initiated a limited number of projects to protect the Government's interest in the gas resources by drilling its own "offset production" wells just inside the boundaries, and by formally sharing in the production, revenues and costs of private wells that are drilled near the boundaries ("communitize" the privately-drilled wells). Continuing analyses by DOE have lead to a determination that the scope of these protection efforts must be expanded. DOE is therefore proposing a Natural Gas Protection Program for NOSRs-1 & 3 which would be implemented over a five-year period that would encompass a total of 200 wells (including the wells drilled and/or communitized since 1985). Of these, 111 (Table 1) would be offset wells drilled by DOE on Government land inside the NOSRs' boundaries and would be owned either entirely by the Government or communitized with adjacent private land owners or lessees. The remainder would be wells drilled by private operators in an area one half- mile wide extending around the NOSRs boundaries and communitized with the Government.

**Table 1**

Proposed Drilling and Gas Gathering Programs

| Field | Formation | Number of Wells | |
|---|---|---|---|
| | | Offset Wells | Private/Communitized Wells |
| Rulison | Wasatch | 27 | 11 |
| | Mesaverde | 25 | 6 |
| Parachute | Wasatch | 10 | 6 |
| | Lower Mesaverde | 7 | 8 |
| Parachute Extension | Wasatch | 16 | 26 |
| | Mesaverde | 9 | 21 |
| Grand Valley | Wasatch | 13 | 7 |
| | Mesaverde | 4 | 4 |
| **Subtotal** | | **111** | 89 |
| **Total Offset and Private/Communitized** | | | **200** |

The proposal described in this document includes all work done in the previous small-scale projects, and thus the impacts analyzed are for all work either carried out to date or planned in the future to protect the gas resources of the NOSRs. The proposal is expected to generate only minimal impacts to the existing environment of the NOSRs, principally from short-term increases in dust and other air pollution emissions during the construction of well pads and other land clearing activities, and by the disturbance of a very small percentage of the total surface area of the NOSRs.

To ensure that all impacts are minimized as much as possible, an extensive series of mitigation measures recommended by the Bureau of Land Management (BLM) will be utilized. The cumulative impacts of the proposal and other projects in the area are expected to be negligible.

# *Section II*
# *Project Background and Proposed Action*

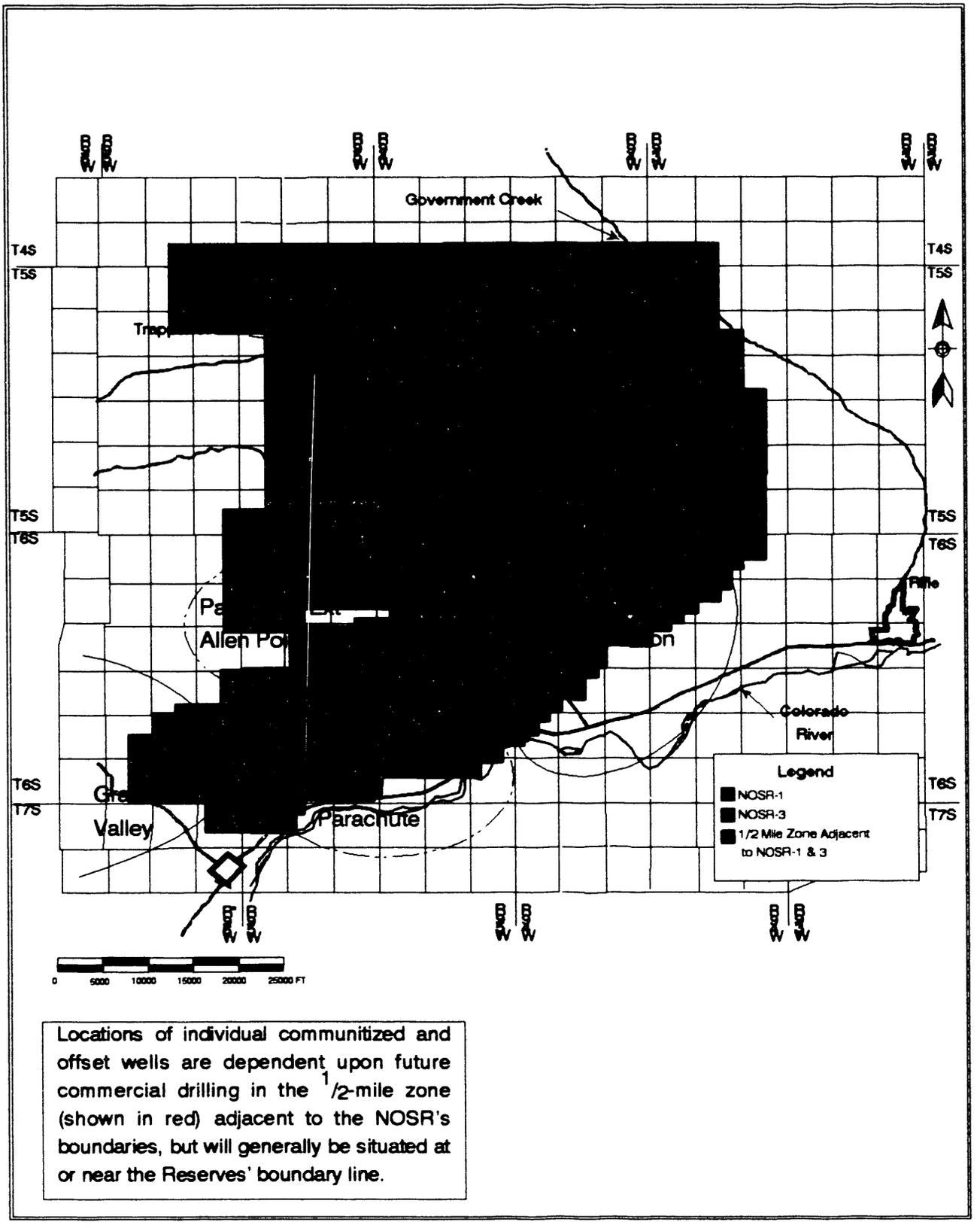
## Project Background

Section 7422 of Title 10, United States Code, charges the Secretary of Energy with the authority and responsibility to "explore, prospect, conserve, develop, use, and operate the Naval Petroleum Reserves." This section further provides that the Naval Petroleum Reserves shall be used and operated for their "protection, conservation, maintenance and testing," and production when authorized. The term "Naval Petroleum Reserves" is defined in 10 U.S.C. 7420 as including the Naval Oil Shale Reserves.

Naval Oil Shale Reserve No. 1 (NOSR-1), consisting of 40,760 acres located about eight miles west of Rifle, Colorado, in Garfield County, Colorado (Figure 1), was established in 1916 by Executive Order of President Wilson as a future source of fuel supplies for the United States Navy. NOSR-1 is estimated to have over 18 billion barrels of shale oil in place, with approximately 2.5 billion barrels recoverable from shale rated at 30 gallons per ton or better. Naval Oil Shale Reserve No. 3 (NOSR-3), adjoining NOSR-1 to the south and east, consists of 14,130 acres set aside by Executive Order of President Coolidge in 1924 to provide closer access to the Colorado River for water which will be needed for shale oil production, and to provide working and disposal areas for such activities. Except for sporadic small-scale oil shale mining and retorting efforts over the years, both Reserves have remained essentially inactive. An extensive pre-development program completed in 1982 provided a compilation and analysis of important resource, engineering, environmental and economic data which identified the potential for production of 200,000 barrels of shale oil per day for over 30 years. There are, however, no plans at the present time to develop the oil shale resources at the NOSRs.

NOSRs-1 & 3 are situated on the north and northwest flanks of three large natural gas producing fields, the Parachute, Rulison, and Grand Valley. Some portion of these gas resources underlie both Reserves. The Office of Naval Petroleum and Oil Shale Reserves in DOE continuously monitors mineral exploration and development activities on lands adjacent to the NOSRs in order to evaluate the potential for drainage and migration of their mineral resources caused by increasing pressure differences between these deposits and commercial producing wells off the Reserves. The Government hydrocarbons requiring protection are contained on lands located along the Reserves' boundary. Private property owners, their lessees, or holders of Federal leases, can drill wells on land adjacent to the NOSRs without any permission or cooperation from DOE. As a result of DOE's monitoring activities, it was determined in 1983 that the potential existed for drainage of natural gas by commercial development in the Rulison Field at the southeast boundary of NOSR-3. Since that time, additional gas wells have been drilled in the Parachute and Grand Valley fields. Figure 2 is a general map of the area indicating the location of the gas fields.

