

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter describes the environmental consequences of each alternative. A comparison of these effects appears on table 2-2 in chapter 2. When there would be any unavoidable adverse impacts or irreversible or irretrievable commitments of resources, discussion of these effects is included in the analysis of each resource. In the same way, the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity is discussed in the analysis of each resource.

Analyses in this document are focused on 1990; however, the time has been expanded to 1995 when necessary to include maximum development. The analyses presented in this chapter were based on the professional judgment of resource specialists when other sources of information were not available.

The individual tract profiles contain site-specific discussions of the impacts of development on each tract, as well as a discussion of agricultural economics.

GEOLOGY AND MINERALS

The only major impact of Alternatives 2 through 6 on geology would be the removal of the coal. The direct impact to topography is insignificant in itself, but the changes would affect wildlife. Those effects are discussed in the "Wildlife" section of this chapter.

Removal of the coal beds and destruction of the strata overlying them would be unavoidable. There would be no short-term impacts on geology. A long-term impact would be the consumption of the coal, which would make it unavailable for future use.

An irreversible effect of Alternatives 2 through 6 would be the consumption of the coal. Recovery of the minable coal in any mining operation is never 100% efficient; normally, 10% to 15% of the coal remains after mining. The coal that remained would be irretrievably lost to future use.

SOILS, VEGETATION, AND RECLAMATION

The total acreage disturbed by mining and related land uses under each alternative is shown in table 4-4 in the "Land Use" section. Impacts would result from the removal of topsoil and vegetation and from the handling and stockpiling of topsoil.

Impacts to subsoils (for example, argillic horizons) could occur in the form of destruction of the soils' structure, which may take thousands of years to develop. Destruction of these soil aggregates (also referred to as peds) could be expected to decrease rates of permeability and infiltration and to decrease air exchange and available-water-holding capacity.

In arid climates, soil structure and bulk density are very important to soil properties affecting the moisture regime of soils. A soil composed of stable soil aggregates arranged loosely maximizes pore space and minimizes bulk density. This results in significantly higher effective moisture than that within a compacted soil. A more favorable moisture regime can be expected to result in higher annual forage production, greater plant cover to reduce erosion, and more palatable forage during the warm season, which should better distribute range utilization by foraging animals.

Large-scale destruction of soil aggregate structure would occur if heavy equipment was driven over moist soil during reclamation. Mitigating measures intended to reduce or eliminate these impacts are included in appendix C.

Dilution of the solum by less fertile substratum material would result in a decrease in the fertility of the soil. The substratum horizons typically contain significant accumulations of calcium carbonate and sometimes soluble salts, which are detrimental to seed germination and water uptake by plant roots. Substratum material also is very low in organic matter, microbial activity, and major plant nutrients, and it has poor structure or physical properties.

Minimum surface soil after replacement should be approximately 24 inches. However, this figure

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is a rough estimate, and other factors such as slope, the quality of the spoil material beneath the soil, and the specific nature of the topsoil that is replaced have to be considered. Table 4-1 gives the approximate thickness of soil rated "good" or "fair" that is available on Montana tracts for surface reclamation. This information is not yet available for the Wyoming tracts.

The success of revegetation (reclamation) depends on the ability of the plant communities to perpetuate themselves under the indigenous environmental conditions of an area, such as moisture distribution during the growing season, wind, temperature extremes, and drought. It also depends on the ability of the reclaimed land to meet postmining land use objectives (Coenenberg 1982). The following are the primary points of concern relevant to reclamation:

- Reestablishment of any type of vegetation
- Reestablishment of forbs, shrubs, and trees
- Reestablishment of diverse native plant communities
- Topographic and landscape alterations with respect to vegetative reclamation

Attempts at reestablishment of cool-season perennial grasses have met with considerable success (DePuit 1982). The principal problem remaining with this technology is that reestablishment of cool-season grasses often is too successful, to the detriment of attempts at establishing diverse plant communities. Reestablishment of warm-season grasses has been unsuccessful in the past because adapted, good quality seed was lacking, because preparation of seed beds was not sufficient, because planting was not done at optimal times, and because seed was not planted at the proper depths (Ries 1982).

The reestablishment of diverse native plant communities depends largely on initial reclamation practices, especially the use of diverse, locally adapted seed mixtures (Coenenberg 1982). Shrub establishment generally has not been successful, but the use of planting techniques that introduce slow-establishing plants first improves success in shrub reestablishment (Eddleman 1982). Reestablishment of ponderosa pine has been difficult; however, the use of tubeling stock for transplantation has shown some success. Reestablishment of deciduous trees (cottonwoods and willows) through transplantation and natural revegetation has been successful at some mines.

A reclamation method that aids in successful reestablishment of a diverse plant community is

the use of native grass hay mulch rather than an agronomic mulch. Other factors that affect the success of plant community reestablishment are timing of fertilization, grazing practices on revegetated areas, and controlled use of fire (Coenenberg 1982).

Sufficient soil moisture to ensure plant growth at critical times is the major limiting factor influencing plant growth in the Northern Great Plains. The shape of land surface, or topography, controls water movement and influences ground moisture (Wollenhaupt and Richardson 1982). Surface mining normally smooths the landscape and eliminates rugged, diverse topography. Because replacement and recontouring of spoils affect the success of revegetation, careful design of spoils replacement is recommended.

Successful establishment of vegetative cover has been demonstrated at the Dave Johnston, Black Thunder, Belle Ayr, Eagle Butte, Big Horn, Decker, and Rosebud coal mines, to name a few. As a rule, successful reclamation of land disturbed by coal mining depends on the total investment in reclamation rather than on physical factors. Successful reclamation can be accomplished provided funding is adequate.

Whether a given reclamation project is considered a success or a failure often depends on the desired land use after mining. If the postmining land use is agriculture, the general smoothing of the landscape is beneficial for production of vegetation suitable for livestock or for crop production. If the land is to be used for wildland and wildlife management, the topographic smoothing and loss of vegetative diversity is detrimental.

Existing laws may be contrary to some desired postmining land uses. For example, some state statutes do not allow the reclamation process to leave highwalls, which would be suitable for raptor nesting. Backsloping and recontouring of spoils precludes leaving rugged topography suitable for big game cover. Flatter slopes normally are less prone to erosion, which, if it were allowed to occur, would eventually create rugged topography.

The issue of whether reclaimed land should be managed for agricultural productivity or as wildland is beyond the scope of this document. For the purposes of this EIS, it can be said that mined land can be reclaimed successfully in the Powder River Basin.

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TABLE 4-1
ESTIMATED DEPTH OF SOIL RATED GOOD OR FAIR AFTER REPLACEMENT
FOR MONTANA TRACTS
(in feet)

Tract	Alternative				
	2	3	4	5	6
Colstrip Maintenance	2.5	2.5	2.5	2.5	2.5
Colstrip C	2.7	2.7	2.7	2.7	2.7
Spring Creek ^b	0.9	0.9	0.9	0.9	0.9
North Decker I	3.4	3.4	3.4	3.4	3.4
North Decker II	1.5	1.5	1.5	1.5	1.5
Wolf Mountain Maintenance	1.1	1.1	1.1	1.1	1.1
Downey Coulee					1.9
Ashland (Decker-Birney)		2.6	2.6	2.6	2.6
Northwest Otter Creek ^a			1.6	1.6	1.6
Hanging Woman Creek				1.3	1.3
Mud Springs		2.1	2.1		2.1

a. Tract contains 1,333 acres of grazeable woodland, or 25% of

b. Because the soil on this tract is so shallow, replacement of overburden must be selective for reclamation to be successful.

WATER RESOURCES

Groundwater

Mining would impair or destroy 275 to 425 wells and at least 25 to 49 springs, depending on the alternative selected. Mine operations would require 9,340 to 12,590 acre-feet per year by 1995, depending on the alternative. Most of the needed water could be supplied from pit dewatering operations, although additional wells would be required for potable supplies. Population growth would require additional municipal supplies of 11,275 to 17,175 acre-feet per year by 1995, depending on the alternative.

Effects on groundwater would occur primarily within a 2- to 3-mile radius of mined areas (Hasfurther, Akerbergs, and Shafer 1982). Mining would have little effect on regional groundwater systems. Impacts would include removal or modification of aquifers, interruption of groundwater flow during mining, modification of flow after reclamation, and changes in water quality.

New mining of federal coal would result in the removal of the lowest coal aquifer mined and all aquifers above it. Coal beds usually are the most extensive shallow aquifers in the region, whereas sandstone aquifers in the overburden and interburden usually are lenticular beds of relatively small areal extent.

Reclamation regulations require that the overburden and interburden (spoil) be replaced in the mine to restore the area to as nearly its original condition as practical. The replaced spoil is usually moderately permeable unless it is unduly compacted during emplacement. Studies by Rahn (1976) indicate that dragline-laid spoil that undergoes gravity sorting and minimal compaction by machinery may be as much as a hundred times more permeable than scraper-laid spoil, which is compacted by scraper wheels. Aquifers created by dragline-laid spoil can have a higher recharge rate and yield than the combined total of the original aquifers, while scraper-laid spoil aquifers may have lower recharge rates and yield than the original aquifers.

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The water-bearing characteristics of spoil laid by truck and shovel are between those of dragline-laid spoil and scraper-laid spoil. Therefore, the impact of removing aquifers in the mined areas can be mitigated by replacing spoil in a manner that will create aquifers with water-bearing characteristics equal or superior to those of the original aquifers.

A mine pit acts as a large well if it extends below the water table. Water entering a pit would be lost through evaporation, consumed in mine operations such as dust suppression, or pumped into streams in dewatering operations. Water discharged from a mine pit would lower the groundwater levels in the vicinity, creating a cone of depression. Pumping of standard wells to supply additional water for mine operations would increase the cone of depression.

The change in the water level surrounding the mine would depend on aquifer characteristics, recharge rates, and pumping rates. The decline would be greatest in the mine itself; it would decrease with distance from the mine edges to negligible amounts within a few miles.

If the cone of depression caused by mining intersected a nearby stream, the hydraulic gradient of the water table could be reversed so that water would move from the stream toward the mine. If this was done, a reduction in streamflow would result, but because of restrictions on mining alluvial valley floors and the generally low permeability of earth materials other than alluvium in the region, the reduction would be less than 1%.

Modification of groundwater flow after reclamation results from breakup of the layering that generally occurs in native formations of the region and from modification of the slope of the land surface. In many parts of the region, relatively impermeable shale layers interbedded with sandstone and coal cause perched zones of saturation to form. Where perching layers outcrop, springs or seeps occur. The replaced spoil is relatively uniform in composition, so that vertical and horizontal permeability are similar. For this reason, in reclaimed areas there are no perched zones with their springs and seeps, and recharge to the water table is increased.

The removal of springs and seeps from their former locations would affect the plants and animals that depend on the additional water at those locations. Springs and seeps might reappear at different locations after the completion of reclamation, or the extra recharge to the water table might discharge into streams. The overall

impact of mining would be a permanent change in groundwater flow, but mining would not permanently diminish the quantity of water available in the area of the mine.

The water in the spoil aquifer would be of poorer quality than the water in the original aquifers. This is because the disturbed spoil presents many fresh surfaces to percolating water, and this causes solution of soluble minerals to occur at a higher rate. The solution rate would eventually return to normal levels; however, with the low levels of precipitation and recharge prevalent in the Powder River Region, this process might take many years, perhaps centuries. Contamination of groundwater in spoil aquifers can be mitigated by requiring selective placement of saline spoil above the zone of saturation.

The groundwater occurring naturally in the region varies greatly in mineral content both areally and with depth at a given location. Spoil aquifer water also varies, but it generally is two to three times as mineralized as water from undisturbed coal aquifers. In general, dissolved solids in spoils aquifer water would not exceed 3,000 mg/l. This would be suitable for use by livestock and wildlife. Better quality water would be available from deeper aquifers. However, drilling costs to develop deeper wells would be higher, and pumping lifts and costs would be greater if the mine was in a recharge area.

Surface Water

Surface outflow from the region will be reduced by about 3,113 acre-feet per year by projected coal mining if no new leasing takes place (Alternative 1). Under Alternatives 2 through 6, the surface outflow would be reduced by an additional amount of 303 to 1,085 acre-feet per year. Estimates of the reduction in surface outflow are less than projected increases in water use because much of the water intercepted and consumed by mining would otherwise be dissipated by evaporation losses on site or en route downstream. Table 4-2 summarizes the estimated maximum reductions in flow for major streams. Flow reductions would be too small to have an adverse effect on beneficial uses or aquatic biology of perennial streams.

Between 55 and 179 livestock ponds and small reservoirs would be destroyed by mining under Alternatives 2 through 6. Although the quantity of water lost would not be regionally significant, the loss of watering sources would be a deterrent to use of the area by wildlife and livestock until the sources were replaced during reclamation. How-

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ever, since only a fraction of the total leased area would be undergoing mining at any one time, only a fraction of the affected reservoirs would be unavailable for use at any one time.

Temporary changes in infiltration rates might slightly affect surface runoff from reclaimed areas. The effect would be short-lived and relatively minor because infiltration on spoils would become similar to infiltration on native rangeland as root systems developed.

Discharge from coal spoils aquifers might contain TDS concentrations two to three times greater than those in undisturbed aquifers (Van Voast and Hedges 1975). This water could be marginal for use by livestock and wildlife. Most of the discharge from spoils aquifers would occur as small springs and seeps in ephemeral stream channels, which would delay and reduce the effect of that discharge on the quality of water in perennial streams.

If no new leasing occurs, the dissolved load of streams in the region will increase as existing mines disturb additional acreage and as projected mines are developed. The effect of new and proposed mines under the "no new leasing" alternative would be to increase TDS concentrations as much as 5.6% in the Cheyenne River, the most heavily affected drainage. In comparison, the increase in TDS in the Tongue River would be a maximum of 1.4% under Alternative 1.

If the maximum amount of leasing took place (Alternative 6), the Tongue River would be most affected by the leaching of mine spoils, with an increase in TDS of as much as 7.2%. This increase could have a small negative impact on beneficial uses of water and downstream aquatic biology; however, it is too small to have a measurable effect on the salinity of the Yellowstone River. Table 4-3 presents the estimated maximum increases in TDS concentrations that would be caused by new mines under each alternative.

TABLE 4-2
ESTIMATED MAXIMUM POTENTIAL REDUCTIONS IN STREAM DISCHARGE
DUE TO NEW AND PROJECTED MINING

Stream	Percentage of Decrease by Alternative					
	1	2	3	4	5	6
Cheyenne River	2.20	3.10	3.10	3.10	3.10	3.80
Belle Fourche River	1.30	1.70	1.70	2.30	2.30	2.30
Little Powder River	2.20	2.20	2.20	2.20	2.20	3.80
Powder River	0.07	0.07	0.07	0.07	0.07	0.07
Tongue River	0.09	0.09	0.12	0.13	0.16	0.44
Rosebud Creek	0.10	0.10	0.10	0.10	0.10	0.19
Armells Creek	1.10	1.10	1.10	1.10	1.10	1.10

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TABLE 4-3
ESTIMATED MAXIMUM POTENTIAL INCREASE
IN TOTAL DISSOLVED SOLID CONCENTRATIONS
DUE TO NEW AND PROJECTED MINING

Stream	Percentage of Increase by Alternative					
	1	2	3	4	5	6
Cheyenne River	5.6	6.3	6.3	6.3	6.3	6.9
Belle Fourche River	1.9	2.4	2.4	3.1	3.2	3.2
Little Powder River	2.6	2.6	2.6	2.6	2.6	4.1
Powder River	0.4	0.4	0.4	0.4	0.4	0.4
Tongue River	1.4	1.7	3.5	4.1	4.3	7.2
Rosebud Creek	---	---	---	---	---	2.3
Armells Creek	2.0	4.3	4.3	4.3	4.3	4.3

Sewage effluent would increase in proportion to the quantity of municipal water used. In addition to increased concentrations of dissolved solids, sewage effluents typically contain fecal coliform, suspended solids, nitrates, nitrites, chlorine, ammonia, and orthophosphates. The volume of effluent would increase 28% to 42% by 1990, depending on the alternative selected. Dilution of the effluent would be very low during low flow periods in receiving streams, and some degradation of water quality could be expected locally. However, National Pollutant Discharge Elimination System permits for all discharge must be issued by the appropriate state agencies (the Wyoming Department of Environmental Quality and the Montana Department of Health and Environmental Sciences). Effluent standards stipulated in the permits limit average and maximum levels of pollution discharge to protect the ambient quality and beneficial uses of receiving waters.

There is evidence that concentrations of heavy metals in some spoils leachates are greater than in most natural surface waters, exceeding the recommended maximum concentrations for irrigation on a continuous basis, for livestock use, for public supply, and for aquatic biota (USDI, BLM 1979b). However, the data are not adequate to allow site-specific evaluation of potential hazards.

Requirements for sediment control measures on areas disturbed by mining would result in reduced sediment yields from those areas compared to natural levels (Wyoming statute 35-11 to 35-406; Montana Strip and Underground Mine Reclamation Act [84-4-2 MCA]). However, existing regulations do not apply to off-site disturbances resulting indirectly from coal mining, such as housing construction and related urbanization. Such off-site disturbance could cause sediment

yields from construction sites to double for one to two years and then gradually decrease, returning to the predisturbance rate in three to four years. The decreased sediment yield from mined areas would offset increases resulting from urbanization; thus, impacts from increased erosion and sedimentation would be local and short term.

LAND USE

The total acreage used for mining and related activities (rail spurs, access roads, urban growth) under each alternative is shown in table 4-4. Acreages shown for alternatives 3, 4, and 6 include a 600-acre power generation plant on the Mud Springs tract. Table 2-4 in chapter 2 shows the annual rate of disturbance and the maximum acreage disturbed at any one time for each alternative.

It is expected that impacts on private landowners not related to energy would be acceptable, because all landowners involved have indicated a positive preference for mining. Off-site effects such as rail spurs, road relocations, and urban growth could have definite impacts on landowners who do not own property within the tracts. Those impacts could include the removal of a significant amount of an operation from agricultural production or dividing of an agricultural operation into two parts. Such impacts would be addressed in the mine permit application for each tract after proposed spur routes were delineated. However, it should be noted that only five tracts would require a spur line more than 5 miles long. The total mileage of new rail spur required for Alterna-

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**TABLE 4-4
TOTAL ACREAGE CONSUMED BY COAL
MINING AND RELATED LAND USES**

Alternative	Acreage Consumed by Coal Mining and Related Land Uses	Percentage of Increase over Baseline
1 (Baseline)	333,700	—
2	355,700	7%
3	372,000	11%
4	391,300	17%
5	402,800	21%
6	444,800	33%

NOTE: Figures for acreage disturbed include mines or tracts, off-site facilities and transportation corridors, and urban growth. Acreages for Alternatives 2 through 6 are cumulative with baseline figure.

tives 2 through 6 would be 5, 10, 10, 45, and 65, respectively.

Underground utilities, pipelines, and overhead power lines would modify agricultural uses but would not remove a significant amount of acreage from production.

An unavoidable adverse impact that would occur under each alternative would be the disruption of agricultural operations outside the tracts by rail spur lines and urban growth. There would be short-term loss of agricultural productivity on the tracts until the land could be returned to agricultural use. An irreversible and irretrievable effect would be the conversion of agricultural lands to urban uses and permanent transportation facilities (see table 4-4).

WILDLIFE

Alternative 2

Wyoming

The major impacts on big game from Alternative 2 would occur in the Highlight antelope herd unit south of Gillette. These impacts would be caused primarily by new impediments to daily and seasonal movements such as road right-of-way fences and railroad spurs. There also would be impacts from road kills, poaching loss, and habitat loss. About 1.8% of the habitat in the herd unit would be disturbed. Because disturbance would not occur to a large part of the land at any one time, habitat loss caused by the projects included in this

alternative would not be significant. With the other impact factors mentioned above included, in the worst case there would be a net loss to the population of 230 antelope over the life of the mines.

There are two golden eagle nests near the Kintz Creek tract, but buffer zones excluded from mining have been established around the nests. There would be some loss of the eagles' hunting habitat, but the impact would be minor.

Seven ferruginous hawk nests are on or within ¼ mile of two of the tracts included in Alternative 2. Special stipulations concerning activities near the nests during the breeding season will be incorporated into the leases if these tracts are leased, as will other mitigating measures. However, even with restrictive stipulations, two nest sites eventually would be destroyed by mining. Since this species normally nests on the ground, alternate nesting sites should be available. The loss of hunting habitat would have moderate negative effects on these birds.

Bald eagles occasionally use the tracts as foraging habitat in the winter. No special habitats such as communal night roosts have been identified on or near any of the Alternative 2 tracts, so no negative impacts would be expected.

Since there are no prairie dog towns on or near any of the tracts included in this alternative, no negative impacts to the black-footed ferret would be likely to occur. Peregrine falcons are only occasional migrants through the area, so there would be no negative impacts on this species.

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Montana

Habitat disturbance to BLM planning areas under this alternative would be limited to 0.9% of the Decker area and 0.6% of the Colstrip area. Small portions of antelope winter range would be leased and eventually mined in the Decker area. Development would closely approach some crucial winter range for mule deer near the Wolf Creek tract. The major adverse impacts would be caused mainly by increased poaching and road kills.

Two sharp-tailed grouse leks would be destroyed by the mining of the Colstrip C tract. Sharp-tailed grouse in other parts of the Colstrip area have established new leks on reclaimed areas near active mining operations. Assuming successful reclamation and the establishment of vigorous grass cover, it is likely that the only effect on sharp-tailed grouse would be displacement by mining.

Bald eagles would not be adversely affected by mine extensions in the Decker area. The only potential problem could be the lowering of water quality in the Tongue River Reservoir. The Montana Department of State Lands and OSM require water quality monitoring and water treatment, so negative impacts on water quality, and ultimately on the bald eagle, should not occur.

There is a prairie falcon nest on the Wolf Mountain Maintenance tract over previously leased federal minerals. After consultation with the U. S. Fish and Wildlife Service, the BLM applied an exception to unsuitability criterion 13 of the federal coal management regulations (43 CFR 3461.1) to allow for mining of the site with appropriate mitigation. Mitigation would include retention of highwalls suitable for raptor nesting and expansion or improvement of nesting holes in cliffs. The decision was stated in a September 1, 1982, letter from the BLM's Miles City District Office to the Office of Surface Mining in Denver (letter 3500/MO61686).

Alternative 2 would have no negative impacts on black-footed ferrets or peregrine falcons in Montana.

Alternative 3

Wyoming

Since the same Wyoming tracts are included in Alternative 2 and Alternative 3, the impacts of

Alternative 3 in the Wyoming portion of the region would be the same as those described under Alternative 2.

Montana

Impacts from Alternative 3 in the Decker and Colstrip planning areas would be the same as those from Alternative 2. Impacts from leasing of competitive tracts would occur in two different areas; thus, they would not be magnified as they would if the tracts were close together or adjacent.

There are no crucial big game habitats on either the Ashland (Decker-Birney) tract or the Mud Springs tract. The loss of seasonal habitat would amount to 9.3% of the Otter Creek area and 5.5% of the Mud Springs area. The major impacts would be due to increased poaching and vehicle-animal collisions.

Two sharp-tailed grouse leks would be mined on the Ashland (Decker-Birney) tract. Both leks overlie fee minerals, so no unsuitability exclusion has been made. The primary effect would be displacement of the grouse to adjacent undisturbed habitat. Successful reclamation should allow for the continued presence of sharp-tailed grouse after mining.

The decision regarding a prairie falcon nest on the Wolf Mountain Maintenance tract is described under Alternative 2.

The black-tailed prairie dog towns on the Mud Springs tract were surveyed in 1980, but no sign of black-footed ferrets was found; therefore, the mining of the towns would have no known adverse effects on the ferret. The towns would have to be surveyed again just before ground-disturbing activities were initiated.

Alternative 3 would have no negative effects on bald eagles or peregrine falcons in Montana.

Alternative 4

Wyoming

The major impacts of Alternative 4 on big game would occur to antelope in the Highlight herd unit and to antelope, mule deer, and white-tailed deer in the Youngs Creek area. These impacts would include impediment of daily and seasonal movements by right-of-way fences and rail spurs. There also would be impacts from road kills, poaching, and habitat loss.

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The total habitat disturbance from development of the tracts included in this alternative would amount to 2.8% of the Highlight herd unit and 0.8% of the antelope hunt area surrounding Youngs Creek. There could be a total net loss of 360 animals in the Highlight herd unit and 20 in the Youngs Creek area through development.

The worst adverse effect on mule deer would occur in the Youngs Creek tract, where destruction of riparian vegetation and of the rocky hillside north of Youngs Creek to the Montana state line would cause loss of cover. The rocky hills along the Belle Fourche River in the Mount Logan tract would be removed, and the topography would be smoother after reclamation. This would permanently lower the value of the area as winter habitat for mule deer, causing an irreversible and irretrievable adverse impact.

White-tailed deer would be most likely to be affected by additional traffic and resultant road kills along the Tongue River valley.

One sage grouse lek and nesting area on the Mount Logan tract would be destroyed, and parts of the nesting areas around two other leks also would be mined. This would have moderately negative impacts on the sage grouse population in southeastern Campbell County.

Mining of the Mount Logan tract under Alternative 4 would affect two more pairs of golden eagles besides those mentioned under Alternative 2. One pair has alternate ground and tree nests at the edge of the tract; the other pair is being manipulated away from the Coal Creek mine east of the tract. The mining company has been trying to lure the birds to an artificial nesting platform and had planned eventually to relocate the birds onto the Mount Logan tract while the Coal Creek mine proceeds to the eastern edge of the Mount Logan tract.

In addition to the ferruginous hawks that would be disturbed under Alternative 2, one more pair would be disturbed under Alternative 4 by the close approach of mining on the Mount Logan tract.

Both pairs of eagles would be affected by disturbance during the nesting season and loss of portions of their hunting territory. A buffer zone surrounding the nest on the northwest portion of the tract will be excluded from mining if the nest is occupied. There is potential for the Coal Creek pair to be adversely affected by the continued manipulation needed to move them again. Provisions for mitigation for both pairs of eagles are described in appendix C.

One pair of prairie falcons on the Youngs Creek tract would suffer some loss of hunting territory. The buffer zone around the cliff nest should be sufficient to provide protection during the nesting season.

The bald eagle pair nesting near the Youngs Creek tract would suffer little or no adverse effects from mining because the buffer zone around their nest protects the riparian corridor along the Tongue River.

The few small black-tailed prairie dog towns on the Youngs Creek tract were surveyed in 1982 for the presence of black-footed ferrets, but none were found. There should be no impact to ferrets if the towns are thoroughly searched immediately before ground-disturbing activities are begun.

There would be no negative effects on peregrine falcons in Wyoming under Alternative 4.

Montana

The impacts of Alternative 4 would be the same in the Colstrip and Decker areas as those described for Alternative 2, and the same for the Mud Springs area as described for Alternative 3. Impacts in the Otter Creek area would intensify under Alternative 4. A total of 18.6% of the Otter Creek area would be disturbed by mining. No crucial big game habitat would be disturbed; however, the Northwest Otter Creek tract supports a population of mule deer during the winter. They probably would be displaced to adjacent habitat, especially to the Custer National Forest, by development of this tract.

Mining of the Northwest Otter Creek tract would disturb two sharp-tailed grouse leks besides those described for earlier alternatives, making a total of four leks disturbed. This is 20% of the total number of leks found during wildlife baseline surveys in the Otter Creek area. It amounts to 15.7% of the breeding population according to 1980 lek counts.

The decision regarding a prairie falcon nest on the Wolf Mountain Maintenance tract is described under Alternative 2.

Mining near Otter Creek has the potential of causing water degradation. Regulations of the Montana Department of State Lands and OSM should prevent damage to the water quality and to sport fish breeding areas in lower Otter Creek.

Leasing of the competitive tracts in Montana under Alternative 4 would not cause adverse impacts on any federally listed endangered species.

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Impacts on endangered species due to the sale of the maintenance tracts are described under Alternative 2.

Alternative 5

Wyoming

The big game species adversely affected by Alternative 5 and the areas of impact would be the same as those described under Alternative 4. The total habitat disturbance from development of the Wyoming tracts in Alternative 5 would amount to 3% of the Highlight antelope herd unit and 2% of antelope hunt area 15. Adverse impacts from development could cause a maximum net loss of 385 antelope in the Highlight herd unit and 60 in area 15.

Development of the Hidden Water tract would adversely affect mule deer because upland cover, in the form of juniper and groves of ponderosa pine, would be removed. Removal of rock outcrops and rock piles would cause loss of topographic cover, and the reclaimed topography would be smoother and less suitable for deer cover. Trees planted on the reclaimed surface would take 15 to 25 years to grow large enough to provide escape and thermal cover. Overall, the carrying capacity for mule deer would be significantly lower for 20 years or more after mining ended. However, in the long term the carrying capacity for mule deer would be only slightly lower than it was before mining.

Two sharp-tailed grouse leks would be destroyed by mining of the Hidden Water tract. The birds probably would be displaced to adjacent unoccupied territory, assuming it would be available. Proper reclamation probably would make the tract suitable for sharp-tailed grouse after mining ended.

Two pairs of golden eagles would be disturbed under this alternative, in addition to those described for Alternative 4. These pairs on or adjacent to the Hidden Water tract would suffer some minor adverse effects through the loss of a small part of their hunting territories.

Mining would destroy a few small black-tailed prairie dog towns on the Hidden Water and Porcupine tracts. U. S. Fish and Wildlife Service personnel surveyed the towns in 1982 but found no sign of black-footed ferrets. Destruction of these towns would have a minor impact, causing the loss of a small portion of potential ferret habitat. The towns would have to be surveyed

immediately before ground disturbance began to ensure protection of the ferret.

Alternative 5 would have no adverse effects on bald eagles or peregrine falcons in Wyoming.

Montana

The impacts of Alternative 5 would be the same in the Colstrip and Decker areas as those described for Alternative 2. Adverse impacts on big game under Alternative 5 would be the same as those described for Alternative 4 in the Otter Creek area. The Mud Springs area would suffer no adverse impacts.

Mule deer in the Hanging Woman Creek tract would be adversely affected by the loss of some crucial winter habitat over state-owned coal. The total amount of habitat disturbed would amount to 28% of the Hanging Woman Creek area. The nearness of mining development to crucial winter range could increase stress on deer using the range. Road kills and poaching also would be likely to increase.

Two sage grouse leks in the Hanging Woman Creek tract would be destroyed by mining. A mitigation plan covering their loss has been arranged by the Montana Department of Fish, Wildlife, and Parks and approved by the BLM. Mitigation includes dedication of lands for management of existing population, hunting access, and cost sharing on sage grouse planting and research. The plan is described in the final amendment to the *Powder River Resource Area Management Framework Plan*, (Miles City BLM 1982). If the plan is allowed to lapse, the sage grouse leks and surrounding habitat will be designated unsuitable for mining unless another mitigation plan is developed and agreed upon by the state of Montana and the lessee.

The decision regarding a prairie falcon nest on the Wolf Mountain Maintenance tract is described under Alternative 2.

Degradation of water quality in Hanging Woman Creek would harm the game fishery in the lower portion of the creek and reduce its value as breeding habitat. However, enforcement of Montana and OSM regulations concerning water treatment and erosion abatement should prevent such degradation.

Mining of the Hanging Woman Creek tract would destroy approximately 60 acres of black-tailed prairie dog towns. These towns would have to be surveyed for the presence of black-footed ferrets immediately before ground-

Environmental Consequences

disturbing activities were to begin so that adverse effects on the ferret could be prevented.

Alternative 5 would have no adverse effects on bald eagles or peregrine falcons in Montana.

Alternative 6

Wyoming

Adverse impacts on big game species under Alternative 6 would be the same as those of Alternative 5. Impacts on the Highlight antelope herd unit would be greater than those of Alternative 5, and impacts on the Gillette antelope herd unit (antelope area 17) would be greater than those of the "no action" alternative. They would be caused by right-of-way fences, rail spurs, road kills, poaching, and habitat loss.