**Figure 2**
NOSRs-1 and 3 Gas Fields Map




Locations of individual communitized and offset wells are dependent upon future commercial drilling in the 1/2-mile zone (shown in red) adjacent to the NOSR's boundaries, but will generally be situated at or near the Reserves' boundary line.

## Proposed Action

The purpose of the proposed action is to protect the Government's interest in the natural gas underlying the NOSRs. To accomplish this, DOE is proposing a program with two key elements: communitization of 89 gas wells; and drilling 111 offset wells.

### *Communitization Program*

In communitization, the Government formally shares in the costs, production and revenues from private wells drilled near the boundaries of the NOSRs. This is similar to the standard petroleum industry practice for sections of land having multiple ownership, where the owners agree to develop the mineral resources jointly and to share the costs and production based on percentage ownership of the surface acreage. In addition, pooling of tracts under communitization agreements is done where the separate tracts cannot be developed and operated independently in conformity with state well spacing requirements or established well development programs. Under the communitization agreements, each well will be operated as a unit and development costs and hydrocarbon production shared between the unit partners, with the actual percentage of ownership based on the amount of each partner's surface land contained in the unit. The communitization agreements will remain in effect for so long as communitized substances are, or can be, produced from the wells.

DOE estimates that it will participate in communitization agreements covering approximately 89 privately-owned wells that are likely to be drilled just outside the borders of the NOSRs during the next five years. Drilling procedures would be identical to those described in the following paragraph. It is possible that a small number of these wells (5-10) may, for reasons such as easier access, topography, and environmental concerns, actually be drilled on Government property inside the Reserves' boundaries.

### *Government-Owned Offset Wells*

To prevent drainage and migration of gas resources underlying the NOSRs, DOE has determined that, along with communitizing privately-owned wells as described above, it will be necessary for the Government to drill its own gas wells inside the Reserves' boundaries to offset and intercept gas production from nearby private wells. In most instances, these wells will be owned and operated entirely by the Government, as they are located sufficiently back from the NOSRs' boundaries such that they do not require any communitization with other property owners. In a few cases, however, these Government offset wells will be communitized with adjacent private property owners and/or lessees. Development activities will consist of access and site clearing and grading; drilling with diesel-powered drill rigs using conventional procedures found in the natural gas industry and approved by BLM and the Colorado Oil and Gas Conservation Commission (COGCC); and connection of the completed wells through appropriate surface facilities and gathering lines to a main gas transmission line, again using standard techniques in the industry. Produced gas will be sold on the open market or to Federal facilities. Based on present estimates of planned activities by

neighboring operators, DOE estimates that it will be necessary to drill approximately 111 offset production wells during the period 1990-1995 to adequately protect the natural gas resources underlying the NOSRs. Associated production facilities with the drilling of the 111 offset wells would be pipelines, compressor stations, water disposal pits, water supply wells, storage yard(s) and warehouse/office facilities.

## Regulatory Compliance

### *National Environmental Policy Act Compliance*

DOE has been monitoring exploration and development activities in the Parachute, Rulison and Grand Valley Gas Fields since 1983. Based on preliminary analyses from these monitoring efforts, DOE initiated, in 1985, a small-scale project to drill two offset production wells to begin protecting the natural gas resources underlying the NOSRs from drainage and migration. As new data were developed and analyses refined, DOE undertook additional protection projects, again on a very limited basis, that involved either communitizing a small number of privately-drilled wells or drilling a few offset wells, that have continued into 1990. To date, in four separate actions, a total of 14 privately-drilled wells have been communitized, and 13 offset wells drilled. To fulfill the requirements of the National Environmental Policy Act (NEPA) for each of these actions, a Memorandum to the File (MTF) was prepared to document the determination that the project was clearly not a major Federal action with significant impacts upon the environment within the meaning of NEPA, and that an environmental impact statement (EIS) did not have to be prepared. MTF for later projects included a cumulative analysis of earlier actions.

DOE has determined that the scope of these earlier isolated protection activities must be expanded to adequately fulfill the statutory mandate to protect the natural gas resources underlying the NOSRs, and has developed the proposed program described above. To ensure that the environmental impacts of the program are evaluated, and because it was not apparent if the proposal would be considered a major Federal action with significant impacts upon the environment within the meaning of NEPA, DOE has prepared this environmental assessment (EA). The proposal described in the EA includes all work done in the previous small-scale projects, and thus the discussion of the impacts of the proposal is a comprehensive analysis of all work either carried out to date or planned in the future to protect the gas resources of the NOSRs.

# Section III
# Description of the Existing Environment

As part of the pre-development program carried out by DOE from 1977 to 1982 to investigate the potential for producing shale oil from NOSRs 1 and 3, an extensive survey of the existing background environment was performed. Although some data, such as for air quality, could have been influenced by the extensive oil shale development being carried out in Garfield County during that time period, DOE has verified from more current data sources, such as the BLM draft environmental impact statement on Colorado Oil and Gas Leasing (1990) that the background environmental conditions observed in the early 1980s remain essentially unchanged, even though the oil shale development boom of that period has all but disappeared. DOE has thus used data from the pre-development program in this description of the existing environment of NOSRs 1 and 3.

## Environmental Setting

NOSRs-1 & 3 are located in Garfield County, Colorado, (which has an area of approximately 3,000 square miles) eight miles west of Rifle in the rugged highland country of western Colorado. The elevations of NOSRs-1 & 3 range from 6,000 feet above sea level at NOSR-3 to 9,300 feet above sea level at NOSR-1. NOSRs-1 & 3 occupy the southeast corner of the Piceance Creek structural basin where the Green River formation, which contains the oil shale deposits, is resistant to weathering and forms a spectacular escarpment. The high tableland north and west of the escarpment has an elevation of about 8,500 feet above sea level and is known as the Roan Plateau. The escarpment, known as the Roan Cliffs, generally marks the boundary between NOSRs-1 and 3. Areas adjacent to the NOSRs' borders consist primarily of BLM land used for low-density natural gas production, grazing and recreation. Some private lands are used for fruit production and other agricultural products. The population density for Garfield County is 9.97 people per square mile.

## Climate

The climate in the Piceance Basin is semiarid, with annual precipitation ranging from 10 inches on NOSR-3 to over 20 inches on NOSR-1. The large difference is due to the elevation change between the two Reserves. Temperatures range from a mean minimum of 30 degrees Fahrenheit (°F) to a mean maximum temperature of 64°F. Rifle, Colorado has recorded an extreme minimum of -38 °F and a extreme maximum of 101 °F. Frost-free periods normally last two to three months. Winds generally average under 10 miles per hour and blow predominantly from the south to southwest.

## Geology and Soils

The most significant structure on NOSR-1 is a local syncline trending northwest from the southwestern quarter of NOSR-1. The eastern tributaries of Parachute Creek flow down dip, thus providing structural control of the streams. NOSR-1 is underlain by oil shales of the Green River formation. NOSR-3 consists of the cuesta scarp of the Roan Plateau and part of the Colorado River Valley adjacent to NOSR-1. The escarpment rises nearly 4000 feet above the Colorado River. The top 700 to 1,000 feet is a vertical cliff, with the slope moderating toward the base. Chemical and physical weathering (frost wedging) loosens the rock for transporting agents such as rock fall, rock slide, debris avalanche and sheet wash. Rocks rolling and sliding down hill erode gullies into the cliff face. The more moderate slopes below are under the influence of talus creep, talus slide, slump, landslide and rock slide. Rock creep and earth creep are major factors here also. There is a change in degree of slope at the contact between the Green River and Wasatch formations. Wasatch, being less restrictive, moderates the steep slope to nearly level near the Colorado River. Large gulches transect the Wasatch eroding up into the cliff face, often depositing large alluvial fans along the Colorado River flood plain.

Oil shale occurs in three major zones on NOSR-1. The rich Mahogany zone (approximately 60 feet thick) interfaces with the upper and lower lean Mahogany zones. Five low-grade zones of oil shale occur above the Mahogany zone, and two below it. Overburden above the Mahogany zone ranges from zero at the East Fork Parachute Creek to 1,200 feet in the northwest portion of the tract. Oil shale of the greatest thickness and quality is found in the northwest corner of NOSR-1. NOSR-3 contains little oil shale. Both Reserves are underlain by portions of three natural gas producing fields, the Parachute, Rulison and Grand Valley. Preliminary studies indicate that some petroleum reservoirs may be present within the NOSR's boundaries as well.