The total habitat disturbance from development of the Wyoming tracts in Alternative 6 would be 3.8% of the Highlight antelope herd unit, 2% of antelope area 15, and 1.2% of the Gillette antelope herd unit. The maximum net loss would be 480 antelope in the Highlight herd unit, 60 in area 15, and 190 in the Gillette antelope herd unit.

Development of the Hay Creek and Calf Creek tracts would have only minor adverse effects on mule deer in the Powder River herd unit. Most of the area in both tracts has excellent forage but poor cover. If the railroad spur lines to those two mines should run through the Little Powder River valley, the loss of riparian vegetation would adversely affect the amount of deer cover, and the fencing of the spur line would hinder daily movement.

Under Alternative 6, in addition to the impacts on game birds mentioned for Alternative 5, one sage grouse lek on the Hay Creek tract would be disturbed. The two pairs of golden eagles and two pairs of ferruginous hawks nesting near the Ridgerunner tract would be adversely affected by the loss of some hunting habitat; however, there would be little disturbance of the actual nest sites because they are off the tract.

A large black-tailed prairie dog town on the Ridgerunner tract would be mined under Alternative 6. This would have no significant adverse effect on the black-footed ferret as long as the town was thoroughly surveyed for the presence of ferrets immediately before the beginning of ground disturbance.

Bald eagles in Wyoming would suffer only minor effects from the loss of some hunting

habitat. Alternative 6 would have no adverse effects on peregrine falcons in Wyoming.

Montana

The adverse impacts on wildlife in the maintenance tracts in Montana under Alternative 6 would be the same as those described for Alternative 2; impacts in the Mud Springs area would be the same as those of Alternative 3; impacts in the Otter Creek area would be the same as those of Alternative 4; and impacts in the Hanging Woman Creek area would be the same as those of Alternative 5.

Development of the Downey Coulee tract would cause a minor loss of yearlong habitat for mule deer. The total habitat disturbed would be 20.4% of the Greenleaf-Miller coal area. The animals probably would be displaced to adjacent undisturbed habitat. There would be some losses from increased poaching and road kills.

This alternative would cause some a loss of nesting habitat for sharp-tailed grouse, which have a display area near the tract, but the loss would be minor.

Development of the Downey Coulee tract could lower the water quality in Rosebud Creek. This would affect game fish in the lower portion of the creek and in the Yellowstone River below its confluence with Rosebud Creek. However, enforcement of federal and state mining and water quality regulations should preclude water quality degradation.

One golden eagle nest on fee minerals will be disturbed by mining if the lessee is able to carry out suitable mitigation. This would have a minor effect on local eagle populations. Suitable natural nest sites are available near the tract so that the birds could nest away from the mining disturbance.

Alternative 6 would have no adverse effects on endangered species beyond those already described in the previous alternatives.

All Alternatives

Unavoidable Adverse Impacts

Removal of vegetation that provides food and cover for wildlife would be an unavoidable adverse impact under Alternatives 2 through 6. Reptiles, amphibians, small mammals, and nesting songbirds would be destroyed by earthmoving activities. Losses of other wildlife species from poaching and road kills would be unavoidable.

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Short-term and Long-term Effects

Losses in Wyoming antelope populations would range from 230 to 480 animals, depending on which alternative was selected. Mule deer in Wyoming would be only slightly affected by any of the alternatives. Big game in Montana would suffer only minor short-term effects under any alternative. Populations would be lowered in the short term, especially in the Highlight antelope herd in Wyoming. The removal of rough topography, which would destroy topographic cover, would cause a long-term minor lowering of mule deer population.

Depending on the alternative chosen, development could destroy as many as six sharp-tailed grouse leks and two sage grouse leks in Montana, and two sharp-tailed grouse leks and two sage grouse leks in Wyoming. The habitat loss and displacement would cause short-term population declines in Montana, and it could contribute to a longer-term population decline in southeastern Campbell County, Wyoming.

From two to seven pairs of golden eagles would suffer new disturbances. Assuming that adequate nesting substrates would be provided during mining and after it ceased, these disturbances would be short term.

The prey base for all raptors and carnivores would be lowered in the short term. If reclamation reestablished native or close to native plant communities, the prey base should return to near premining levels within a few years after the cessation of mining.

The loss of black-tailed prairie dog towns in Wyoming and Montana would have minor long-term effects on the black-footed ferret through a loss of prey base and habitat.

Mining would cause a short-term loss of habitat diversity. In some habitat types, especially the woody riparian type, the loss of diversity could well be a long-term loss, since replacement of microhabitat could take 10 to 30 years.

Irreversible or Irrecoverable Effects

Animals lost during the development of new mines in the region would be irretrievably lost. Loss of topographic diversity would cause an irreversible loss of cover for big game (mule deer) and other wildlife, thereby lowering the carrying capacities of reclaimed areas.

CULTURAL RESOURCES

Alternative 1

No cultural resources can be expected to suffer as a result of Alternative 1, since "no new leasing" would negate the possibility of new surface-disturbing activities. Inventory, cataloguing, and salvage or destruction of cultural sites will continue as scheduled on existing mines included in the baseline.

Alternatives 2 through 6

The known number of historic and prehistoric sites that might be affected under Alternative 2 is 48; for Alternative 3, 62; for Alternative 4, 142; for Alternative 5, 189; and for Alternative 6, 253. The individual tract profiles contain descriptions of sites by tract. Although a number of cultural sites are known, until an intensive resource inventory has been done for each tract, no accurate quantification of the potential impacts can be made.

The possible adverse effects on any development, as listed by the Advisory Council on Historic Preservation, are destruction or alteration of all or part of a property; isolation from or alteration of its surrounding environment; or introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting (36 CFR 800.9). Possible effects are not limited to these, and each project must be evaluated to determine effects on specific cultural resources. Cultural resource inventories and compliance required by the Historic Preservation Act of 1966 and Executive Order 11593 must be conducted before any federal action that authorizes surface disturbance is approved.

Salvage of cultural resources allows recovery of a portion of the scientific data present. However, under current research methods and priorities, sites or potential data within sites that would have been important to future research might be overlooked, and some sites not selected for salvage might be destroyed with recovery of only preliminary data. In this way, valuable cultural resources could be lost.

Increased populations would cause accelerated unauthorized collection and vandalism in sites both inside and outside of the coal lease areas. At present, very few sites have been identified that have not been damaged to some extent, and any increase in vandalism could impair their potential for future research.

Environmental Consequences

VISUAL RESOURCES

Mining and related activities would alter the landscape character and change the visual management class. Silos, conveyors, and facility structures would change the line of the landscape; removal of topsoil and overburden would change form, line, color, and texture of the landscape. Off-site impacts from rail spurs, access roads, and power lines would also change the landscape character.

Most of the area affected under the alternatives is VRM class IV (BLM) or visual quality objective (VQO) "modification" (FS). Some areas of VRM class III and VQO "partial retention" also would be affected. Most areas could be returned to the existing VRM class or VQO rating after reclamation. Some steep slopes, scoria knobs, and areas of highly developed erosion would be smoother and more rounded after reclamation; thus, some variety would be lost and the management rating might be reduced. Because the areas do not have high scenic classifications, mining would have a minimal effect on the scenic quality.

An unavoidable adverse impact would be the dominance of the landscape by mining activities and structures. The rolling terrain of the area would reduce the extent of this impact.

Scenic quality and management classifications would be reduced in the short term, causing a short-term change of affected areas to VRM Class V or to visual quality objective "maximum modification." Reclamation would return most of these areas to their existing classifications in the long term.

An irreversible and irretrievable effect of mining would be the change in the landscape character in areas where rough, steep-sided hills and gullies or scoria knobs were replaced after reclamation by gently rounded slopes. Roads, railroads, or power lines left as permanent structures also would constitute an irreversible impact.

NOISE

The noise-related impacts within the 55 dBA zone would be interference with sleep and work tasks, disruption of concentration, and general annoyance to people who live within these zones along rail lines. These impacts would be most

significant along new railroad lines such as the Tongue River Railroad and the Chicago and North Western line.

Table 4-5 shows the number of feet from track centerline to the 55 dBA contour for main lines leaving the region. The distance to the 55 dBA contour on a spur line serving one mine would be 2,000 feet.

The zone around each mine would extend for 1/3 mile to 1 mile. Topography, vegetation, and land use would affect the dissipation of the noise associated with the mines.

AIR QUALITY

Introduction

This section considers the direct effects of mining and end-use facilities and the indirect effects of mining-related development such as population growth and the need for more transportation.

The significant pollutant emissions associated with the development of the tracts and the accompanying secondary growth would be total suspended particulates, nitrogen dioxide, and sulfur dioxide. The effects of emissions of other pollutants would be insignificant and, on a regional scale, virtually unmeasurable (USDI, BLM 1981b).

Mining activities generate significant quantities of TSP and relatively small quantities of nitrogen dioxide, sulfur dioxide, carbon monoxide, non-methane hydrocarbons, ozone, and lead. Power plants now in the region are significant sources of TSP, nitrogen dioxide, and sulfur dioxide. They emit smaller amounts of other pollutants.

The principal emissions from cities and towns are TSP, nitrogen dioxide, and sulfur dioxide. Vehicular traffic may produce local elevations of carbon monoxide levels, but these emissions are not significant regionally.

This analysis will focus on the impacts of mining on levels of TSP, nitrogen dioxide, and sulfur dioxide. The environmental consequences of these airpollutant emissions would be extensive and complex. The direct consequences related to each tract have been analyzed and reported in individual site-specific analyses prepared by PEDCo Environmental, Inc., for the BLM in 1983.

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TABLE 4-5
RAILROAD NOISE--55dBA CONTOUR ZONE
(number of feet from track centerline)

	Alternative					
	1 (baseline)	2	3	4	5	6
<u>Montana</u>						
Miles City (BN)	5,300	5,300	5,800	6,200	5,800	6,500
<u>Wyoming</u>						
Gillette (BN)	7,000	7,000	7,400	7,400	7,800	9,400
Newcastle (BN)	12,000	12,200	12,400	13,600	13,600	14,900
Torrington (BN)	5,800	6,400	6,400	6,800	6,800	7,100
Lusk (C&NW)	5,800	6,400	6,400	6,800	6,800	7,100

BN = Burlington Northern Railroad C&NW = Chicago and
North Western

The site-specific analyses are on file in the Casper District office.

Possible Effects in This Region

In order to evaluate the effects of project pollutant emissions it is necessary to know the pre-existing, or background, concentrations of the pollutants. Table 3-5 in chapter 3 shows the background figures used in evaluating the modeling results. The background concentration figures were supplied by the state of Wyoming.

The modeling studies show the potential adverse consequences of maximum development on air quality and indicate the types of effects to be expected, their geographical extent, degree of intensity, and relationship to regulatory standards. This information can be used in selecting a preferred alternative and anticipating its impacts. It can also guide more detailed future evaluation of the selected alternatives and its implementation. However, it must be understood that the modeling studies were limited by various constraints; consequently, the conclusions are subject to limitations.

Only maximum development situations were evaluated, because they are the most important in determining acceptable project limits. However, maximum development results give no quantitative information on average impacts, on minimum development situations, or on frequencies to be expected in the worst, average, best, or any other circumstances.

Visibility Impairment

If the projected Mud Springs plant should be built (Alternatives 3, 4, or 6), two main types of visibility impairment might be of concern in the Powder River region: atmospheric discoloration ("plume blight") and visual range reduction (general haze).

Plume from coal-fired power plants or other sources may be discolored by nitrogen oxide emissions that are converted to nitrogen dioxide in the atmosphere. Atmospheric discoloration due to nitrogen oxide emissions is greatest during periods of stable conditions with light winds following nighttime transport. However, since a plume tends to remain intact during such conditions, the discoloration would be confined to a small streak in the sky.

Increased general haze resulting in visibility reduction is caused primarily by particulate emissions and secondary aerosols, such as sulfates resulting from sulfur dioxide emissions. General haze is greatest during light wind, limited mixing, or stagnation conditions after daytime transport. Under these conditions, conversion of gaseous precursor emissions to secondary aerosols is more rapid. Consequently, an individual plume may not be visible at all, but the general haze formed by regional emissions would cause decreased contrast and loss of clarity in the landscape.

Reduction of visibility in the atmosphere due to pollution is primarily caused by light scattering by particles or by light absorption by particles

Environmental Consequences

and gases. Particles suspended in the air reduce visibility, or visual range, by scattering and absorbing light coming from both an object and its background, thereby reducing the contrast between them. Moreover, suspended particles scatter light into the line of sight, illuminating the air between, to further degrade the contrast between an object and its background.

Light scattering by particles is the most important cause of visual reduction, and particulates with diameters from 0.1 to 1.0 microns are the most effective per-unit mass in scattering light. Light absorption by particles also is significant when finely divided carbon particles (soot) are present.

Light absorption by gases also may be important to visibility in the Powder River Region because nitrogen dioxide, which results from the emissions of nitrogen oxide by power plants and other sources, absorbs light. It absorbs light strongly at the blue end of the visible spectrum, while allowing light at the red end to pass through. In the atmosphere it reduces the brightness and contrast of distant objects, causing the horizon, the sky, and white objects to appear pale yellow to reddish-brown.

Congress has recognized the problem of visibility degradation and addressed it for mandatory Class I areas and for various national parks and other such federal lands in the Clean Air Act of 1977. In section 169A(a)(1) of the act, Congress said, "as a national goal the prevention of any future, and the remedying of any existing, impairment of visibility in mandatory Class I Federal areas, which impairment results from man-made air pollution."

The EPA has issued visibility regulations implementing the statute. These regulations protect visibility within Class I areas and with respect to "integral vistas" associated with Class I areas (40 CFR 51.300 et. seq.). An "integral vista" is a view from within a Class I area that is important to the visitor's visual experience of the Class I area itself. No integral vistas have been listed for the Class I area in the Powder River Region.

EPA regulations protect Class I visibility by requiring each affected state to develop a program to assure reasonable progress toward meeting the national goal or remedying existing and preventing future visibility impairment by air pollution. Among other things, the visibility program must require that certain existing major stationary sources of pollution affecting Class I visibility be retrofitted with the best available technology to reduce such impacts. It also must require review of Class I visibility impacts of new major stationary sources of major modifications

before a PSD permit can be granted, to ensure that emissions will be consistent with "making reasonable progress toward the national goal."

Neither Montana nor Wyoming has yet amended its state implementation plan to meet the federal Class I visibility management requirements; however, both states have adopted ambient air quality standards governing visibility in general.

Total Suspended Particulates

As part of the technical report prepared by PEDCo, the analysis area was subdivided into six smaller areas. Each subarea was analyzed for the six alternatives for 1990, 1995, and 2000 and for the annual and 24-hour averaging periods. For the purpose of this document, only the results for 1995 are shown. The other results appear in the technical report. Appendix E contains a summary of the methodology used in the analysis.

The year 1995 was chosen as the "worst case" in terms of particulate emissions. The area considered for analysis and the locations of existing and committed mines and the lease tracts are shown in figure E-1, appendix E. Existing mines are producing coal now; committed mines have acquired the requisite operating permits but have not begun operation.

Table 4-6 shows the total TSP that would be expected under each alternative in 1995. The emissions from power plants are shown in table 4-7. There are no other major point sources in the analysis area.

The annual and 24-hour concentrations projected for each alternative in 1995 are displayed in figures 2 through 13 in appendix E.

The maximum TSP concentrations projected for each alternative are shown in table 4-8.

The total annual emissions under each alternative would be within the ambient air quality concentrations, but the concentrations would be very close to the Wyoming primary standard and the federal secondary NAAQS. The projected 24-hour maximum emissions under all alternatives exceed the Wyoming and Montana ambient air quality standards and the federal secondary standard. However, each alternative must be considered individually because one receptor point in an alternative may be the only violation that would occur under that alternative, and it also may be a repetitive violation through all alternatives. The project sources that would cause violations of the 24-hour ambient air quality standards are listed by alternative in table 4-9.