The Piceance Basin contains prominent systems of faults that cross the basin about 20 miles northwest of the NOSR-1 property. Regularity of structure contours within the Reserve suggests that large faults are probably not present in the NOSRs. One small fault is located on the NOSRs in an extreme northwest area of the Reserve. This fault is 1,500 feet long, as observed on aerial photos, and is not considered a hazard to development; however, it may provide a channel for the flow of water into underground shale mining operations in the vicinity of the property. NOSR-1 is an area of low seismic potential. There are no active faults on or near the NOSRs' property. Only minor damage would be anticipated from distant earthquakes. No restrictions are foreseen in mine placement due to faulting or unstable slopes on the property. Soil creep, rock fall, and rare landslides present the main categories of geologic hazard on NOSR-1.

A total of eleven soil series comprising fourteen different soil phases and complexes are present at the NOSRs. Four soil series (Parachute, Rhone, Northwater, and Irigul) occur on mountainsides and ridges. Three other series (Potts, Iledfonso, and Silas) occur in alluvium, alluvium fan benches and sides of valleys. The rest of the series

(shallow soils, badlands and rock outcrop complexes) occur on steep mountain slopes and escarpments.

## Hydrology

### *Surface Water*

NOSRs-1 & 3 are within the Upper Colorado River drainage basin. The area of interest is along the southeast border of the Piceance Creek structural basin and is drained by tributaries of the Colorado River. Drainage of the NOSRs is accomplished by the western tributaries of Government Creek on the eastern side of the Reserves, the eastern tributaries of Parachute Creek on the western side of the Reserves, and streams and washes which empty directly into the Colorado River on the south side of the Reserves. Government and Parachute Creeks are a part of the Rifle sub-basin drainage of the Upper Colorado River drainage basin. Total runoff from the NOSRs is approximately 20,083 acre-feet per year, the water being used for irrigation and livestock grazing before or after it enters the Colorado River. Water flow through the Reserves is minimal during the late summer, fall and winter.

Analysis of surface water quality data reveals that NOSRs' surface waters are of generally high quality. Specific conductance ranges from 380 to 1,250 mhos (at 25°C), with most values lying in the 300-600 mhos range. Total dissolved solids concentrations generally fall in the vicinity of 400-500 mg/l. Stream sediment loadings are highly variable. Of the parameters which have been measured, only nitrate and nitrite consistently exceed water quality standards. This is probably due to livestock usage on the NOSRs. Cadmium and mercury levels have occasionally exceeded standards. Sediment production is estimated at 2,000 parts per million (ppm) which totals 40,477 cubic yards per year. Dissolved solids, 350 to 700 ppm, consist primarily of calcium-magnesium and sulfate-chloride.

### *Ground Water*

Hydrologic studies of NOSRs-1 and 3 have shown the presence of four persistent water-bearing zones. The uppermost zone includes facies of the Uinta Formation and the upper part of the Parachute Member of the Green River Formation, which also contains a leach zone readily identifiable on outcrop. This zone, called Zone 1, probably is a more or less unconfined water table zone. Zone 2 is located at the A-Groove, the lean zone overlying the Mahogany Zone. Zone 3 is located in the vicinity of the B-Groove, the lean zone at the base of the Mahogany Zone. Zone 4 lies 100 to 200 feet below the base of the R-6 oil shale strata that underlie the B-Groove. The topographic surface water drainage divide which separates NOSRs streams from the Piceance Creek drainage to the north also is a groundwater divide. The groundwater system underlying NOSRs-1 and 3, for about the first 2,000 feet in depth, is nearly an island unto itself, having very little interaction with the rest of the Piceance structural basin.

Preliminary analysis of NOSRs' groundwater indicates that it is of high quality. Specific conductance ranges from 460 to 895 mhos (at 25°C), with means of 569, 652,

685, and 719 for Zones 1 through 4, respectively. Total dissolved solids range from 290 to 1,060 mg/l with means of 350, 384, 382, and 408 for Zones 1 through 4. While there may be a slight increase in conductance and dissolved solids with depth, there is considerable variability in the data and overlap of ranges. Of the parameters measured, three sometimes exceeded the Safe Drinking Water Standards. Arsenic and lead occasionally exceeded standards in Zone 1 only. Fluorides exceeded the standard in Zones 2, 3, and 4 and average concentrations increase with depth.

## Wetlands

There are no rivers, lakes, or natural wetlands on the NOSRs. Several small streams, East Fork Parachute Creek and Trapper Creek originate on the NOSRs with Government Creek flowing through the north east corner as shown in Figure 2. Two small water retention ponds (less than ½ acre each) were constructed in 1990 on the NOSRs by third party lessees.

## Air Quality

NOSRs-1 and 3 are located in a region of generally excellent air quality. Occasional short-term violations are reported in the region as the result of natural dust (total suspended particulates) and hydrocarbon aerosols (non-methane hydrocarbons). Although Garfield County, in which the NOSRs are located, is in attainment for the National Ambient Air Quality Standards (NAAQS) primary standards, parts of Mesa County to the south violate standards for TSP. As shown in Table 2, air pollutant concentrations are well below both Federal and Colorado standards with the exception of ozone. The low levels are due to the current absence of major emission sources on the site or in the region, while the elevated ozone level is typical for high altitude areas.

**Table 2**

Baseline Air Quality Data
($\mu g \backslash m^3$)

| Pollutant\Averaging Period | 1980 | 1981 | Federal Standards | Colorado Standards |
|---|---|---|---|---|
| Suspended Particulates | | | | |
| 24-hour Maximum | 30 | 37 | 260 | 150 |
| Sulfur Dioxide | | | | |
| 24-hour Maximum | 13 | 69 | 365 | 365 |
| 3-hour Maximum | 44 | 118 | 1,300 | 700 |
| Ozone | | | | |
| 1-hour Maximum | 206 | 265 | 240 | 160 |
| Lead | | | | |
| Quarterly Average | 0.013 | 0.006 | 1.5 | 1.5 |

Monitoring periods were June 25 to September 21, 1980, and June 25 to September 20, 1981.

## Vegetation

The distribution of plant communities occurring on the NOSRs is strongly influenced by elevation, topography and aspect. This has resulted in a great diversity of plant community types, with a total of 14 communities being identified during a survey of a portion of the NOSRs conducted during July and August 1981. Twelve of these types (Table 3) occur in units which could be mapped. These 14 communities were grouped into three vegetation zones or areas based on their general flora affiliation.

**Table 3**

Vegetative Cover Estimates for Vegetation Types

| Vegetation Area | Community | Herbaceous Plants | Shrubs | Small Trees | Large Trees |
|---|---|---|---|---|---|
| Semi-desert | Sagebrush Shrubland | 1 | 3-4 | — | — |
| Escarpment | Eroded Land | 1 | 1 | — | — |
| | Juniper Woodland | 1 | 2 | 3 | — |
| | Mountain Mahogany Shrubland | 1 | 4 | 1 | — |
| | Gamble Oak Shrubland | 1 | 4 | 1 | — |
| | Talus Slope | 2 | 1 | 1 | — |
| | Douglas Fir Forest | 1 | 3 | — | 3 |
| Plateau Area | Aspen Forest | 4 | 3 | — | 5 |
| | Douglas Fir-Blue Spruce Forest | 1 | 1 | — | 5 |
| | Serviceberry Shrubland | 2 | 3 | — | — |
| | Sagebrush Shrubland | 2-3 | 3-4 | 2 | |
| | Mountain Grasslands | 5 | 1 | — | — |

Key:
- 5 Heavy (Cover of 75% to 100%)
- 4 Moderate (Cover of 50% to 75%)
- 3 Sparse (Cover 25% to 50%)
- 2 Scattered (<25% cover, but living plants a dominate feature)
- 1 Rare (<25% cover and living plants not readily evident)
- — Typically Absent

The lower vegetative area, Semi-Desert Area, occurs typically between 5,200 feet to 6,400 feet above sea level on the relatively flat portions of the Colorado River Valley. Vegetative cover can be considered an extension of the semi-desert or cold-desert shrub communities of the Colorado River Plateau. Two major subdivisions of this zone include salt bush, greasewood and sagebrush shrublands.

The second vegetation area, Escarpment Area, is formed along the escarpment of the Roan Cliffs. Elevation ranges from approximately 5,400 feet to 8,500 feet. A significant portion of this zone is eroded and largely devoid of plant growth. This especially pertains to exposed portions of the Wasatch formation and steep slopes and cliffs of the overlying Green River formation. A juniper woodland cover occurs on the more gentle west, south and east slopes. Shrublands formed largely by mountain mahogany occur on the less exposed northeast facing slopes. At slightly higher elevations and typically within the protection of ravine cuts, Gambel oak predominates. Immediately below the cliff face sub-mesic conditions permit an extension of the Gambel oak shrub community and isolated stands of Douglas fir. The escarpment vegetation forms a transition between the xeric vegetation typical of the Colorado River Plateau and the mountain vegetation of the Middle Rocky Mountains.