TABLE 4-6
ESTIMATED EMISSION OF TOTAL SUSPENDED PARTICULATES BY 1995
FROM MINING SOURCES
(in tons per year)

<u>Alternative</u>	<u>Existing and Committed Developments</u>	<u>Tracts</u>	<u>Total</u>
1	34,044.8	0	34,044.8
2	34,044.8	5,226.8	39,271.6
3	34,044.8	7,427.2	41,472.0
4	34,044.8	10,305.8	44,350.6
5	34,044.8	12,489.3	46,534.1
6	34,044.8	19,274.7	53,319.5

TABLE 4-7
ESTIMATED EMISSION OF POLLUTANTS FROM POWER PLANTS BY 1995
(in tons per year)

<u>Pollutant</u>	<u>Alternative 1</u>	<u>Alternative 2</u>	<u>Alternative 3</u>	<u>Alternative 4</u>	<u>Alternative 5</u>	<u>Alternative 6</u>
<u>Total Suspended Particulates</u>						
Existing and Committed Plants	4,634	4,634	4,634	4,634	4,634	4,634
Mud Springs Plant	0	0	1,239	1,239	0	1,239
Total	4,634	4,634	5,873	5,873	4,634	5,873
<u>Sulfur Dioxide</u>						
Existing and Committed Plants	26,695	26,695	26,695	26,695	26,695	26,695
Mud Springs Plant	0	0	10,381	10,381	0	10,381
Total	26,695	26,695	37,076	37,076	26,695	37,076
<u>Nitrogen Dioxide</u>						
Existing and Committed Plants	71,762	71,762	71,762	71,762	71,762	71,762
Mud Springs Plant	0	0	20,696	20,696	0	20,696
Total	71,762	71,762	92,458	92,458	71,762	92,458

TABLE 4-8
MAXIMUM AMBIENT ANNUAL AND 24-HOUR CONCENTRATIONS
OF TOTAL SUSPENDED PARTICULATES BY 1995
VERSUS AMBIENT AIR QUALITY STANDARDS
(in micrograms of pollutant per cubic meter of air)

<u>Background</u>	<u>Alternative</u>	<u>Concentration</u>	<u>Total</u>	<u>Ambient Air Quality Standards^a</u>		
				<u>Federal</u>	<u>Montana</u>	<u>Wyoming</u>
<u>Annual</u>						
15	1	37	52	75 (60)	75	60
	2	42	57			
	3	42	57			
	4	42	57			
	5	42	57			
	6	42	57			
<u>24-hour</u>						
61.5	1	149.5	211	260 (150)	200	150
	2	170.5	232			
	3	170.5	232			
	4	170.5	232			
	5	170.5	232			
	6	170.5	232			

a. Numbers in parentheses denote the federal secondary standard.

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TABLE 4-9
SOURCES OF OFFSITE VIOLATIONS
OF STATE 24-HOUR AIR QUALITY STANDARDS BY 1995

<u>Alternative</u>	<u>Existing and Committed Facilities</u>	<u>Tracts Included in Alternatives</u>
1	Belle Ayr Caballo Rojo North Rawhide Eagle Butte Buckskin Bighorn East Decker West Decker	None
2	Mines listed for Alternative 1 Jacobs Ranch Black Thunder	Thundercloud Kintz Creek
3	Mines listed for Alternative 2	Thundercloud Kintz Creek
4	Mines listed for Alternative 2	Thundercloud Kintz Creek Mount Logan
5	Mines listed for Alternative 2	Thundercloud Kintz Creek Mount Logan
6	Mines listed for Alternative 2	Thundercloud Kintz Creek Mount Logan Calf Creek Downey Coulee

NOTE: The Wyoming Department of Environmental Quality does not recognize the validity of the 24-hour prediction process.

Effects by Area

The air quality impact of the alternatives can be summarized if the region is divided into the following six geographical areas.

Southeast of Reno Junction. In the Wyoming area southeast of Reno Junction, the Wyoming 24-hour standard would be violated under Alternatives 2 through 6 around Jacobs Ranch Mine, west of the Black Thunder Mine, and around the Thundercloud tract.

South of Gillette. In the area south of Gillette, Wyoming, the Wyoming 24-hour standard would be violated in 1990, 1995, and 2000 east of Belle Ayr and Caballo Rojo under Alternatives 1 through 6, east of Kintz Creek under Alternatives 2 through 6, and between Mount Logan and Coal Creek under Alternatives 4, 5, and 6.

North of Gillette. In the area north of Gillette, Wyoming, the Wyoming 24-hour standard would be violated in 1990 and 1995 between North Rawhide and Eagle Butte under all alternatives.

Violations of the 24-hour standard would occur in 2000 east of Buckskin under all alternatives and in 1995 north of Calf Creek under Alternative 6.

Sheridan-Decker. In the area from Sheridan, Wyoming, to Decker, Montana, there would be marginal violations of the Montana 24-hour standard in the area of the Tongue River Reservoir between the West Decker and East Decker mines in 1990 under Alternatives 4, 5, and 6 and in 1995 and 2000 under all the leasing alternatives.

Colstrip-Ashland. In the area of Colstrip and Ashland, Montana, the Montana 24-hour standard would be violated in 1990 east of Downey Coulee under Alternative 6.

Mud Springs-Hanging Woman Creek. In the vicinity of the Mud Springs and Hanging Woman Creek tracts, no federal or state standard would be violated in any of the analysis years.

It must be noted that the Wyoming DEQ does not recognize the validity of techniques used to predict 24-hour concentrations. Therefore, the

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federal NAAQS must be used for comparison. That standard would not be violated under any of the alternatives.

TSP Effects on Visibility

The TSP emissions from the facilities consist of relatively large dust particles, larger than the optimum size for visibility degradation. The maximum reduction in visual range resulting from particulate concentrations during the second-worst 24-hour period would be less than 5%. This impact can be considered slight; it is generally accepted that a 5% to 10% reduction in visual range is the threshold of perceptability by human observers, even in simultaneous comparisons. The technical report by PEDCo contains more detailed visibility analysis, including the actual percentage of reduction along several lines of sight.

Sulfur Dioxide and Nitrogen Dioxide

The Mud Springs tract is included in Alternatives 3, 4, and 6. If a coal-fired power plant was built on this tract, as has been proposed in an expression of interest, sulfur dioxide and nitrogen dioxide would be emitted at a constant rate shown in table 4-7.

The most restrictive regulation on sulfur dioxide is the PSD increment for the Class I Northern Cheyenne Indian Reservation. The 24-hour allowable increment consumption for sulfur dioxide in a Class I area is 5 micrograms per cubic meter. The maximum increment consumption for sulfur dioxide is projected to be 2.1 micrograms per cubic meter at the reservation boundary. As the isopleths on figures 14, 15, and 16 in appendix E show, no cumulative impacts from sulfur dioxide would be expected from the combination of the projected Mud Springs power plant and existing sources of that pollutant.

Increased gaseous emissions from increased traffic and population under any alternative would have a negligible effect on gaseous pollutant concentrations.

Unavoidable Adverse Impacts

Coal cannot be produced by surface mining without generating fugitive dust. The impacts of dust from individual mines decrease rapidly beyond the mine boundary. Violations of 24-hour ambient air quality standards would occur under the worst-case meteorological conditions near the

Thundercloud, Kintz Creek, Mount Logan, Calf Creek, and Downey Coulee tracts under alternatives that include those tracts.

Short-term and Long-term Effects

Anticipated air quality impacts would constitute a short-term use of the air resource. Insofar as mining under a given alternative might cause or contribute to violations of the state ambient air quality standards (as might occur in the immediate vicinity of some existing and proposed mine clusters) or consume a portion of the PSD increment, there could be a potential restriction on the nearby development of other industrial activities that emit air pollutants. Near the mines, this impact would cease when mining was completed and the areas were reclaimed.

Irreversible and Irrecoverable Effects

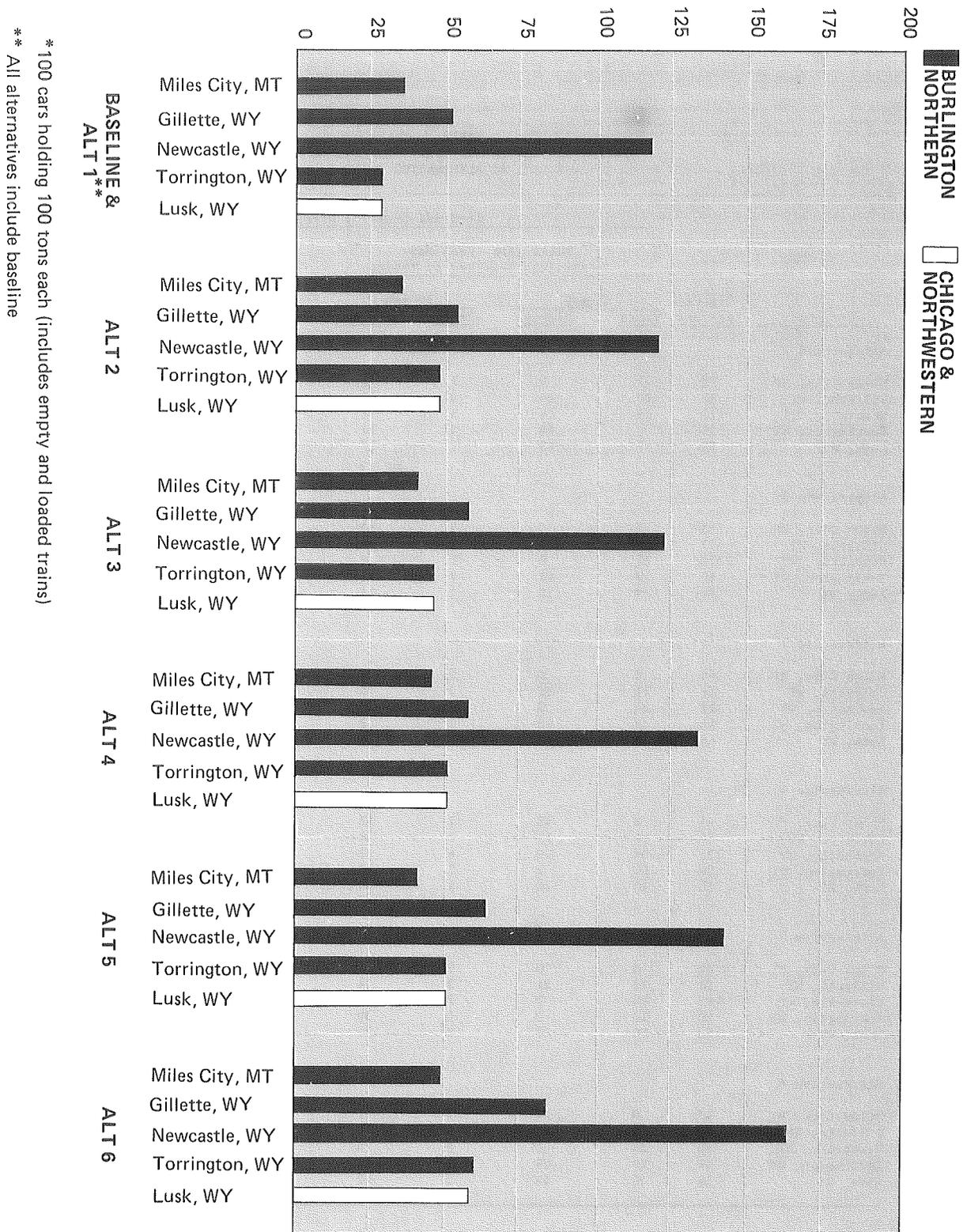
Leasing of federal coal under the alternatives would irreversibly commit a relatively small portion of the region's air resource. After mining and reclamation were completed and the population increments resulting directly and indirectly from mining activities were relocated, it would be possible to retrieve the air resource commitment and return the air quality to the current conditions.

TRANSPORTATION FACILITIES

Railroads

Impacts related to railroads would come from two sources: increased main-line traffic and additional spur-line construction. Increased traffic along main lines would disrupt automobile traffic at at-grade crossings for longer periods, raise accident rates at at-grade crossings, and increase noise levels.

Impacts directly to the railroad would be increased maintenance and the need to upgrade switches, sidings, and traffic control devices. The capacity of these lines could be increased to keep up with mining production (Briggs 1981). The projected number of unit trains per day for each alternative in 1995 is shown on figure 4-1. At-grade crossing interruptions and accident rates for selected cities along the main lines leaving the region are shown on table 4-10. These figures are all based on full production potential, which represents maximum development.



*100 cars holding 100 tons each (includes empty and loaded trains)
 ** All alternatives include baseline

Figure 4-1
 PROJECTED UNIT TRAINS/DAY*
 BASED ON 1981 FIGURES AND
 1995 COAL PRODUCTION POTENTIAL

TABLE 4-10
 TRAINS PER DAY AND AT-GRADE CROSSING EFFECTS
 BY ALTERNATIVE

At-Grade Crossing Effects						
Location	Trains per Day	Total Time Each Day Crossings Occupied by Trains				Car-Train Accidents per 100 Years
		5 mph		20 mph		
		Hours	Minutes	Hours	Minutes	
Alternative 1						
Miles City, MT	35	7	0	1	45	4
Gillette, WY	52	10	24	2	36	6
Newcastle, WY	117	23	24	5	51	13
Torrington, WY	39		48	1	57	4
Lusk, WY	39	7	48	1	57	4
Alternative 2						
Miles City, MT	35	7	0	1	45	4
Gillette, WY	52	10	24	2	36	6
Newcastle, WY	120	24	0	6	0	14
Torrington, WY	46	9	12	2	18	6
Lusk, WY	46	9	12	2	18	6
Alternative 3						
Miles City, MT	40	8	0	2	0	5
Gillette, WY	56	11	12	2	48	7
Newcastle, WY	122	24	0	6	6	14
Torrington, WY	46	9	12	2	18	6
Lusk, WY	46	9	12	2	18	6
Alternative 4						
Miles City, MT	44	8	48	2	12	5
Gillette, WY	56	11	12	2	48	7
Newcastle, WY	131	24	0	6	33	16
Torrington, WY	50	10	0	2	30	6
Lusk, WY	50	10	0	2	30	6
Alternative 5						
Miles City, MT	40	8	0	2	0	5
Gillette, WY	62	12	24	3	6	7
Newcastle, WY	141	24	0	7	3	17
Torrington, WY	50	10	0	2	30	6
Lusk, WY	50	10	0	2	30	6
Alternative 6						
Miles City, MT	47	9	24	2	21	6
Gillette, WY	82	16	24	4	6	9
Newcastle, WY	162	24	0	8	6	19
Torrington, WY	54	10	48	2	42	6
Lusk, WY	54	10	48	2	42	6

NOTE: Figures for all alternatives are based on production potential. The actual number of trains would depend upon contracts and coal demand.

a. Based on 1,000 vehicles per day.

Environmental Consequences

Additional spur lines constructed to new facilities would account for 5 to 65 miles of new track.

These lines would remove 105 to 1,365 acres from agricultural production, alter farming and ranching land use patterns, and disrupt wildlife movements. Their effects are discussed under "Land Use" and "Wildlife."

Impacts from rail lines could be felt by farming and ranching operations not affected by the lease properties themselves. The specific impacts from railroad spur lines would be outlined in the mine permit application for each mine.

An unavoidable adverse impact of increased rail traffic would be an increase in delays for automobile traffic at at-grade crossings. This is particularly important to emergency vehicles. Other unavoidable adverse impacts would be increased car-train accidents and disruption of farm and ranch operations and wildlife movement.

The loss of life and property in car-train accidents would be irreversible and irretrievable.

Highways

Traffic would increase along major routes serving the mine areas because of increased employment and population. The major routes affected in Wyoming would be Wyoming 59, both south of Gillette and north of Gillette, U.S. 14-16 north of Gillette, and Wyoming 338 north of Sheridan. Highways affected in Montana would be Interstate 94 west of Miles City to Forsyth, Montana 39 south of I-94, U.S. 212 from I-90 to Broadus, Montana 314 from Ashland to the Wyoming border, and I-90 from Billings to Sheridan, Wyoming.

No new traffic-related impacts would be expected with continuation of existing energy development. With new leasing (Alternatives 2 through 6) there would be a slight increase in impacts related to energy development such as increased road maintenance, accident rates, and wildlife road kills.

Most of the major highway systems could handle increased traffic due to the proposed leasing, but U.S. 14-16 and Wyoming 59 north of Gillette do not have the structure design and alignment to handle large volumes of traffic (Hanlin 1983). These highways would be affected by the Calf Creek and Hay Creek tracts under Alternative 6, with U.S. 14-16 receiving the greater impacts.

In Montana, reconstruction and repairs already planned should keep highways in good condition (Braut 1983). The greatest amount of access road upgrading would be needed for the Mud Springs and Hanging Woman Creek tracts—28 miles would be needed for Mud Springs and 25 miles for Hanging Woman Creek. Mud Springs is included in Alternatives 3, and 4, Hanging Woman Creek in Alternative 5, and both in Alternative 6.

Wyoming Highway 338 crosses the east side of the Youngs Creek tract. Coal under this highway is unsuitable for mining. This would affect 180 acres of federal coal within the tract.

Country roads that would be interrupted by the tracts would be relocated or alternate routes provided.

EMPLOYMENT AND SALARIES AND WAGES

This section presents projections of the employment and the salaries and wages that would exist in 1990 in the Powder River Region under each alternative. It will be noted that the employment and the salaries and wages under Alternative 1, without additional federal leasing, are the same as those presented for 1990 in chapter 3. The figures shown for Alternatives 2, 3, 4, 5, and 6 project the different levels of employment and salaries and wages that would result under the leasing alternatives.

The Eastern and Western Powder River Region

Under the leasing alternatives, employment levels in Campbell and Sheridan counties would change considerably more than those in other counties in the Eastern and Western Powder River Region. This would occur because Campbell and Sheridan counties would host coal development under these alternatives, but the other counties would only receive secondary effects.

Because Alternatives 2 and 3 are identical for the Eastern and Western Powder River Region, they would result in the same employment for all counties except Sheridan County (see tables 4-11 and 4-12). Employment levels in Sheridan County would differ between the two alternatives because federal coal leasing in the Northern Powder River Region under Alternative 3 would

TABLE 4-11
COVERED EMPLOYMENT AND SALARIES AND WAGES IN 1990
FOR THE EASTERN AND WESTERN POWDER RIVER REGION UNDER THE ALTERNATIVES
(salaries and wages are in millions of dollars)

County/Sector	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Employ- ment	Sala- ries and Wages										
Campbell County												
Coal employment	10,500	281.8	11,800	316.7	11,800	316.7	12,400	332.8	12,400	332.9	14,600	391.8
Construction employment	2,100	44.5	2,170	46.0	2,170	46.0	2,230	47.3	2,240	47.5	2,170	46.0
All other employment	11,900	198.6	12,100	202.0	12,100	202.0	12,200	203.6	12,300	205.3	12,600	210.3
All covered employment	24,500	524.4	26,100	564.7	26,100	564.7	26,800	583.7	26,900	585.7	29,400	648.1
Converse County												
Coal employment	990	24.7	990	24.7	990	24.7	990	24.7	990	24.7	990	24.7
Construction employment	610	12.2	620	12.4	620	12.4	620	12.4	630	12.6	850	17.1
All other employment	5,400	95.2	5,500	97.0	5,500	97.0	5,600	98.8	5,600	98.8	5,800	102.3
All covered employment	7,000	132.1	7,100	134.1	7,100	134.1	7,200	135.9	7,200	136.1	7,600	144.1
Crook County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	170	2.9	170	2.9	170	2.9	170	2.9	170	2.9	180	3.0
All other employment	1,430	18.1	1,440	18.2	1,440	18.2	1,460	18.5	1,460	18.5	1,480	18.7
All covered employment	1,600	21.0	1,610	21.1	1,610	21.1	1,630	21.4	1,630	21.4	1,660	21.7
Goshen County												
Mining and construction ^a	310	4.2	310	4.2	310	4.2	320	4.4	320	4.4	320	4.4
All other employment	3,690	36.8	3,700	36.9	3,700	36.9	3,800	37.9	3,800	37.9	3,900	38.9
All covered employment	4,000	41.0	4,000	41.1	4,000	41.1	4,100	42.3	4,100	42.3	4,200	43.3
Johnson County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	250	3.6	250	3.6	250	3.6	250	3.6	250	3.6	250	3.6
All other employment	2,550	29.6	2,580	30.0	2,580	30.0	2,600	30.2	2,600	30.2	2,650	30.8
All covered employment	2,800	33.2	2,830	33.6	2,830	33.6	2,850	33.8	2,850	33.8	2,900	34.4
Natrona County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	3,800	71.3	3,840	72.1	3,840	72.1	3,900	73.2	3,900	73.2	4,000	75.1
All other employment	39,300	683.8	39,800	692.5	39,800	692.5	40,300	701.2	41,100	715.1	41,400	720.4
All covered employment	43,100	755.1	43,600	764.6	43,600	764.6	44,200	774.4	45,000	788.3	45,400	795.5

TABLE 4-12
COVERED EMPLOYMENT AND SALARIES AND WAGES IN 1990
FOR SHERIDAN COUNTY UNDER THE ALTERNATIVES
(salaries and wages are in millions of dollars)

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Employ- ment	Sala- ries and Wages										
Coal employment	990	24.9	990	24.9	990	24.9	1,490	37.4	1,840	46.2	1,840	46.2
Construction employment	1,150	18.9	1,160	19.2	1,270	21.0	1,300	21.5	1,230	20.3	1,360	22.5
All other employment	8,060	91.6	8,200	93.1	8,300	94.3	8,500	96.6	8,400	95.4	8,800	100.0
All covered employment	10,200	135.4	10,400	137.2	10,600	140.2	11,300	155.5	11,500	161.9	12,000	168.7
Secondary employment induced in Sheridan County by Montana employment ^a	300	3.6	300	3.6	560	7.2	610	7.8	450	5.6	700	9.1
Montana workers residing in Sheridan County ^b	1,140	32.0	1,140	32.0	2,740	55.6	2,740	55.6	1,340	37.6	2,940	61.2

NOTE: Employment projections are derived from the Casper District input-output model. Salary and wage projections are based on 1980 average weekly wages as published by the Wyoming Employment Security Commission. Figures may not add due to rounding.

a. Estimate of employment induced in Sheridan County by primary employment in neighboring Montana counties. See footnote "b" to table 4-13 for the methodology used in projecting induced employment. Because covered employment is reported by county of employment, these numbers are included in Sheridan County employment.

b. Industrial estimates of the number of Big Horn County coal mine employees living in Sheridan County in 1982 were 50.89% of the estimated 1982 coal employment in Big Horn County. That percentage was used to estimate the number of persons employed in Big Horn County and at the Mud Springs tract in Powder River County who might reside in Sheridan. Because covered employment is reported by county of employment, these numbers are included in Big Horn County and Powder River County employment.

Environmental Consequences

result in an increase in secondary employment in Sheridan County.

In terms of employment levels, Alternatives 4 and 5 also are significantly alike, again in all but Sheridan County. In this instance, however, a coal tract in Sheridan County under Alternative 5 would add to the dissimilarity between the two alternatives.

Predictably, Alternative 6 would provide the highest levels of employment throughout the Eastern and Western Powder River Region. However, when attention is focused on Sheridan County, Alternative 5 clearly presents the best ratio of new jobs in the county to impacts from the Northern Powder River Region.

The Northern Powder River Region

Alternative 6 would provide the highest level of employment in the the Northern Powder River Region, as it would in the Eastern and Western Powder River Region (see table 4-13). For Big Horn and Rosebud counties this would result from secondary effects as much as from coal development. This is partly because there is only one proposed tract in each of those counties and partly because of the level of development proposed for Powder River County. Of the proposed development in Powder River County, construction of the mine-mouth power plant at the Mud Springs tract would have the greatest influence on employment levels. This effect is obvious because employment levels under Alternative 5, in which Mud Springs is not included, are two-thirds lower.

The Crow and Northern Cheyenne Indian Reservations

An opportunity to increase employment and income levels among the Crow and Northern Cheyenne Indians does exist to a limited degree under all the leasing alternatives. Opportunity is obviously greatest under Alternative 6, with the greatest potential in Powder River County because of the greater differences in employment levels between leasing and no leasing. However, without some employment agreement it is not possible to predict the extent to which the Indians would participate in the new employment opportunities. It is therefore assumed that the labor force, employment, and unemployment under all alternatives would remain the same for the Crow and the Northern Cheyenne as projected in the baseline (see table 3-9).

POPULATION AND HOUSING

This section presents projections of population and housing requirements that would exist in 1990 under each of the alternatives in the Powder River Region. As with employment, it will be noted that the population and housing projected under the alternatives without additional federal competitive leasing are the same as those presented for 1990 in chapter 3, and the figures presented under Alternatives 2 through 6 are projections of the different levels of population that would exist under the various leasing levels.

The Eastern and Western Powder River Region

Because of greater employment opportunities under the leasing alternatives, population would increase far more in Campbell County and Sheridan County than in other counties in the Eastern and Western Powder River Region (see tables 4-14 and 4-15). In addition, the population of Sheridan County would be increased even more as a direct result of primary employment in the Northern Powder River Region. Of the persons employed by any primary employment in Big Horn County or on the Mud Springs tract in Powder River County, it is estimated that 50% would reside in Sheridan County.

Because the Mud Springs tract is not included under Alternative 5, the impacts to Sheridan County from development in the Northern Powder River Region would be far lighter under that alternative than under the other leasing alternatives. It also should be pointed out that utilization of the unemployed labor force among the Crow and the Northern Cheyenne Indians would serve to limit population increases in the region, thereby reducing impacts to Sheridan County from development in the Northern Powder River Region.

The Northern Powder River Region

Of the persons employed by new primary employment in Powder River County under the leasing alternatives, it is estimated that about 50% would reside in Rosebud County or Sheridan County. However, Powder River County would

TABLE 4-13
COVERED EMPLOYMENT AND SALARIES AND WAGES IN 1990
FOR THE NORTHERN POWDER RIVER REGION UNDER THE ALTERNATIVES
(salaries and wages are in millions of dollars)

County/Sector	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Employ- ment	Sala- ries and Wages										
Big Horn County												
Coal employment ^a	2,240	63.1	2,240	63.1	2,240	63.1	2,240	63.1	2,630	74.0	2,630	74.0
Construction employment ^{b,c}	420	12.3	420	12.3	540	15.9	560	16.5	490	14.4	600	17.7
All other employment ^b	2,570	27.8	2,570	27.8	2,770	30.0	2,800	30.3	2,650	28.7	2,790	30.2
All covered employment	5,200	103.2	5,200	103.2	5,600	109.0	5,600	109.9	5,800	117.1	6,000	121.9
Powder River County												
Coal employment ^a	440	9.5	440	9.5	780	16.8	1,090	23.5	1,090	23.5	1,090	23.5
Construction employment ^{b,c}	40	0.5	40	0.5	3,200	47.2	3,200	47.2	40	0.5	3,200	47.2
All other employment ^b	580	6.3	580	6.3	610	6.6	620	6.7	600	6.5	630	6.9
All covered employment	1,100	16.3	1,100	16.3	4,600	70.6	4,900	77.4	1,730	30.5	4,900	77.6
Rosebud County												
Coal employment ^a	1,340	37.5	1,340	37.5	1,340	37.5	1,340	37.5	1,340	37.5	1,540	43.2
Construction employment ^{b,c}	820	17.3	820	17.3	970	20.5	1,000	21.1	900	19.0	1,050	22.2
All other employment ^b	2,690	26.8	2,690	26.8	2,960	29.6	3,000	30.0	2,830	28.3	3,100	31.0
All covered employment	4,800	81.6	4,800	81.6	5,300	87.6	5,300	88.6	5,100	84.8	5,600	96.4

NOTE: Figures may not add due to rounding.

a. Projections of coal employment are based on the relationship of 1 additional employee for each additional 25,300 tons of projected coal capacity (relationship derived from the Casper District input-output model). Salaries and wages for coal are based on the 1980 weekly average wage for mining.

b. Projected secondary employment is estimated at one additional job in the region for each additional permanent job in energy and 0.5 additional job in the region for each temporary job (as derived from the Casper District input-output model). The secondary employment is then distributed among sectors on the basis of each sector's share of the ten-year (1970-1980) regional change in all employment less mining. The secondary sector change is then distributed to the counties on the basis of each county's share of the ten-year (1970-1980) change in regional employment in that sector. Salaries and wages are projected on the basis of 1980 average weekly wages.

c. Construction projections include construction employment for mines, power plants, and railroads, as applicable, in addition to secondary construction employment. Construction estimates for major projects were obtained from industrial planning and environmental impact statements.

TABLE 4-14
1990 POPULATION UNDER EACH ALTERNATIVE, WITH HOUSING REQUIREMENTS
FOR THE EASTERN AND WESTERN POWDER RIVER REGION

County/Community	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Popu- lation	Housing										
Campbell ^a	45,600	17,800	48,400	18,900	48,400	18,900	50,000	19,500	50,100	19,500	54,700	21,300
Gillette	22,700	9,100	24,100	9,600	24,100	9,600	24,900	10,000	24,900	10,000	27,200	10,900
Converse ^b	16,700	6,400	16,900	6,400	16,900	6,400	17,200	6,500	17,200	6,500	18,100	6,900
Douglas	7,100	2,800	7,200	2,800	7,200	2,800	7,300	2,830	7,300	2,830	7,700	2,990
Glenrock	3,250	1,240	3,300	1,260	3,300	1,260	3,300	1,260	3,400	1,300	3,500	1,340
Crook ^c	5,800	2,660	5,900	2,710	5,900	2,710	5,900	2,710	5,900	2,710	6,000	2,750
Sundance	1,190	520	1,200	530	1,200	530	1,210	530	1,210	530	1,230	540
Moorcroft	1,110	480	1,120	490	1,120	490	1,130	490	1,130	490	1,150	500
Goshen ^c	14,600	6,100	14,800	6,200	14,800	6,200	15,000	6,300	15,100	6,300	15,500	6,500
Torrington	6,600	2,700	6,700	2,750	6,700	2,750	6,800	2,790	6,800	2,790	7,000	2,870
Johnson ^c	8,100	3,700	8,200	3,700	8,200	3,700	8,200	3,700	8,300	3,800	8,400	3,800
Buffalo	4,600	2,020	4,700	2,070	4,700	2,070	4,700	2,070	4,700	2,070	4,800	2,110
Natrona ^c	83,800	33,200	84,900	33,700	84,900	33,700	85,900	34,100	87,400	34,700	88,300	35,000
Casper	59,500	23,600	60,300	23,900	60,300	23,900	61,000	24,200	62,100	24,700	62,700	24,900
Niobrara ^c	3,200	1,570	3,220	1,580	3,220	1,580	3,240	1,590	3,250	1,590	3,300	1,620
Lusk	1,800	850	1,810	850	1,810	850	1,820	860	1,830	860	1,860	880
Platte ^c	9,200	3,900	9,400	4,000	9,400	4,000	9,500	4,000	9,500	4,000	9,800	4,100
Guernsey	1,530	670	1,560	680	1,560	680	1,580	690	1,590	700	1,630	710
Wheatland	4,500	1,950	4,600	1,990	4,600	1,990	4,600	1,990	4,700	2,030	4,800	2,080
Sheridan: A separate table has been prepared for Sheridan County. See table 4-												
Weston ^c	9,900	4,000	10,000	4,100	10,000	4,100	10,100	4,100	10,100	4,100	10,300	4,200
Newcastle	5,000	2,010	5,100	2,050	5,100	2,050	5,100	2,050	5,100	2,050	5,200	2,090
Upton	1,660	730	1,680	740	1,680	740	1,690	740	1,690	740	1,720	760

NOTE: Projections were derived by applying 1980 population-to-employment ratios to projected employment. City projections are based on the 1980 city-to-county ratio. Housing requirements are based on the number of persons to house in 1980.

a. For Campbell County, a ratio of 1.888 was used for permanent employment, plus 1.209 for temporary employment.

b. For Converse County, a ratio of 2.3721 was used for permanent employment, plus 1.209 for temporary employment.

c. Ratios applied for all employment in each county are as follows: Crook, 3.681; Goshen, 3.636; Johnson, 2.932; Natrona, 1.943; Niobrara, 3.868; Platte, 3.097; Weston, 2.981.