The third vegetation area is the Plateau Area. This zone is typified by mesic to sub-mesic habitats, with forests and grasslands in ravine cuts or on slopes with a northerly aspect, and sub-xeric shrubland on southerly facing slopes. The plateau portion of the NOSRs is steeply rolling with elevation changes from approximately 8,000 to 9,100 feet above sea level. Numerous small valleys and ravines have been cut into the slopes, which increases the diversity of habitats. Typically, slopes with a northerly aspect support aspen, Douglas fir or spruce forests, or mountain grasslands. Southerly facing slopes not occurring in the smaller valleys typically support sagebrush shrubland on more sloping and xeric sites and serviceberry shrubland on less sloping and sub-xeric sites. Vegetation occurring along major and minor streams, as well as that occurring within the Shetland Bluffs, comprises communities dominated by hydrophyllic plants.

### Wildlife

NOSRs-1 and 3 support an abundant wildlife population, with many species of large and small mammals and birds observed in surveys. Most of NOSR-1 serves as a summer range for mule deer and elk. According to BLM personnel, elk and mule deer immigrate onto NOSR-1 in the late spring, arriving there no later than June. They emigrate from the area in November or December depending on the arrival of severe weather. In addition to the use of NOSR-1 as summer range, NOSR-3 serves as winter range for elk and mule deer and some of the lower elevations are part of the critical winter range for mule deer in the Rifle area. Information provided by the BLM indicates that elk populations throughout the area have increased by 128 percent over the last 30 years. The reintroduction of bighorn sheep began in 1975. An area just east of NOSR-1 along Government Creek is identified as a bighorn sheep area. In 1989, a major reintroduction program was implemented. Bighorn sheep do not currently exist on the NOSRs.

A total of 29 species of mammals have been observed on the NOSRs. In addition to mule deer and elk, black bears, a puma, coyotes, beaver, and bobcat were observed, along with many smaller mammals including several species of squirrels, voles, ground squirrels, weasels, mice, and rabbits.

Sixty-five species of birds have been observed on the NOSRs, with the most common species being the Vesper Sparrow, Blackcapped Chickadee, Gray-headed Junco, and Mountain Bluebird. Sage grouse are known to exist within the NOSRs. However, the most critical habitat for wintering, strutting (leks) and brood rearing, can be found approximately 10 miles west of the NOSRs. Waterfowl are primarily found in wetlands areas. There are no known wetlands within the NOSRs that can support waterfowl. River bottoms located outside of the Reserves do provide habitat for waterfowl populations. Raptors (birds of prey) are abundant throughout the NOSRs. Prairie falcons, red-tailed hawks, marsh hawks and golden eagles are the more common raptors breeding and nesting in the area. Precipitous rock formations, large trees, and mountain meadows provide suitable nesting habitat for these species. Woodland nesting species such as goshawks, Coopers hawks and sharp-shinned hawks are common in the wooded areas.

The fish resources on NOSR-3 are limited. No fish have been observed in the isolated pools in Balzac Gulch or elsewhere below the cliff line. On NOSR-1, East Fork Parachute Creek and First Anvil Point Creek contain populations of brook trout and Colorado cutthroat trout. Both share the limited available habitat.

## Threatened and Endangered Species

Communication with the U.S. Fish and Wildlife Service relative to Section 7(c) of the Endangered Species Act indicated that the following species may be present in the

**Table 4**

Endangered Species Possibly Present on NOSRs-1 and 3

| **Federally Listed Species** | |
|---|---|
| **Common Name** | **Scientific Name** |
| Colorado squawfish | *Ptychocheilus lucius* |
| Humpback chub | *Gila cypha* |
| Bonytail chub | *Gila elegans* |
| Razorback sucker | *Xyrauchen texanus* |
| Black-footed ferret | *Mustela nigripes* |
| Bald eagle | *Haliaeetus leucocephalus* |
| Peregrine falcon | *Falco peregrinus* |
| **Federal Candidate Species** | |
| Colorado cutthroat trout | *Salmo clarki pleuriticus* |
| Ferruginous hawk | *Buteo regalis* |
| Wetherill milkvetch | *Astragalus wetherillii* |
| Parachute beardtongue | *Penstemon debilis* |

general area of the NOSRs. A copy of the letter from the U.S. Fish and Wildlife Service can be found in Appendix A.

Surveys have found no evidence of the presence of any of the listed endangered or candidate species on the NOSRs (TRW Energy Engineering Division. November 1981. *Naval Oil Shale Reserves Biological Resources Baseline Report* and Department of Interior, Bureau of Land Management, Colorado State Office, April 1990. *Draft Environmental Impact Statement on Colorado Oil and Gas Leasing*), with the exception of the candidate species Colorado cutthroat trout, which as been observed in some streams on NOSR-1 (Department of Interior, Bureau of Land Management, Colorado State Office, April 1990. *Draft Environmental Impact Statement on Colorado Oil and Gas Leasing*).

## Hazardous Materials and Hazardous Wastes

Within the NOSRs, there are two locations with hazardous materials. The first location is the mine bench at the Anvil Points facility on NOSR-3, where a few buildings have siding containing asbestos. These buildings are scheduled for demolition during the summer of 1991, and any materials containing asbestos will be disposed of according to applicable regulations. The second location is the spent shale pile. During the operation of the Anvil Points Research and Development facility, spent oil shale was deposited in a draw adjacent to the facility. The shale pile has the potential to produce small quantities of hazardous wastes which could possibly enter the Colorado River about 1⅔ miles down stream of the site. DOE is currently monitoring this location and has not detected any concentrations of any substances that would be considered harmflul to the environment. Monitoring is continuing to determine the best available technology for management of the site.

## Cultural Resources

### *Prehistoric and Historic Background*

Archaeological finds in western Colorado have identified a series of primitive cultural traditions from about 8,000 B.C. to the Historic Period. Major periods of occupation are equated with cultural traditions defined on the basis of distinctive artifact assemblages, notably projectile point styles. Euro-American settlement began following the Civil War. During the early 1880s the removal of Ute Indians from the area occurred, the use of the Roan Plateau for cattle and sheep grazing began, and the Parachute Mining District was developed as significant interest in oil shale began. By 1928, over 50,000 oil shale claims had been filed. NOSR-1 was established by President Woodrow Wilson on December 6, 1916, and then amended on May 16, 1919. NOSR-3 was established by Executive Order on September 27, 1924. Oil shale interest waxed and waned over the decades which followed, depending on the availability of domestic oil and the stability of foreign oil supplies.

### *Archaeological/Historical Sites*

Parts of NOSRs-1 & 3 have been surveyed for archaeological remains on two occasions; once by the Allan Kane Survey sponsored by the University of Colorado in 1973 and again by Cultural Resources Consultants, Inc. (CRC) in 1981. While the Kane study focused on specific parts of the Reserves, the CRC study was designed to provided a representative sampling of all of the NOSRs. A general pattern of site locations on NOSRs-1 & 3 can be inferred from the data collected during both the 1973 and 1981 surveys. Sites appear to be clustered in major drainages where physiographic conditions exist which are amenable to prehistoric habitation. It may be assumed from the surveys with some certainty that the majority of sites do occur in the major drainage bottoms and along their tributaries.

Since these surveys only covered portions of NOSRs-1 & 3, it will still be necessary to survey each well site, pipeline, and access road prior to initiating any surface disturbances for the gas protection program to ensure that construction work does not impact archaeological/historical resources.

### *Paleontological Resources*

Fossils have been found in the Roan Cliffs (NOSR-3 and the edge of NOSR-1), as well as in equivalent rock formations off the NOSRs' property. While some of the formations have yielded significant finds (including previously undiscovered species), the most promising research sites are not near areas of the NOSRs which are likely to be developed in the gas drainage protection program.

## Visual Resources

The Visual Resource Management (VRM) system is a process developed by the BLM to identify the degree of acceptable visual change within a particular landscape. A classification is assigned to lands based on the guidelines established for scenic quality, visual sensitivity, and visibility. A VRM Class I classification preserves the existing characteristic landscape and allows for natural ecological changes only. It includes Congressionally authorized areas (wilderness) and areas approved through resource management where landscape modification activities should be restricted. The Class II classification retains the existing characteristic landscape. The level of change in any of the basic landscape elements (form, line, color, texture) due to management activities should be low or not evident. A Class III classification partially retains the existing characteristic landscape. The level of change in any of the basic landscape elements due to management activities may be moderate and evident. A Class IV provides for major modifications of the characteristic landscape. Such activities may dominate the landscape and be the major focus of viewer attention.

Based on the BLM management classes, the plateau area above the cliffs, including most of NOSR-1, is evaluated as VRM Class I. The area around Anvil Points on NOSR-3 is ranked VRM Class II as a result of the visibility of the southern side of the escarpment from Interstate 70.

### Wilderness Characteristics

NOSRs-1 & 3 are not under the primary jurisdiction of the Department of Interior or the Department of Agriculture and therefore, have not been officially classified in terms of wilderness characteristics. However, an unofficial review of the Reserves, using BLM wilderness review criteria, was made as a means of assessing the wilderness values of NOSRs-1 & 3. This review showed that the Reserves would not qualify as a wilderness area due to roads and other signs of human activity.

### Recreational Values

The primary recreational use of the NOSRs is for mule deer hunting. Other types of recreation include off-road vehicle use (snowmobiles, motorcycles and four-wheel drive vehicles) and sightseeing. Due to other nearby mountainous areas, fishing and camping are relatively unimportant on the Reserves.

### Land Use

Livestock grazing has been a long standing land use of the NOSRs. Sheep and cattle graze the NOSRs seasonally. Cattle and sheep graze on the NOSRs highlands from April through October and on the lowlands all year long. NOSR-1 provides primarily summer range, while NOSR-3 serves as winter range. Other land uses revolve around mineral development. The predominant land use throughout the area, livestock grazing, is rapidly giving way to rural subdivisions. Numerous ranches, especially in the Roaring Fork and Eagle River Valleys and in the Rifle area, have been purchased by land developers and subdivided for both seasonal and permanent home sites.

### Socio-Economic Aspects

The population of Garfield County is 29,910. The social and economic base of the general area is agriculture and recreation. Uncrowded conditions (9.97 people per square mile) and a rural life style are dominant in the area. Recreation and tourism are an economic force. The bulk of the area economy is based upon year-round outdoor recreational activities and their related trades and services. Other constituents of the economy include agricultural and livestock operations, mining, timber operations, light industry and tourism. During the 1970s, development of the oil shale industry brought an influx of people into the Rifle-Parachute area. The oil shale bust, which occurred in the early 1980s, caused a large movement of oil shale companies and their employees from the area.

### Summary of Existing Environment

- NOSRs-1 and 3 comprise about 2.8% of Garfield County land area and are located on the western slope of the Rocky Mountains 254 miles west of Denver and 62 miles from the city of Grand Junction.

- Climate is typical of a high-elevation semi-arid area, with adequate rainfall and a 3 month growing season. NOSRs-1 and 3 support abundant wildlife and vegetative communities. No endangered animal or plant species are known to be present on the NOSRs.
- NOSR-1 has an extensive surface water regime of generally good quality except during spring snow melt and summer storms, when soil erosion generates increased levels of sediment and dissolved solids in the water. Groundwater quality on the NOSRs is good to excellent.
- Air quality is excellent, except for ozone, which is a condition typical of the high altitude of the area rather than any industrial sources.
- No hazardous or toxic wastes are known to be present on the NOSRs other than very small amounts of asbestos in a few abandoned mining buildings.
- There are no significant cultural resources on the NOSRs.
- The area has a very small population (29,910 in Garfield County), with an economy influenced by farming, tourism, and a small-scale energy development and extraction industry.

# *Section IV*
# *Impacts of the Proposed Action*

## Summary of Proposed Action

The proposed action includes:

- Drilling approximately 111 government-owned offset wells during the next five years.
- Participating in a communitization program covering approximately 89 privately drilled wells.
- The exact location of all wells is dependent upon future commercial drilling outside the NOSR's borders, but likely would be along the Reserve's boundary lines.

Activities involved in implementing the proposed project would include construction and reclamation of well pads, access roads, and pipeline routes. The estimated environmental impacts of construction associated with the 111 Government-owned offset wells and the 89 communitized wells are included in the following analyses.

## Impacts to Resources

### *Geology and Soils*

There would be no impacts to the geologic structure of the area under the proposed action. Ground subsidence caused by the drilling and gas extraction is highly unlikely due to the small number of wells and the large areal extent of the drilling.

Impacts to soils disturbed by surface activities may be long-term and can be irreversible. They are typically described as compaction, mixing, burial, contamination, and removal (erosion). Soil compaction results from the use of vehicles during construction and production activities. The severity of compaction is a result of the types of vehicle used, soil texture, and moisture content. Compacted soils result in a reduction of infiltration rate. Soil mixing is a common occurrence during construction operations. Topsoil is mixed with subsurface or bedrock materials producing a less productive soil. Less productive soil supports sparse or poorer quality vegetation which in turn leads to soil erosion. Topsoil can be lost during construction through the application of road surface materials and placing buildings and other production facilities on topsoil. If the material is buried, the production capacity and biological activity is reduced. Contamination of the soil occurs when petroleum products, bentonite, drilling fluids or poor quality water is spilled. The chemical and physical properties, such as pH and high soluble salts, may adversely affect soil productivity. Soil removal (erosion) results

from the disturbance of the surface soil and the protective layer of vegetation growing on it. The soil is loosened and exposed to wind and water and is literally carried away by these physical processes.

Table 5 presents information regarding anticipated acreage disturbance for construction of access roads, drill pads, pipelines, and gas gathering facilities. A portion of the disturbed areas would be only temporarily disturbed and reseeded immediately after construction work ceases, thereby restoring the area to natural habitat and preventing erosion. Other portions of the disturbed areas, or permanent production facilities, would not be reseeded for the life of the well (estimated at 20 to 30 years). When a well reaches the end of its useful life and is plugged and abandoned, the entire well pad would be reclaimed and reseeded. As shown in the table, the projected long term disturbance would total about 0.6% of the surface area of the NOSRs and the ½-mile wide buffer zone surrounding the Reserves where the privately-drilled wells would be communitized with the government. Consequently, any impacts to the soils from compaction, erosion, etc. would be highly localized and of extremely limited extent. In addition, a number of mitigation measures (see page 25) would be employed to minimize impacts to soils.

**Table 5**

Disturbed Acreage
(Acres)

| Action | Temporary | % | Long Term | % |
|---|---|---|---|---|
| Drill Pads | 160 | 0.2 | 80 | 0.1 |
| Roads | 400 | 0.5 | 400 | 0.5 |
| Gas Gathering Facilities | 14 | 0.0 | 14 | 0.0 |
| Flowlines | 120 | 0.1 | 0.0 | 0.0 |
| **Total** | **694** | **0.8** | **494** | **0.6** |

Disturbance is based on a total of 200 wells drilled (111 government-drilled offset wells, 89 privately-drilled communitized wells) and associated roads and pipelines. Percentages are based on a comparison with the total of 80,450 acres for NOSR-1 & 3 and the ½-mile wide buffer zone surrounding the NOSRs. Long-Term disturbance would occur during the producing life of the well, typically 20 to 30 years. Once each well has ceased production, it would be formally plugged and abandoned pursuant to state and BLM procedures and the area reclaimed to its original natural state.

## *Hydrology*

### *Surface Water*

Erosion, caused by removal of vegetation during construction, could result in additional sediment loading of nearby streams. The potential for spills of drilling and well stimulation chemicals would be mitigated through the use of spill prevention and control measures such as good maintenance practices and installation of earthen berms around fuel storage areas. Placement of blooie pits away from natural runoff and alluvium would reduce the possibility of drilling fluids reaching subsurface water

or a stream. The use of air drilling and the absence of fluid production from wells in these fields would minimize the chance that any fluid spill would be of sufficient volume to reach the Colorado River. Use of current well drilling and completion techniques, including the cementing of casing, would minimize the possibility of fluid production and drilling fluids commingling with perched water tables. Soil erosion would be minimized through proper well and road construction utilizing erosion control devices such as diversion ditches, water bars, straw bales, etc.

### *Ground Water*

The use of air drilling, cementing of surface casing, and the lack of fluid production from wells drilled to date, make it unlikely that there would be any impacts to ground water from the offset drilling program.

### *Wetlands*

As there are no natural wetlands on the area of the proposed action, there would be no impact from the proposed drilling program. No drilling is anticipated in the vicinity of any of the man-made water retention ponds.