TABLE 4-15
1990 POPULATION UNDER EACH ALTERNATIVE, WITH HOUSING REQUIREMENTS
FOR SHERIDAN COUNTY

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Popu- lation ^a	Housing ^b										
Primary impact of Montana employment	3,300	1,440	3,300	1,440	5,200	2,270	5,200	2,270	3,900	1,700	5,800	2,530
Secondary impact of Montana employment	800	350	800	350	1,560	680	1,710	750	1,230	540	1,950	850
Base without Montana impacts ^c	28,500	12,400	28,900	12,600	28,900	12,600	30,700	13,400	31,800	13,900	32,500	14,200
County total	32,600	14,200	33,000	14,400	35,700	15,600	37,600	16,400	36,900	16,100	40,300	17,600
City of Sheridan	19,700	8,600	19,900	8,700	21,600	9,400	22,700	9,900	22,300	9,700	24,300	10,600

a. Projections of total Sheridan County population are based on the 1980 population-to-employment ratio of 2.8997 for permanent employment, plus 1.2085 for temporary employment. Estimates of primary and secondary impacts to Sheridan County due to Montana employment were made after the population-to-employment ratio was modified by alternately adding and subtracting Montana employment and its effects from Sheridan County employment and population in each projected year. City population is projected at its 1980 share (60.47%) of county population.

b. Housing projections are based on 1980 ratio of 2.292 persons per house for the county and 2.293 persons per house for the city.

c. Base population and housing were derived by subtracting primary and secondary impacts from the total.

Environmental Consequences

bear the largest increase in population in either relative or absolute terms (see table 4-16). Under Alternative 5, in which the Mud Springs tract is not included, the magnitude of the increase would be reduced, but it would still be substantial.

The Crow and Northern Cheyenne Indian Reservations

Table 4-17A presents the population levels with housing requirements that would exist on the Crow and Northern Cheyenne Indian reservations under the alternatives. For table 4-17A, it is assumed that on a "worst case" basis the increases would occur in the non-Indian segments of the populations. This effect would be reduced with increased Indian participation in employment opportunities.

Alternate "Scenario" for the Northern Cheyenne Reservation

Because of concern that the population distribution to the Northern Cheyenne Reservation (as presented in tables 4-16 and 4-17A) might prove invalid, a separate population distribution was prepared for the Northern Powder River Region under an alternative "scenario." To accomplish the alternative analysis, a group of individuals who are knowledgeable of the area, including three very knowledgeable members of the Northern Cheyenne Tribe, performed a distribution of primary employment by place of residence. It should be noted, however, that the Northern Cheyenne Tribe does not endorse the validity of this analysis.

A major assumption in the alternative "scenario" is the participation of the Northern Cheyenne in the new employment opportunities, implying that some preferential employment agreement might be in effect.

In addition, the following considerations and assumptions were major factors in the alternative analysis.

There are high schools at Forsyth, Colstrip, Broadus, and Ashland and there are elementary schools in the same communities and in Lame Deer.

Colstrip has new, well-developed community services.

Ashland has sewer capacity for a community of 2,500.

Broadus, which is the county seat of Powder River County, has a relatively well-developed infrastructure.

Broadus is a secondary trade center for Powder River and Rosebud counties.

There is school bus between Ashland and Broadus.

There is excess housing capacity at Colstrip, and Colstrip is no longer a company town; therefore, open development is now possible.

There is contracted bus service from the reservation to Colstrip, although its future is uncertain at present.

Lame Deer has its own utility company.

The population influx into Powder River County would locate in Broadus and on other developments along the transportation corridors (Assumption).

There is much BLM and FS land in the Ashland vicinity; therefore, the limited land for expansion is relatively high-priced when compared to lands on the reservation.

Tongue River Railroad could require land in the Ashland area at the expense of expansion opportunities; however, there is an alternate route.

There is limited housing in the Ashland area both on and off the reservation.

One or two trailer courts are now planned for the Ashland area, both on and off the reservation.

Housing will be built to accommodate the population influx (Assumption).

Living on reservation has advantages: no property taxes, fewer restrictions, it is more scenic (Assumption).

There are non-Indians living on the reservation and working off-reservation at present.

Non-Indians can purchase deeded land on the reservation.

Approximately 25% of the Northern Cheyenne Reservation is deeded.

Indians can get a 2.5-acre life estate for a building that can be leased (renewable) to non-Indians for 25 years.

Distances, weather, and road conditions (present and future) have been considered.

3The road between Kirby and Decker will be oiled (Assumption).

TABLE 4-16
1990 POPULATION UNDER-EACH ALTERNATIVE, WITH HOUSING REQUIREMENTS
FOR THE NORTHERN POWDER RIVER REGION

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Popu- lation	Housing										
Big Horn County ^a	15,600	5,400	15,600	5,400	16,600	5,800	16,700	5,800	17,200	6,000	17,900	6,200
Crow Reservation Div. ^b	7,900	2,430	7,900	2,430	8,400	2,580	8,500	2,610	8,700	2,670	9,100	2,800
Hardin Division ^b	6,000	2,450	6,400	2,450	6,400	2,620	6,400	2,620	6,600	2,700	6,900	2,820
Hardin ^b	4,600	1,900	4,900	1,900	4,900	2,020	4,900	2,020	5,100	2,100	5,300	2,180
Northern Cheyenne Div. ^b	1,420	400	1,420	400	1,510	430	1,520	430	1,570	450	1,630	460
Tongue River Division ^b	270	150	270	150	290	170	290	170	300	170	310	180
Powder River County ^c	4,640	2,070	4,640	2,070	7,500	3,340	8,200	3,650	6,100	2,720	8,200	3,650
Broadus Division ^b	2,430	1,130	2,430	1,130	3,900	1,810	4,300	1,990	3,200	1,480	4,300	1,990
Broadus ^b	1,320	620	1,320	620	2,130	1,000	2,310	1,090	1,740	820	2,340	1,100
East Powder River Div. ^b	1,340	560	1,340	560	2,170	910	2,350	980	1,770	740	2,380	990
Other Division ^b	870	380	870	380	1,410	620	1,530	670	1,150	500	1,550	680
Rosebud County ^{d,e}	14,500	5,500	14,500	5,500	16,200	6,200	16,900	6,500	16,200	6,200	18,000	6,900
Ashland Division ^{b,e,f}	830	370	830	370	1,410	620	1,900	840	1,860	820	1,960	860
Ashland ^{b,e,f}	610	190	610	190	1,170	360	1,660	510	1,630	500	1,700	520
Forsyth Division ^b	5,100	2,140	5,100	2,140	5,600	2,340	5,600	2,340	5,400	2,260	6,000	2,510
Forsyth ^b	3,700	1,530	3,700	1,530	4,000	1,650	4,100	1,690	3,900	1,610	4,300	1,770
Northern Cheyenne Div. ^b	3,900	1,120	3,900	1,120	4,200	1,200	4,300	1,230	4,100	1,170	4,600	1,320
Rosebud Division ^b	4,600	1,900	4,600	1,900	5,000	2,070	5,100	2,110	4,800	1,980	5,400	2,230
Colstrip ^b	2,160	700	2,160	700	2,350	760	2,380	770	2,260	730	2,530	810

NOTE: Figures may not add due to rounding.

- a. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.992 was used for permanent employment, plus 1.256 for temporary employment.
- b. Projections are based on the 1980 share of county population, except for Ashland and the Ashland district of Rosebud County. It is expected that some of the workforce for the Ashland (Decker-Birney) and Northwest Otter Creek tracts (in Powder River County) would live in Rosebud County; accordingly, projections for those areas include the population effect of 50% of the workforce from those tracts.
- c. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 4.367 was used for permanent employment, plus 1.263 for temporary employment. As there was no apparent temporary population in Powder River County in 1980, the average of the temporary ratios for Rosebud and Big Horn counties was used for Powder River County. Fifty percent of the workforce from the Ashland (Decker-Birney), Northwest Otter Creek, and Mud Springs tracts was excluded from these computations so that population effects could be allocated to Rosebud and Sheridan counties.
- d. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.997 was used for permanent employment, plus 1.270 for temporary employment. Population effects of the workforce from the Ashland (Decker-Birney) and Northwest Otter Creek tracts were then added to Ashland, Ashland Division, and the county total.
- e. Includes population impacts resulting from 50% of the work force on the Ashland (Decker-Birney) and Northwest Otter Creek tracts.
- f. Not to be confused with the Ashland District of the Northern Cheyenne Reservation.

TABLE 4-17A
1990 POPULATION UNDER EACH ALTERNATIVE, WITH HOUSING REQUIREMENTS
FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Popu- lation	Housing										
Crow Reservation	5,400	1,090	5,400	1,090	5,400	1,090	5,400	1,090	5,400	1,090	5,400	1,090
Indian	2,770	1,420	2,770	1,420	3,300	1,700	3,300	1,700	3,600	1,850	4,000	2,050
Reservation total ^{a,b,c}	8,200	2,520	8,200	2,520	8,700	2,790	8,700	2,790	9,000	2,940	9,400	3,140
Lodge Grass ^e	1,060	300	1,060	300	1,120	330	1,130	330	1,160	340	1,210	340
Northern Cheyenne Reservation												
Indian	4,500	1,040	4,500	1,040	4,500	1,040	4,500	1,040	4,500	1,040	4,500	1,040
Non-Indian ^{a, b}	810	470	810	470	1,240	720	1,310	760	1,140	660	1,680	980
Reservation total ^{a,d}	5,300	1,510	5,300	1,510	5,700	1,760	5,800	1,800	5,600	1,700	6,200	2,020
Ashland (on reservation) ^e	540	160	540	160	580	190	590	190	570	180	630	210
Birney (on reservation) ^e	210	60	210	60	230	10	230	10	220	10	240	10
Busby ^e	1,170	330	1,170	330	1,270	390	1,280	400	1,240	370	1,360	440
Lame Deere	2,890	820	2,890	820	3,100	960	3,200	980	3,100	930	3,360	1,100

NOTE: Figures may not add due to rounding.

a. Population increases were derived by applying the reservation's share of county population in 1980 to the projected change in county population; however, the Northern Cheyenne Reservation's share of county population was not applied to the portion of the population effect of the Ashland (Decker-Birney) and Northwest Otter Creek tracts that was allocated to Ashland (off reservation).

b. Housing projections are based on the number of persons per house in 1980.

c. Includes the portion of the Crow Reservation in Yellowstone County, Montana. This portion was held constant for the projections.

d. Reservation housing is the sum of Indian and non-Indian housing.

e. Community population projections are based on the community's share of reservation population in 1980. Community housing is based on the community's share of reservation housing in 1980.

Environmental Consequences

There will be a new road built between Decker and the Mud Springs tract (Assumption).

Interstate 90 will be completed between Lodge Grass and Sheridan.

The workforce for the construction of Colstrip 3 and 4 will no longer be in place for the construction of projects after 1988.

Because of the construction and operation of Colstrip, there is a trained Indian workforce in existence.

Ten percent of the construction workforce would consist of Indians (Assumption).

Fifteen percent of the operations workforce would consist of Indians (Assumption).

Ten percent of new Indian hires would be from outside of the region (Assumption).

Fifty percent of new Indian hires would be from unemployed reservation Indians (Assumption).

Fifty percent of new Indian hires would relocate to the reservation (Assumption).

Lame Deer would contribute the largest number of Northern Cheyenne workers (Assumption).

Hiring for Montana construction and operations would be through Billings union halls (Assumption).

Construction of the proposed Mud Springs power plant would result in an on-site labor camp being constructed (Assumption).

On the basis of distance, road systems, and historical experience in the Decker mines, it is assumed that 50% of the operations workforce and 33% of the construction workforce from Mud Springs and Hanging Woman would reside in Sheridan County, Wyoming (Assumption).

The locations and kinds of regional secondary employment generated by these actions would occur in the same patterns as in the 1970-1980 period (Assumption).

Indian participation in secondary employment would be negligible (Assumption).

The population level resulting from both primary and secondary employment would occur at the same county population-to-employment ratios that existed in 1980. (Assumption)

Population resulting from primary employment would be distributed in the same pattern as the distribution of primary employment by place of residence (see table 4-17B) (Assumption).

Population from secondary employment would be distributed in the same pattern that existed in 1980.

Table 4-17B presents the alternative distribution of primary employment by place of residence, and table 4-17C presents the resulting distribution of population. The major differences between the alternate population distribution (table 4-17C) and the original (tables 4-16 and 4-17A) are the shift of population increases from Sheridan County to Yellowstone County and the increase in the Indian segment of the reservation population under the alternatives. Both of these changes are predictable under the new assumptions. However, it must be noted that the total populations projected for the Northern Cheyenne Reservation under the alternate "scenario" (table 4-17C) varied only marginally from the original analysis (tables 4-16 and 4-17A)—the maximum difference was 6.8% under Alternative 5.

In addition, the results of comparing, or ranking, the alternatives on the basis of reservation population remain the same for both population distributions. Inasmuch as expenditure levels and community services and facilities would vary directly with population levels, it would not be productive to carry the alternate "scenario" any further in this document.

REVENUES AND EXPENDITURES

This section presents a comparison of potential revenues to peak expenditures in the Powder River Region under the alternatives. The absolute magnitude of the revenues or expenditures should not be emphasized. This analysis is based on relative change as an indicator of potential costs versus potential benefits. All expenditures are projected on the basis of 1980 per capita spending levels.

It will be noted that expenditures under the alternatives that do not propose additional federal competitive leasing are the expenditure levels projected for 1990 in chapter 3. Without additional federal competitive leasing, it is assumed that funding will equal expenditures through taxation, user fees, grants, or deficit spending.

As we stated in chapter 3, it must be assumed that localities that cannot utilize these measures

TABLE 4-17B
 DISTRIBUTION OF PRIMARY EMPLOYMENT WITH INDIAN PARTICIPATION
 BY PLACE OF RESIDENCE BASED ON JUDGMENTAL WEIGHTING
 (projections for all alternatives are for 1990)

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
<u>Northern Cheyenne Reservation</u>						
Ashland (on reservation)						
Indian	---	---	85	94	35	115
Non-Indian	---	---	105	146	102	167
Busby						
Indian	---	---	45	54	27	72
Non-Indian	---	---	20	25	14	39
Lame Deer						
Indian	---	---	170	188	65	230
Non-Indian	---	---	40	49	27	82
Birney Village						
Indian	---	---	30	39	27	47
Non-Indian	---	---	---	---	---	---
Reservation total						
Indian	---	---	330	375	154	464
Non-Indian	---	---	165	220	143	288
<u>Rosebud County</u>						
Ashland (off reservation)	---	---	195	263	174	304
Colstrip	---	---	85	108	64	229
Birney	---	---	20	25	14	29
Forsyth	---	---	---	---	---	15
County total	---	---	730	912	508	1,218
<u>Powder River County</u>	---	---	975	1,089	324	1,174
<u>Big Horn County</u>						
Hardin	---	---	40	40	---	40
County total	---	---	105	119	41	151
Billings	---	---	500	500	---	500
<u>Sheridan County</u>			830	830	167	997
Grand total			3,140	3,450	1,040	4,040
Indian	---	---	330	375	154	464
Non-Indian	---	---	2,810	3,075	886	3,576

TABLE 4-17C
 ALTERNATE POPULATION DISTRIBUTION
 BASED ON INDIAN PARTICIPATION IN PRIMARY EMPLOYMENT OPPORTUNITIES
 AND JUDGMENTAL WEIGHTING OF THE RESULTING PRIMARY EMPLOYMENT DISTRIBUTION
 (projection for all alternatives are for 1990)

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
<u>Northern Cheyenne Reservation^a</u>						
Ashland (on reservation)						
Indian	460	460	520	540	510	570
Non-Indian	80	80	290	420	390	480
Busby						
Indian	950	950	990	1,000	990	1,030
Non-Indian	220	220	260	280	260	320
Lame Deer						
Indian	2,480	2,480	2,610	2,630	2,580	2,700
Non-Indian	410	410	490	520	500	520
Birney Village						
Indian	180	180	210	220	220	240
Non-Indian	30	30	30	30	30	30
Reservation total	5,300	5,300	5,890	6,130	5,980	6,470
Indian	4,500	4,500	4,750	4,820	4,730	4,950
Non-Indian	810	810	1,140	1,310	1,250	1,520
<u>Rosebud County</u>						
Ashland (off reservation)	610	610	1,000	1,210	1,140	1,340
Colstrip	2,160	2,160	2,360	2,440	2,380	2,820
Birney ^b	200	200	240	260	250	270
Forsyth	3,700	3,700	3,790	3,810	3,750	3,880
County total	14,500	14,500	15,740	16,250	15,880	17,080
<u>Powder River County</u>	4,640	4,640	6,320	6,820	6,080	7,200
<u>Big Horn County</u>						
Hardin	4,600	4,600	4,720	4,730	4,640	4,750
County total	15,600	15,600	15,920	15,980	15,770	16,100
<u>Yellowstone County</u>						
Billings ^c	82,600	82,600	85,330	85,670	83,740	86,320
County total ^d	133,600	133,600	137,630	138,180	135,450	139,230
<u>Sheridan County^e</u>	32,600	32,600	34,240	34,350	33,440	35,020

NOTE: Figures may not add due to rounding.

a. Indian and non-Indian estimates for Alternatives 1 and 2 (1990 baseline) are based on the 1980 share of reservation population.

b. Birney population is based on 1980 population of 136 (Montco Mine draft HHS) and a 1.4% share of 1980 county population.

c. Alternatives 1 and 2 (1990 baseline) are based on 1980 share of county population.

d. Alternatives 1 and 2 (1990 baseline) are based on 1980 census of 108,035 and an assumed growth rate of the prior ten years (1970-1980).

e. This analysis does not include the effects on Sheridan County from Wyoming coal development.