## *Air Quality*

As shown in Table 2, air quality at the NOSRs is generally good with the exception of ozone, which is typically present at higher concentrations in high-altutude areas. No permanent sources of air polluntant emissions are associated with the NOSRs natural gas protection drilling program, which thus should not affect air quality over the long term. Drilling activities may, however, produce temporary, short-term impacts on air quality within the immediate area of the drilling site: the drilling operation would use air drilling technology which produces large volumes of dust. The data presented in Table 6 were developed through site sampling and computer analysis during actual air drilling operations at the Naval Petroleum Reserve No. 3 with equipment similar to the rigs to be used in the NOSR drilling program. A comparison of the background readings from the NOSRs (Table 2) and NPR-3 (Table 6) indicates that they are basically the same (30 to 37 $\mu g \backslash m^3$ for the NOSRs vs. 33 $\mu g \backslash m^3$ for NPR-3). Therefore, particulate emission levels produced during air drilling operations at the NOSRs could be expected to approximate those of NPR-3 which did not exceed allowable limits and rapidly dissipated with distance from the drilling site. Other sources of air pollutant

**Table 6**

Estimated Fugitive Dust Emission Levels ($\mu g \backslash m^3$)
for Drilling Activities

| Upwind (Background) | Downwind | One Mile Downwind | 24 Hour Maximum Allowable |
|---|---|---|---|
| 33 | 68 | 29 | 150 |
| Data developed from actual drilling operations conducted at Naval Petroleum Reserve No. 3. | | | |

emissions, such as heavy construction equipment and drill rig motors, are not subject to regulatory limits and would be operating only a very small fraction of time during the five-year drilling program. Random leaks of natural gas from well heads, flanges, etc. may occur, but standard industry practices would minimize their occurrence and duration. Therefore, the potential effect on air quality by the drilling program would be negligible.

### *Vegetation*

Minor loses of vegetation would occur from surface disturbance associated with the construction of access roads, drill pads, pipelines, and gas gathering facilities (Table 5). Other vegetation losses could result from soil erosion. Woodland and shrubland areas removed during construction would be reclaimed with grasses. Trees and shrubs would, over a period of years, come back naturally on temporarily disturbed areas. With the drilling of the 200 wells over a five year period, approximately 494 acres would not be available for vegetation production during the estimated 20 to 30 year production period of the program. This is but a small fraction (0.6%) of the total surface area of the NOSRs and should have no effect on the overall number and diversity of the vegetative community of the Reserves. Reclamation activities, such as recontouring the disturbed ground and reseeding with native species of grasses and forbs, would help prevent soil erosion and further reduce project impacts to vegatation.

### *Wildlife*

The major impact on wildlife populations would be a temporary increase in human and vehicle activity. Reduction of potential browse would be minimal and mitigated by reclamation. During the winter months (December through April) mule deer and elk migrate off the more elevated highlands of NOSR-1 onto the lower elevations of NOSR-3 and other nearby lands, which serve as winter range. Disturbance at critical times, such as fawning and birth of smaller animals, could reduce the number of young and their survival rates. Impact on wildlife during wintering and birth must be considered on a case by case basis before construction is permitted in a given area. Raptors are very sensitive to human activity during the nesting cycle. If disturbed, they may abandon the nest with subsequent mortality of the young. This impact is addressed by one of the mitigation measures to be used. The temporary short-term impacts on the small areal extent of the project and the slow pace of drilling (spread over five years), are not anticipated to affect wildlife.

Impact to fisheries would primarily be from soil erosion from construction of roads, drilling pads and pipelines. During construction there would be a higher rate of sediment loading in streams then during operational activities. Following completion of each well, reclamation activities would reduce the areal extent of ground surface exposed to erosion. Those areas not needed for production facilities/activities would be reclaimed.

### *Threatened and Endangered Species Impacts*

No endangered species are known to occur on the NOSRs (TRW Energy Engineering Division. November 1981. *Naval Oil Shale Reserves Biological Resources Baseline Report* and Department of Interior, Bureau of Land Management, Colorado State Office, April 1990. *Draft Environmental Impact Statement on Colorado Oil and Gas Leasing*). Therefore, the proposed action should not have an impact on any endangered species. It is possible that the peregrine falcon and bald eagle may become future residents within the Reserves, given their increasing numbers and the excellent nesting areas afforded by the precipitous cliffs found throughout the site. However, the topography of these nesting areas would preclude any drilling activities nearby, thus minimizing the potential impacts to the species.

### *Hazardous Materials*

Oil and gas production and drilling fluid waste streams are presently excluded under RCRA, and the drilling operations would not use any materials that are classified as hazardous wastes. Therefore, there would not be any impact to the environment associated with hazardous materials.

### *Cultural Resources*

Cultural resource surveys would be conducted prior to the construction of access roads, drill sites, production facilities, or pipelines. Surveys would be conducted by professionals knowledgeable in standard survey techniques and reporting procedures. In the event archaeological sites are identified in the area of proposed construction, mitigation actions would be coordinated with the State Historic Preservation Officer (SHPO) and could include excavation of the area or, if necessary, the selection of an alternate location. There are no natural landmarks designated under the National Registry of Natural Landmarks in the are of the proposed project.

### *Visual*

Some of the proposed wells could have an impact on the scenic quality where wellsites, access roads, and pipelines are constructed on slopes facing the Interstate 70 (I-70) scenic corridor. Proper planning during each site specific analysis, including construction of roads and facilities on slopes facing away from the I-70 corridor or along the wider ravine bottoms, would mitigate visual impacts.

### *Land Use*

Grazing activities on the NOSRs are currently managed by the BLM. In the event drilling programs do affect grazing patterns, the BLM will assess the situation and make adjustments. However, due to the relatively low number of wells to be drilled, it is not anticipated that grazing activities would be affected. Recreational use of the area is currently limited due to the lack of access to some of the more remote sections. The construction of access roads to the various drilling sites would increase the opportunity for hunting, camping, fishing, and wildlife observation. However, con-

struction of access roads would also reduce the wilderness aspects that currently exist in certain areas of the NOSRs. Development of the 200 wells and the associated disturbance for access roads, pipelines, and production facilities would only disturb 0.8% of the area temporarily and 0.6% long term (Table 5). There is no prime or unique farmland as designated by the Unique Farmlands/Farmland Protection Policy Act on the NOSRs.

### *Socio-Economic Impacts*

Socio-economic impacts to the area from the proposed gas protection program would be a small but positive factor for the local economy. Motels, restaurants, local contractors, and service companies would benefit from increased local expenditures from construction operations. As construction activities are planned to extend over a five year time frame, these benefits would not be sustained nor would they be consistent. As more wells are placed into production, the need for personnel to supervise operations and conduct maintenance would increase. It is estimated that during the life of the project, five to ten personnel would be required for these operations.

## Cumulative Impacts

Cumulative impacts associated with the proposed DOE drilling program and the communitization of privately-drilled wells within the ½-mile wide buffer zone surrounding the Reserves are not expected to affect the area, due to the small area involved with the proposal compared with the surrounding region and the relatively small scale of private development of natural gas production in the region. During the next five years, it is estimated that 300 private wells could be drilled in the general region including the NOSRs, covering about 1,000 additional acres. Considering the total land area of Garfield County, which is approximately 3,000 square miles (almost 2 million acres), the disturbance is negligible. The areas surrounding the NOSRs are managed by the BLM, and therefore management practices would be implemented to ensure that any impacts from private drilling are further minimized.

Estimates developed by the Bureau of Land Management indicate that drilling programs conducted outside of the NOSRs would generate $500,000 in federal royalties, and $175,000 in local property taxes. Taking into account Garfield County's share of these revenues, there would be an increase of 2.6% for the county. Additional benefits would be realized in the private sector in such areas as worker housing/lodging, construction contractors and suppliers, etc. The expected increase in drilling activities would not create a burden on local services such as schools, medical facilities, municipal services or housing.

## Projected Impacts

- Temporary disturbance of 694 acres (0.8%) of the NOSRs area and the ½-mile wide buffer strip surrounding the Reserves which would be spread over a five year period.

After reclamation, approximately 0.6% would remain disturbed for the life of the project, which is estimated to be 20 to 30 years.

- The exposure of soils to erosional factors (wind and water) through construction activities may slightly increase the sedimentation load of local streams.
- Minimal increase in air pollution emissions. Through application of best management practices, emissions would be kept well below regulated emission standards.
- There would be no production, use or disposal of hazardous wastes.
- No threatened or endangered species are known to exist on the NOSRs or in the ½-mile wide buffer strip surrounding the Reserves. Impacts to non-endangered wildlife would be minimal, as the project would be spread out over a five year period and land disturbance would be limited to a very small percentage of the total area.
- There would be no impact to the recreational values of the area. In some instances, recreational areas would become more accessible through construction of roads.
- Agricultural use of the area would not be impacted.
- Cumulative impacts associated with production of gas from DOE and private facilities would affect about 1,700 acres in an area of almost 2 million acres during the next five years. This impact would extend for the estimated 20 to 30 year life for the gas fields.
- Socio-economic impacts to the area would be small but beneficial to the local economy. Motels, restaurants, local contractors, and service companies would benefit from an increase in expenditures from drilling and construction operations.

## Mitigation Measures

The proposed NOSR gas protection program is projected to cause minimal short- and long-term impacts to the surrounding region. However, to ensure that efforts are made to mitigate even the minor impacts estimated to occur, the following measures, all recommended by BLM in its drilling leases, would be implemented:

- All soil and vegetation disturbing activities would be restricted to the smallest area possible.
- Disturbed areas would be reclaimed and reseeded as soon as practicable.
- Facilities would be painted to blend in with the natural landscape.
- Water mist at the drill rig blooie line would be used to reduce fugitive dust from dry cuttings carried up the bore during air drilling.
- Problem construction areas would be wetted and/or vehicle travel would be restricted in these areas to reduce fugitive dust.
- Proper drilling, casing and completion techniques would be used to protect groundwater.
- During raptor nesting seasons, special care would be given to the identification of nesting areas and restricting human activity in those areas.

A more complete list of BLM-approved mitigation measures is presented in Appendix B.

# Section V
# Alternatives to the Proposed Action

## No Action Alternative

### *Communitization*

If the Government does not participate with private owners in communitizing wells, the wells would likely be drilled by their private owners anyway, and any impacts associated with their drilling and operation would still occur. The Government would lose part of the natural gas resource and its potential revenues by not communitizing private wells. Not participating in communitized wells would also fail to fulfill the statutory requirement to protect the resources of the NOSRs.

### *Government Owned Offset Wells*

If no protective wells are drilled, none of the minimal impacts to the environment discussed previously would occur. However, significant loss of the natural gas resources underlying the NOSRs through drainage to offset wells on private lands would result, and the statutory requirement to protect these resources would not be met. Although there would be no environmental impact if no DOE wells were drilled, the environmental impacts from drilling by other operators on neighboring lands would likely still occur.

## Cooperative Agreements

The objective of this proposal is to protect the NOSRs from drainage of valuable natural gas by wells on neighboring lands. This objective could possibly be achieved through entering into cooperative agreements, such as communitizations, with additional owners and lease holders on adjacent properties. As discussed in the cumulative impacts section, impacts from all projected government and private drilling projects in the area are not expected to affect the area, and increased government communitization of private wells should not alter this. However, it is possible that, given the incentive of reducing individual risk exposure through sharing with partners, a greater number of private land owners and lease holders would elect to drill wells than would have without any Government participation, thereby increasing the impacts associated with this off-Reserve drilling. But, since revenues as well as expenses would have to be shared, the number of opportunistic wells (drilled only because of government participation) is not expected to be large. Also, this alternative only partially achieves the government's goal, since a portion of the gas produced from these jointly-owned wells, and hence the revenues from gas sales, would be owned by non-Government partners. In addition, it is likely that private wells drilled sufficiently back from the boundaries of the Reserves so as to not be amenable to mandatory communitization would still drain some of the gas resources under the NOSRs. This could only be

prevented by drilling 100 percent Government owned offset wells inside the NOSR borders.

## Leasing

The potential revenues from the natural gas resources of the NOSRs, if not the resource itself, could be protected by leasing the rights to drilling to the private sector. In exchange for these drilling rights, the Government would get revenue. However, leasing would require special legislation and authority to conduct, and to date, there has been a lack of Congressional interest to do so. Therefore, leasing is not considered to be a feasible alternative to the proposal at this time.

# Section VI
# References

Cameron Engineers. May 1972. *Compilation of Existing Data and Preliminary Plan for Development of Naval Oil Shale Reserves 1 and 3.*

Department of Energy, NPOSR-CUW. October 1987. *Plan for Protection of Oil and Natural Gas Resources, Naval Oil Shale Reserve No. 1 & 3, Garfield County, Colorado.*

Department of Energy. January 1989. *Action Description Memorandum for the Oil Shale and Natural Gas Protection Plan for the Naval Oil Shale Reserves.*

Department of Interior, Bureau of Land Management, Denver, Colorado. 1980. Cultural Resources Series No. 9, *Environmental Factors as Determinants of Archaeological Site Location in the Piceance Basin in Northwestern Colorado.*

Department of Interior, Bureau of Land Management. 1982. *The Glenwood Springs Umbrella Oil and Gas Environmental Assessment* (CO-070-GS-2-22).

Department of Interior, Bureau of Land Management. 1982. *Draft Environmental Impact Statement on the Glenwood Springs Resource Management Plan.*

Department of Interior, Bureau of Land Management. 1983. *Final Environmental Impact Statement on the Glenwood Springs Resource Management Plan.*

Department of Interior, Bureau of Land Management. 1988. *Glenwood Springs Revised Resource Management Plan/Record of Decision 1988.*

Department of Interior, Bureau of Land Management. 1980. *Visual Resource Management Program.*

Department of Interior, Bureau of Land Management. 1986. *Visual Resource Contrast Rating, BLM Manual Handbook 8431-1.*

Department of Interior, Bureau of Land Management. 1986. *Visual Resource Inventory, BLM Manual Handbook 8410-1.*

Duncan, D. C. and Denson, N. M. 1949. *Geology of Naval Oil Shale Reserves 1 and 3, Garfield County, Colorado,* U.S. Geological Survey Oil and Gas Investigations Preliminary Map OM-94.

Lawrence-Allison & Associates West, Inc. February 1983. *FY 1990-1999 Long Range Plan for Naval Petroleum and Oil Shale Reserves, Colorado, Utah, and Wyoming.*

Radian Corporation. September 1981. *Soil Resources - Anvil Points Oil Shale Facility, Garfield County, Colorado, Final Report.*

Radian Corporation. January 1982. *Vegetation Survey - Anvil Points Oil Shale Facility, Garfield County, Colorado.*

TRW Energy Systems Planning Division. September 1980. *Interim Hydrology Report for NOSR-1, for U.S. DOE.*

TRW Energy Systems Planning Division. September 1980. *Long-Range Utilization of NOSR-1: Photogeologic Evaluation of Hazards, for U.S. DOE.*

TRW Energy Engineering Division. July 1981. *NOSR Baseline Characterization Report - 1980–Draft.*

TRW Energy Engineering Division. November 1981. *Cultural Resources Inventory for NOSR 1 and 3.*

TRW Energy Engineering Division. November 1981. *Naval Oil Shale Reserves Biological Resources Baseline Report.*

TRW Energy Engineering Division. 1982. *NOSR-1 Air Quality and Meteorological Monitoring 1981 Data Report.*

Department of Interior, Bureau of Land Management, Colorado State Office, April, 1990. *Draft Environmental Impact Statement on Colorado Oil and Gas Leasing.*

Department of Energy, NPOSR-CUW, October, 1987. *Naval Petroleum Reserve No. 3 - Ambient Air Quality Report.*

# *Section VII*
# *Agency Contacts and Personal Communications*

Junkin, P.D. July 1981. Private communication.

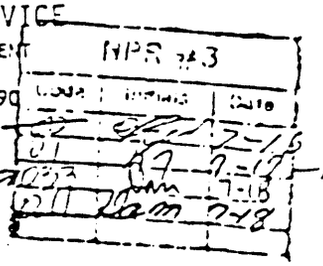
Garfield County, Building and Planning Department, Glenwood Springs, Colorado, November, 1990. Mark Beam. Personal communications.

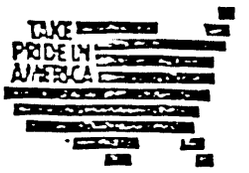
United States Bureau of Land Management, Grand Junction District, Grand Junction, Colorado.

United States Fish & Wildlife Service, Golden, Colorado, LeRoy W. Carlson, State Supervisor.

# *Section VIII*
# *Appendix*

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
Colorado State Office
730 Simms Street, Suite 290
Golden, CO 80401
FTS 776-2675
COMM (303) 236-2675




IN REPLY REFER TO:

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NPR-3 WYO

FWE/CO:DOE:Species List
Mail Stop 65412 Grand Junctio

C. Ray Williams
U.S. Department of Energy
800 Werner Court, Suite 342
Casper, Wyoming 82601

Dear Mr. Williams:

This responds to your June 15, 1990, letter regarding the Department of Energy's plans for drilling protective gas wells at Naval Oil Shale Reserves 1 and 3 in Garfield County, Colorado.

To comply with Section 7(c) of the Endangered Species Act of 1973, as amended, Federal agencies or their designees are required to obtain from the Fish and Wildlife Service (Service) information concerning any species or critical habitat, listed or proposed to be listed, which may be present in the area of a proposed construction project. Therefore, we are furnishing you the following list of species which may be present in the concerned area:

FEDERALLY LISTED SPECIES

| | |
|---|---|
| Colorado squawfish | Ptychocheilus lucius |
| Humpback chub | Gila cypha |
| Bonytail chub | Gila elegans |
| *Razorback sucker | Xyrauchen texanus |
| Black-footed ferret | Mustela nigripes |
| Bald eagle | Haliaeetus leucocephalus |
| Peregrine falcon | Falco peregrinus |

* Proposed to be listed June 1990.