Environmental Consequences

will forgo new or additional facilities or services. In cases where services and facilities are already considered inadequate, it must be further assumed that additional needs will further aggravate an already bad situation.

The Eastern and Western Powder River Region

It is assumed that, in the worst case, all counties in the Eastern and Western Powder River Region that would not host coal development would experience increases in expenditures due to secondary population increases; however, they would not participate in revenue increases from coal production (see table 4-18). It is also assumed that the communities in the vicinity of coal development would not benefit from increases in coal property tax revenues and therefore would experience a shortfall in revenues (after an initial increase in returns from sales and user taxes during the construction of mines). All shortfalls would require additional taxation, user fees, or grants.

In addition, it is assumed that a lag of one year would occur between initial spending increases and initial revenue increases for Campbell and Sheridan counties and their respective school districts.

As can be seen on table 4-18, Campbell County and Campbell County School District 1 should experience a relative abundance of funding under all the alternatives. Sheridan County, however, would experience this abundance only under Alternative 5 or 6. Sheridan County schools would enjoy this abundance under Alternative 4 as well as under Alternatives 5 or 6. It should be pointed out that, because of the lower level of impacts from coal development in the Northern Powder River Region, Alternative 5 presents the best ratio of funding to expenditures in Sheridan County.

The Northern Powder River Region

Table 4-19 presents a comparison of potential revenues to estimated peak expenditures in the Northern Powder River Region under the alternatives. Estimates of revenues for counties and schools are based on the gross proceeds tax and

property taxes. The taxable value of gross proceeds is 45% of the contract value of coal (estimated at \$7.83 per ton of coal production). The taxable value of coal property is 11% of the market value of the property (estimated at \$5 million per million tons of production capacity).

The Mud Springs power plant would be an additional source of property tax revenue for Powder River County and Powder River County schools. The taxable value of power plant property is 15% of the market value, which is estimated at \$200,000 per megawatt of production capacity for this analysis.

The county levy for Big Horn County in 1980 was 38.28; the mill levy for Rosebud County schools in 1980 was 78.45. For purposes of this analysis, these levies were used for all counties and schools in the Northern Powder River Region.

Communities in the Northern Powder River Region would not benefit from gross proceeds or property tax revenues; instead, they would find it necessary to petition the Montana Coal Board for revenues.

It is assumed that the revenue changes under the alternatives would lag by a minimum of one year. In the case of Big Horn County, Big Horn County schools, Rosebud County, and Rosebud County schools, and in all cases under Alternative 5, peak revenues would occur in 1991. For Powder River County and Powder River County schools, only about one-third of the increase would occur in 1991 under Alternative 3, and only about one-half would occur in 1991 under Alternative 4 or 6. The full increases would be realized by 1993 in Powder River County under Alternative 3, 4, or 6.

The Crow and Northern Cheyenne Indian Reservations

Table 4-20 presents a comparison of potential revenues and expenditures on the reservations under the alternatives. Although the tribes would experience increased expenditures, they would not participate in increased revenues from gross proceeds or property taxes. Therefore, they would find it necessary to petition the Montana Coal Board for grants.

TABLE 4-18
 POTENTIAL REVENUES COMPARED TO PEAK EXPENDITURES UNDER EACH ALTERNATIVE
 IN THE EASTERN AND WESTERN POWDER RIVER REGION

(in thousands of dollars, rounded to the nearest \$100,000)

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
Campbell County						
Revenues	26,900	32,500	32,500	35,200	35,200	45,300
Expenditures	26,900	28,500	28,500	29,500	29,500	29,500
School District 1						
Revenues	70,600	80,200	80,200	85,000	85,000	102,500
Expenditures	70,600	74,800	74,800	77,300	77,400	77,400
Gillette						
Revenues	20,000	20,600	20,600	20,900	20,900	22,100
Expenditures	20,000	21,200	21,200	21,900	21,900	21,900
Converse County						
Revenues	10,500	10,500	10,500	10,500	10,500	10,500
Expenditures	10,500	10,600	10,600	10,800	10,800	11,300
School District 1						
Revenues	19,300	19,300	19,300	19,300	19,300	19,300
Expenditures	19,300	19,500	19,500	19,800	19,800	20,900
Douglas						
Revenues	8,400	8,400	8,400	8,400	8,400	8,400
Expenditures	8,400	8,500	8,500	8,600	8,600	9,000
School District 2						
Revenues	7,200	7,200	7,200	7,200	7,200	7,200
Expenditures	7,200	7,300	7,300	7,400	7,400	7,800
Glenrock						
Revenues	1,500	1,500	1,500	1,500	1,500	1,500
Expenditures	1,500	1,600	1,600	1,600	1,600	1,700
Crook County						
Revenues	3,900	3,900	3,900	3,900	3,900	3,900
Expenditures	3,900	3,900	3,900	3,900	3,900	4,000
School District 1						
Revenues	5,100	5,100	5,100	5,100	5,100	5,100
Expenditures	5,100	5,200	5,200	5,200	5,200	5,300
Sundance						
Revenues	600	600	600	600	600	600
Expenditures	600	600	600	600	600	600
Moorcroft						
Revenues	400	400	400	400	400	400
Expenditures	400	400	400	400	400	400

NOTE: Debt servicing is included.

Revenues: It is assumed that revenues under Alternative 1, without additional competitive federal leasing, will equal expenditures through taxation, user fees, grants, or debt. Revenue increases under Alternatives 2, 3, 4, 5, and 6 were derived from Stinson's coal revenue model.

Expenditures: All expenditures are projected on the basis of 1979 per capita expenditures.

(continued on next page)

REVENUES AND EXPENDITURES--EASTERN AND WESTERN POWDER RIVER REGION (continued)

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
Goshen County						
Revenues	2,300	2,300	2,300	2,300	2,300	2,300
Expenditures	2,300	2,400	2,400	2,400	2,400	2,500
School District 1						
Revenues	9,500	9,500	9,500	9,500	9,500	9,500
Expenditures	9,500	9,700	9,700	9,800	9,900	10,100
Torrington						
Revenues	5,100	5,100	5,100	5,100	5,100	5,100
Expenditures	5,100	5,200	5,200	5,300	5,300	5,400
Johnson County						
Revenues	2,500	2,500	2,500	2,500	2,500	2,500
Expenditures	2,500	2,600	2,600	2,600	2,600	2,600
School District 1						
Revenues	6,900	6,900	6,900	6,900	6,900	6,900
Expenditures	6,900	7,000	7,000	7,000	7,100	7,200
Buffalo						
Revenues	2,400	2,400	2,400	2,400	2,400	2,400
Expenditures	2,400	2,400	2,400	2,400	2,400	2,400
Natrona County						
Revenues	42,900	42,900	42,900	42,900	42,900	42,900
Expenditures	42,900	43,400	43,400	43,900	44,700	45,100
School District 1						
Revenues	37,200	37,200	37,200	37,200	37,200	37,200
Expenditures	37,200	37,600	37,600	38,000	38,700	39,100
Casper						
Revenues	50,400	50,400	50,400	50,400	50,400	50,400
Expenditures	50,400	51,100	51,100	51,700	52,600	53,100
Niobrara County						
Revenues	1,000	1,000	1,000	1,000	1,000	1,000
Expenditures	1,000	1,000	1,000	1,000	1,000	1,000
School District 1						
Revenues	3,100	3,100	3,100	3,100	3,100	3,100
Expenditures	3,100	3,100	3,100	3,100	3,100	3,200
Lusk						
Revenues	1,600	1,600	1,600	1,600	1,600	1,600
Expenditures	1,600	1,600	1,600	1,600	1,600	1,700

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REVENUES AND EXPENDITURES--EASTERN AND WESTERN POWDER RIVER REGION (continued)

Platte County						
Revenues	2,200	2,200	2,200	2,200	2,200	2,200
Expenditures	2,200	2,300	2,300	2,300	2,300	2,400
School District 1						
Revenues	5,300	5,300	5,300	5,300	5,300	5,300
Expenditures	5,300	5,400	5,400	5,500	5,500	5,600
Wheatland						
Revenues	2,600	2,600	2,600	2,600	2,600	2,600
Expenditures	2,600	2,600	2,600	2,600	2,700	2,800
School District 2						
Revenues	1,000	1,000	1,000	1,000	1,000	1,000
Expenditures	1,000	1,100	1,100	1,100	1,100	1,100
Guernsey						
Revenues	500	500	500	500	500	500
Expenditures	500	500	500	500	500	500
Sheridan County						
Revenues	19,700	19,700	19,700	22,100	23,700	23,700
Expenditures	19,700	20,000	21,600	22,800	22,300	24,400
School District 2						
Revenues	13,300	13,300	13,300	17,400	20,300	20,300
Expenditures	13,300	13,400	14,500	15,300	15,000	16,400
Sheridan						
Revenues	9,600	9,600	9,600	9,900	10,000	10,000
Expenditures	9,600	9,700	10,500	11,000	10,800	11,800
Weston County						
Revenues	5,400	5,400	5,400	5,400	5,400	5,400
Expenditures	5,400	5,400	5,400	5,500	5,500	5,600
School District 1						
Revenues	5,200	5,200	5,200	5,200	5,200	5,200
Expenditures	5,200	5,200	5,200	5,300	5,300	5,400
Newcastle						
Revenues	2,300	2,300	2,300	2,300	2,300	2,300
Expenditures	2,300	2,400	2,400	2,400	2,400	2,400
School District 7						
Revenues	1,800	1,800	1,800	1,800	1,800	1,800
Expenditures	1,800	1,900	1,900	1,900	1,900	1,900
Upton						
Revenues	1,900	1,900	1,900	1,900	1,900	1,900
Expenditures	1,900	1,900	1,900	1,900	1,900	2,000

TABLE 4-19
 POTENTIAL REVENUES COMPARED TO PEAK EXPENDITURES UNDER EACH ALTERNATIVE
 IN THE NORTHERN POWDER RIVER REGION

(in thousands of dollars, rounded to the nearest \$100,000)

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
Big Horn County						
Revenues	8,600	8,600	8,600	8,600	10,200	10,200
Expenditures	8,600	8,600	9,100	9,200	9,500	9,900
Big Horn County Schools						
Revenues	13,900	13,900	13,900	13,900	17,100	17,100
Expenditures	13,900	13,900	14,800	14,900	15,300	16,000
Hardin						
Revenues	1,100	1,100	1,100	1,100	1,100	1,100
Expenditures	1,100	1,100	1,200	1,200	1,200	1,200
Powder River County						
Revenues	7,200	7,200	10,700	11,900	9,700	11,900
Expenditures	7,200	7,200	11,600	12,600	9,400	12,600
Powder River County Schools						
Revenues	3,700	3,700	10,900	13,400	8,900	13,400
Expenditures	3,700	3,700	6,000	6,600	4,900	6,600
Broadus						
Revenues	300	300	300	300	300	300
Expenditures	300	300	500	500	400	500
Rosebud County						
Revenues	9,400	9,400	9,400	9,400	9,400	10,200
Expenditures	9,400	9,400	10,500	10,900	10,500	11,600
Rosebud County Schools						
Revenues	8,700	8,700	8,700	8,700	8,700	10,300
Expenditures	8,700	8,700	9,700	10,100	9,700	10,700
Ashland						
Revenues	210	210	210	210	210	210
Expenditures	210	210	400	560	550	580
Colstrip						
Revenues	7,000	7,000	7,000	7,000	7,000	7,000
Expenditures	7,000	7,000	7,700	7,800	7,400	8,300
Forsyth						
Revenues	1,900	1,900	2,100	2,200	2,000	2,300
Expenditures	1,900	1,900	2,100	2,200	2,000	2,300

NOTE: Debt servicing is included. See text for derivation.

TABLE 4-20
 POTENTIAL REVENUES COMPARED TO PEAK EXPENDITURES UNDER EACH ALTERNATIVE
 ON THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

(in thousands of dollars, rounded to the nearest \$100,000)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Crow Reservation						
Revenues (1990) ^a	8,900	8,900	8,900	8,900	8,900	8,900
Expenditures (1990) ^b	8,900	8,900	9,400	9,400	9,800	10,200
Lodge Grass						
Revenues (1990) ^a	120	120	120	120	120	120
Expenditures (1990) ^b	120	120	130	130	130	140
Northern Cheyenne Reservation						
Revenues (1990) ^a	10,100	10,100	10,100	10,100	10,100	10,100
Expenditures (1990) ^b	10,100	10,100	10,900	11,100	10,700	11,900

a. Under Alternative 1 or 2, it is assumed that revenues would equal expenditures through taxation, user fees, grants, or debt. Revenues are not expected to increase under the other alternatives, as the reservations are not expected to benefit from gross proceeds or property taxes.

b. Expenditures are projected on the basis of 1980 per capita expenditure levels.

Environmental Consequences

COMMUNITY SERVICES

Tables 4-21 through 4-25 present estimates of community services or facilities that would be required under the alternatives in the Powder River Region. The estimates are based on the levels per thousand population that existed in 1979-1980.

When a service or facility did not exist in 1979-1980, a footnote indicates the method that was used for measuring the additional need for that service or facility.

It will be seen that the estimates for alternatives that do not propose additional federal competitive leasing are the same as the projections for 1990 in the affected environment, chapter 3.

SOCIOLOGY

Alternative 2

The most significant and visible social consequences of implementing Alternative 2 would occur in Sheridan and Campbell counties, Wyoming, in the late 1980s and early 1990s. However, the projected population increase over the baseline is such that the changes in community life would be routine and subtle even at peak.

Both of these counties, and the major communities within them, are in strong positions to absorb the projected growth effectively. Both areas have experienced industrialization previously and have relatively large and diversified populations. Services and facilities are broadly developed. The Wyoming regulatory environment is well established and local leaders and administrators have been exposed to growth management issues. In short, development of the tracts included in Alternative 2 should present unremarkable social effects.

The effects of leasing maintenance tracts in Montana also would be minor, because the consequences—additional employment and related community change—have largely occurred already in Forsyth, Colstrip, and Sheridan, Wyoming (which would be affected by development of Montana tracts).