We would like to bring to your attention species which are candidates for official listing as threatened or endangered species (Federal Register, Vol. 54, No. 4, January 6, 1989; Vol. 55, No. 35, February, 21, 1990). While these species presently have no legal protection under the Endangered Species Act (Act), it is within the spirit of the Act to consider project impacts to potentially sensitive candidate species. Additionally, we wish to make you aware of the presence of Federal candidates should any be proposed or listed prior to the time that all Federal actions related to the project are completed.

## FEDERAL CANDIDATE SPECIES

| | |
|---|---|
| Colorado cutthroat trout | *Salmo clarki pleuriticus* |
| Ferruginous hawk | *Buteo regalis* |
| Wetherill milkvetch | *Astragalus wetherillii* |
| Parachute beardtongue | *Penstemon debilis* |

Section 7(c) of the Endangered Species Act, as amended, requires that the Federal agency proposing a major Federal action significantly affecting the quality of the human environment conduct and submit to the Service a biological assessment to determine effects of the proposal on listed species. The biological assessment shall be completed within 180 days after the date on which initiated or a time mutually agreed upon between the agency and the Service. The assessment must be completed before physical project modification/alteration begins. If the biological assessment is not begun within 90 days, the species list above should be verified prior to initiation of the assessment.

When conducting a biological assessment, a thorough review of the project and the potential impacts of said project on threatened and endangered species within the immediate project area as well as the area of influence must be made.

The Service can enter into formal Section 7 consultation only with another Federal agency or its designee. State, county or any other governmental or private organizations can participate in the consultation process, help prepare information such as the biological assessment, participate in meetings, etc.

The lead Federal agency for Endangered Species Act (ESA) Section 7 consultation should review their proposed Federal action and determine if the action would affect any listed species or critical habitats. If the determination is "may affect" for listed species, the Federal agency must request in writing formal consultation from our office. At this time, your agency should provide this office a biological assessment and/or any other relevant information used in making the impact determinations.

Your attention is also directed to Section 7(d) of the Endangered Species Act, as amended, which underscores the requirement that the Federal agency or the applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which, in effect, would deny the formulation or implementation of reasonable and prudent alternatives regarding their actions on any endangered or threatened species.

If the Service can be of further assistance, please contact Bob Leachman of the Grand Junction office at (303) 243-2778 or FTS 322-0351.

Sincerely,

Keith L. Rose

for LeRoy W. Carlson
Colorado State Supervisor

cc: FWE/FWE, Grand Junction
FWS/FWE, Salt Lake City
CDOW, Glenwood Springs

## Appendix B

Surface Use Plan Mitigating Measures for NOSRs 1 & 3 Gas Well Drilling Development and Production

1. All soil disturbing activities should be well planned and restricted to the smallest area possible.
2. In case of extremely wet or dry conditions, construction activities may be curtailed to prevent soil damage, dust problems and erosion. As needed, drill pad access roads may be wetted for dust control or graveled as a permanent dust and erosion control measure.
3. Pipelines will be buried and the surface revegetated, with erosion control measures employed where feasible.
4. The drill site and all roads not needed for maintenance will be reshaped to blend with the natural surroundings, revegetated in an approved manner, and erosion control measures employed where necessary. Where possible, roads will be constructed on slopes where tree removal will be slight.
5. Buffer distances will be maintained where physically possible to protect the following:
   a. Watercourses, drainage ways and impoundments (natural and man-made), to prevent possible pollution in the event of an accidental spill.
   b. Extremely unstable slopes and slide areas.
   c. Critical wildlife habitats, such as prairie dog towns, breeding habitat of rare and/or endangered wildlife species, etc.
   d. Other man-made improvements or structures legally occupying public lands.
6. The timing of operations and activities will be controlled to protect such things as the following:
   a. Watershed from undue acceleration or erosion associated with periods of saturated soils or low moisture.
   b. Critical Deer and Elk Range - In order to protect critical winter range for elk and mule deer located within NOSR-3 drilling and other development activity may not be allowed during the period from January 15 to April 30 on such ranges. This mitigation does not apply to maintenance and operation of producing wells. Exceptions to the limitation in any year may be specifically authorized in writing by the Director, Naval Petroleum and Oil Shale Reserves, Colorado, Utah and Wyoming (DNPOSR-CUW) in consultation with the District Manager, BLM.
   c. All surface resources during periods of extreme fire danger.
7. Operations and activities will be modified and controlled to protect aesthetic and environmental values by pursuing the following:
   a. Blend operation, hardware, and other improvements with the landscape by the use of paints which match the natural colors of surrounding vegetation and rock.
   b. Hide or conceal operations, hardware, and improvements within view of travelers on Interstate 70; route roads and pipelines to avoid the steep slopes and cliff faces visible from Interstate 70 and other major highway travel routes where possible.
   c. Keep clearing and other surface disturbances to a minimum. Where possible route roads and pipelines away from wooded areas as pinion-juniper trees take years to restart. Where possible route roads and pipelines along the sides of drainages. This will conceal and keep surface disturbance to a minimum.
   d. Restore disturbed and/or abandoned areas to appear as natural as possible; plant and/or reseed with native species. Recommended reseeding is as follows:
      - ✿ 2#/acre - Fairway Crested Wheatgrass
      - ✿ 4#/acre - Bluebunch Wheat Grass
      - ✿ 3#/acre - Russian Wildrye
      - ✿ 3#/acre - Indian Rice Grass
   e. Use existing rights-of-way to the greatest extent possible, and locate new rights-of-way to facilitate future oil and gas activities and best serve multiple use management of surface resources.

## Appendix B

Surface Use Plan Mitigating Measures for NOSRs 1 & 3 Gas Well Drilling Development and Production (continued)

8. To preserve aesthetics, roads may be constructed in drainage bottoms. Roads constructed on slopes may be insloped 3% and ditched on side slopes of 10% or more. On side slopes of 10% or less, roadways may be ditched and crowned. Water barring will be used where necessary. Natural drainage will be utilized where possible. Culverts with aprons to prevent erosion immediately below the discharging end will be used for all drainages capable of flowing at a rate of 10 cfs or greater during a 25 year event.
9. All diesel equipment will be equipped with approved catalytic exhaust scrubbers and/or spark arresters.
10. If brackish water is detected, the well will be cased or if the well is a dry hole, it will plugged and abandoned to prevent mixing of aquifers.
11. Sludge pits will be constructed to prevent leakage or breakage. Drilling fluids, cuttings, chemical and salts will be contained in the reserve pit. As soon as possible, the pit will be allowed to evaporate, leveled and revegetated.
12. Vegetation will not be cleared except where absolutely necessary.
13. Top soil removed from the location will be stock piled.
14. All trash will be disposed of in an approved sanitary landfill, or approved on-site disposal pit. No trash will be disposed of in the reserve pit. The well site and access road will be kept free of trash and debris.
15. Chemical toilets will be used. County approved vendors will be used to dispose of all sewage.
16. All equipment and facilities left on the site will be painted to blend with the natural surroundings.
17. During operations the sludge pits will be fenced to prevent animals from entering.
18. In the event threatened or endangered species are found on lands proposed for development, the DNPOSR-CUW may add additional stipulations as to site occupancy prior to periods of exploration or drilling.
19. Immediately upon completion of drilling, the location and surrounding area will be cleared of all remaining debris, materials, and trash and hauled to the nearest legal landfill.

A complete cultural resource survey will be made of the potentially disturbed area prior to any surface disturbance activities. The services of a qualified professional archaeologist, provided or approved by the BLM, shall be engaged to conduct a thorough and complete survey for evidence of archaeological or historic sites or materials.

The discovery of antiquities or other objects of historic or scientific interest including, but not limited to historic or prehistoric ruins, fossils, or artifacts discovered as a result of operations, shall result in the curtailment of all onsite activities until directed to proceed by the DNPOSR-CUW.

For each of the 111 well locations a written site plan will be developed by the DOE operating contractor and reviewed by the DNPOSR-CUW and where required by the BLM Branch of Fluid Minerals and BLM Area Resource Office. The plans will detail specific mitigating measures needed for specific well site and access road placement and for surface-disturbing operations.

During periods of adverse weather or unusual soil conditions, all activities creating irreparable or extensive damage as determined by the DNPOSR-CUW will cease.

# END

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01/03/92