Alternative 3

Wyoming

The absolute population effects of implementing Alternative 3 would be greater in Wyoming than in Montana. However, the projected baseline population levels in 1990 and 1995 (with no additional leasing) are much greater for Wyoming than for Montana. In a relative sense, the social consequences of this alternative would not be nearly as profound in Campbell and Sheridan counties, Wyoming, as those that would be expected in Montana. The effects that would occur in Wyoming can appropriately be described as moderate, because the capacity of Sheridan and Gillette and their respective counties to absorb population is much higher than that of the Montana communities (see the "Sociology" section of chapter 3).

It is likely that trends already long evident in these areas, such as segmentation, growth of the bureaucracy, and impersonalization, would be magnified. Personal behaviors that indicate instability—divorces, lack of commitment to community, dropouts—would be perpetuated somewhat by this additional future growth. However, both Campbell and Sheridan counties are expected to continue to have relatively high levels of in-migration, with attendant community and personal uncertainties, regardless of a particular federal action; therefore, the direct effects of Alternative 3 would be marginal and incremental.

Montana

Leasing and development of the tracts in Alternative 3 would have profound and durable social consequences in southeast Montana. The effects would be most evident during the late 1980s and early 1990s but would persist during the operational life of the development. Indeed, it is likely that eventual closure of the operations would be as difficult for future residents of several communities as would the construction period. For many communities that have been dependent on large industrial operations, the ultimate closing of those facilities has proved to be traumatic.

The social effects expected in Montana during the next decade under Alternative 3 would fall largely in Powder River and Rosebud counties. Consequences in Big Horn County would not be significant. Both absolutely and relatively, the central location of the effects would be in Powder River County, an area with a low baseline population and the largest projected population increases.

TABLE 4-21
 PROJECTED 1990 SCHOOL ENROLLMENT AND HOSPITAL BEDS REQUIRED
 UNDER EACH ALTERNATIVE IN THE POWDER RIVER REGION

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
SCHOOL ENROLLMENT						
<u>Eastern and Western Powder River Region</u>						
Gillette	8,600	9,100	9,100	9,400	9,400	10,300
Douglas	2,350	2,380	2,380	2,420	2,420	2,550
Glenrock	1,390	1,410	1,410	1,430	1,430	1,510
Sundance	520	530	530	530	530	540
Moorcroft	480	490	490	490	490	490
Torrington	2,020	2,040	2,040	2,070	2,090	2,140
Buffalo	1,680	1,700	1,700	1,700	1,720	1,750
Casper	15,800	16,000	16,000	16,200	16,500	16,700
Lusk	630	630	630	640	640	650
Guernsey	320	320	320	330	330	340
Wheatland	1,620	1,660	1,660	1,670	1,670	1,730
Sheridan	4,400	4,400	4,800	5,000	4,900	5,400
Newcastle	1,730	1,750	1,750	1,760	1,760	1,800
Upton	560	570	570	580	580	590
<u>Northern Powder River Region</u>						
Big Horn County	3,360	3,360	3,600	3,600	3,700	3,900
Powder River County	1,070	1,070	1,720	1,890	1,400	1,890
Rosebud County	3,700	3,700	4,200	4,400	4,200	4,600
<u>Crow and Northern Cheyenne Indian Reservations</u>						
Ashland (on reservation)	600	600	650	660	640	710
Busby	310	310	340	340	330	370
HOSPITAL BEDS						
<u>Eastern and Western Powder River Region</u>						
Gillette	58	62	62	64	64	69
Douglas	37	37	37	38	38	40
Sundance	18	18	18	18	18	18
Torrington	68	69	69	70	70	72
Buffalo	42	43	43	43	43	44
Casper	329	333	333	337	343	347
Lusk	13	13	13	13	13	14
Wheatland	33	34	34	34	35	35
Sheridan	126	127	138	145	143	156
Newcastle	58	60	60	60	60	61
<u>Northern Powder River Region</u>						
Big Horn County	70	70	75	75	78	81
Powder River County ^a	19	19	30	33	24	33
Rosebud County	38	38	43	44	43	47
<u>Crow Reservation</u>						
Crow Agency	47	47	50	50	51	54
<u>Northern Cheyenne Indian Reservation^a</u>						
	21	21	23	23	22	25

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

a. Figures are based on a regional average of 4 beds per 1,000 population.

TABLE 4-22
 SWORN LAW OFFICERS REQUIRED IN 1990 UNDER EACH ALTERNATIVE
 IN THE POWDER RIVER REGION

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
<u>Eastern and Western Powder River Region</u>						
Campbell County	47	50	50	51	51	56
Gillette	58	62	62	64	64	69
Converse County	12	12	12	12	12	13
Douglas	12	12	12	12	12	13
Glenrock	10	10	10	10	10	10
Crook County	4	4	4	4	4	5
Sundance	5	6	6	6	6	6
Moorcroft	4	4	4	4	4	5
Goshen County	5	5	5	5	5	5
Torrington	16	16	16	16	16	17
Johnson County	10	10	10	10	10	10
Buffalo	8	9	9	9	9	9
Natrona County	73	74	74	75	77	77
Casper	136	138	138	140	142	144
Niobrara County	2	2	2	2	2	2
Lusk	7	7	7	7	7	7
Platte County	5	5	5	5	5	5
Guernsey	5	5	5	6	6	6
Wheatland	9	9	9	9	10	10
Sheridan County	9	9	10	11	10	11
Sheridan	38	38	41	43	43	47
Weston County	7	7	7	7	7	7
Newcastle	14	14	14	14	14	14
Upton	7	7	7	7	7	7
<u>Northern Powder River Region</u>						
Big Horn County	22	22	24	24	25	26
Hardin	a	a	a	a	a	a
Powder River County	7	7	12	13	10	13
Broadus	a	a	a	a	a	a
Rosebud County	28	28	31	32	31	35
Ashland	a	a	a	a	a	a
Colstrip	a	a	a	a	a	a
Forsyth	a	a	a	a	a	a
<u>Crow Reservation</u>	21	21	22	22	23	24
Crow Agency	16	16	17	17	18	19
Lodge Grass	3	3	3	3	3	3
<u>Northern Cheyenne Reservation</u>						
Ashland	1	1	1	1	1	1
(on reservation) ^b						
Birney	0	0	0	0	0	0
(on reservation) ^b						
Busby ^b	2	2	2	2	2	2
Lame Deer ^b	4	4	4	4	4	5

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

a. It is assumed that the county can continue to provide adequate law enforcement services.

b. Projections are based on a regional average of 1.4 officers per 1,000 population.

TABLE 4-23
 FIREFIGHTERS REQUIRED IN 1990 UNDER EACH ALTERNATIVE
 IN THE POWDER RIVER REGION

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Full-time	Volunteer										
Eastern and Western Powder River Region												
Campbell County		41	10	44	10	44	10	45	10	45	11	49
Gillette												
Coverse County		35		36		36		36		36		38
Douglas		30		30		30		30		31		32
Glenrock												
Crook County		16		17		17		17		17		17
Sundance		31		31		31		31		31		32
Moorcroft												
Goshen County		49		49		49		50		50		51
Torrington												
Johnson County		21		21		21		21		21		21
Buffalo												
Natrona County		111		112		112		114		116		117
Caeper												
Niobrara County		26		26		26		26		27		27
Lusk												
Platte County		26		27		27		27		27		28
Guernsey		54		55		55		55		57		58
Wheatland												
Sheridan County		23		24		26		27		27		29
Sheridan												
Weston County		56		57		57		57		57		58
Newcastle		35		35		35		35		35		36
Upton												
Northern Powder River Region												
Big Horn County		32		32		34		35		36		37
Hardin		28		28		30		30		31		32
Powder River County		28		28		45		49		49		49
Broadus		a		a		a		a		a		a
Rosebud County												
Ashland		4b		4b		7b		10b		10b		10b
Colstrip		40		40		43		44		41		46
Forsyth		23		23		25		26		24		27

TABLE 4-24
 WATER CAPACITY REQUIRED IN 1990 UNDER EACH ALTERNATIVE
 IN THE POWDER RIVER REGION
 (in millions of gallons per day)

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
<u>Eastern and Western Powder River Region</u>						
Gillette	6.7	7.2	7.2	7.4	7.4	8.1
Douglas	4.1	4.2	4.2	4.2	4.2	4.5
Glenrock	1.8	1.8	1.8	1.8	1.9	1.9
Sundance	0.7	0.7	0.7	0.7	0.7	0.7
Moorcroft	0.3	0.3	0.3	0.3	0.3	0.3
Torrington	3.0	3.1	3.1	3.1	3.1	3.2
Buffalo	4.6	4.7	4.7	4.7	4.7	4.8
Casper	30.3	30.7	30.7	31.1	31.6	32.0
Lusk	2.4	2.4	2.4	2.4	2.4	2.5
Guernsey	1.0	1.0	1.0	1.0	1.0	1.1
Wheatland	3.6	3.7	3.7	3.7	3.8	3.9
Sheridan	13.0	13.1	14.3	15.0	14.7	16.0
Newcastle	4.9	5.0	5.0	5.0	5.0	5.1
Upton	1.0	1.0	1.0	1.0	1.0	1.0
<u>Northern Powder River Region</u>						
Hardin	5.6	5.6	5.9	5.9	6.2	6.4
Broadus	0.9	0.9	1.5	1.6	1.2	1.6
Ashland	a	a	a	a	a	a
Colstrip	b	b	b	b	b	b
Forsyth	5.1	5.1	5.5	5.6	5.3	5.9
<u>Crow Reservation</u>						
Crow Agency	1.2	1.2	1.3	1.3	1.4	1.4
Lodge Grass	0.4	0.4	0.4	0.4	0.4	0.4
<u>Northern Cheyenne Reservation</u>						
Ashland (on reservation)	0.1	0.1	0.1	0.1	0.1	0.1
Birney (on reservation)	0.1	0.1	0.1	0.1	0.1	0.1
Busby	0.2	0.2	0.2	0.2	0.2	0.2
Lame Deer	0.5	0.5	0.6	0.6	0.6	0.6

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

a. Ashland has water capacity to serve a population of 2,500. The largest population projected for Ashland is 1,700 under Alternative 6.

b. Colstrip has water capacity to serve a population of 7,200. The peak population projected for Colstrip under is 2,530 for Alternative 6.

TABLE 4-25
SEWAGE CAPACITY REQUIRED IN 1990 UNDER EACH ALTERNATIVE
IN THE POWDER RIVER REGION
(in millions of gallons per day except where otherwise noted)

	Alterna- tive 1	Alterna- tive 2	Alterna- tive 3	Alterna- tive 4	Alterna- tive 5	Alterna- tive 6
<u>Eastern and Western Powder River Region</u>						
Gillette	3.2	3.4	3.4	3.5	3.5	3.8
Douglas	0.4	0.4	0.4	0.4	0.4	0.4
Glenrock	1.8	1.8	1.8	1.8	1.9	1.9
Sundance	0.3	0.3	0.3	0.3	0.3	0.3
Moorcroft	0.2	0.2	0.2	0.2	0.2	0.2
Torrington	1.1 ^a	1.2 ^a				
Buffalo	0.7	0.7	0.7	0.7	0.7	0.8
Casper	7.6	7.7	7.7	7.8	7.9	8.0
Lusk	0.3	0.3	0.3	0.3	0.3	0.3
Guernsey	0.5	0.5	0.5	0.5	0.5	0.5
Wheatland	1.3	1.3	1.3	1.3	1.4	1.4
Sheridan	6.5	6.6	7.1	7.5	7.4	8.0
Newcastle	2.8	2.8	2.8	2.8	2.8	2.9
Upton	0.6	0.6	0.6	0.6	0.6	0.6
<u>Northern Powder River Region</u>						
Hardin	b	b	b	b	b	b
Broadus	4.8 ^c	4.8 ^c	7.7 ^c	8.3 ^c	6.3 ^c	8.4 ^c
Ashland	d	d	d	d	d	d
Colstrip	e	e	e	e	e	e
Forsyth	0.7	0.7	0.8	0.8	0.8	0.8
<u>Crow Reservation</u>						
Crow Agency	23.0 ^c	23.0 ^c	25.0 ^c	25.0 ^c	26.0 ^c	27.0 ^c
Lodge Grass	16.0 ^c	16.0 ^c	17.0 ^c	18.0 ^c	18.0 ^c	19.0 ^c
<u>Northern Cheyenne Reservation</u>						
Ashland (on reservation)	6.0 ^c	7.0 ^c				
Birney (on reservation)	3.0 ^c					
Busby	4.0 ^c	4.0 ^c	5.0 ^c	5.0 ^c	5.0 ^c	5.0 ^c
Lame Deer	14.0 ^c	14.0 ^c	16.0 ^c	16.0 ^c	16.0 ^c	17.0 ^c

NOTE: Projections are based on 1979-1980 levels per 1,000 population.

a. Based on a standard of 168 gallons per capita per day.

b. Hardin has sewage treatment capacity to serve a population of 6,000. The heaviest population projected for Hardin is 5,300 under Alternative 6.

c. Surface acres of sewage lagoon.

d. Ashland has sewage capacity to serve a population of 2,500. The heaviest population projected for Ashland under this analysis is 1,700 for Alternative 6.

e. Colstrip has sewage capacity to serve a population of 7,500. The heaviest population projected for Colstrip is 2,530 under Alternative 6.

Environmental Consequences

Powder River County

Powder River county is vulnerable to the effects described above. As the "Sociology" section of chapter 3 explains, this rural-agricultural area has had little exposure to industrialization and possesses a limited base of services and facilities. There is no planning mechanism, and city and county leaders have only limited or no experience in responding to growth management questions. Coordination with state government agencies responsible for providing rapid-growth assistance is untested. For these reasons, Powder River County, Broadus, and the rural areas of the county would undergo a radical transformation.

The short-term construction period would be characterized by chaotic conditions in housing, law enforcement, education, and similar areas of community life. The county's population would be increasingly transient and industrial, in sharp contrast to the existing pattern of overall stability and predictability. The adaptability of longtime residents would be stressed, at least during the short term. Uncertainty and anxiousness would be widespread among residents, particularly the elderly.

Through time, perhaps by the early or mid-1990s, conditions would become stabilized, but the long-term changes in the county would be substantial in the centers of population. Virtually every aspect of community life—education, religion, interpersonal relations, recreation, and so on—would be affected.

Rosebud County

For several reasons, the community in Rosebud County that would be most affected by Alternative 3 is Ashland. Like Broadus and Powder River County, Ashland has a limited capacity to respond to change effectively. The conditions are similar, with the additional complications that Ashland is unincorporated and culturally fragmented. The community simply has few resources to draw upon for dealing with rapid growth, both now and in the foreseeable future. Conditions to be expected in the short term and the post-construction period parallel those described above for Powder River County and its communities.

The social effects of this alternative would be moderate elsewhere in Rosebud County, except possibly on the Northern Cheyenne Indian Reservation, which is discussed in the next section. The expected base conditions in Forsyth and Colstrip are such that the levels of growth under this

alternative could be managed without extensive or intensive difficulty. In fact, such development probably would supplement similar changes that already have occurred because of past development, and it probably would be widely viewed as beneficial.

The Northern Cheyenne Indian Reservation

It is projected that some non-Indian persons and families would locate in or near Lame Deer, Busby, Birney, and other reservation communities. Furthermore, development near the reservation could draw non-reservation Northern Cheyenne to live on the reservation. For Alternative 3, it is projected that population levels in 1990 would be roughly 8% above the baseline.

There are severe public administrative problems on the reservation, and social problems among individuals are widespread and chronic. Given these conditions and potential cultural incompatibility, even a few hundred additional non-Indians and Indians on the homeland would further intensify uncertainties and resentment on such issues as law enforcement authority, economic prosperity, and access to public services and facilities. The potential for cultural deterioration would be increased if non-Indian influences became further established and prevalent. The reservation is vulnerable to growth even on a moderate scale.

Increased traffic on U. S. Highway 212, Montana 39, and County 314, along with persistent jurisdictional problems, would present problems for reservation residents. Trespass, poaching, unsafe driving conditions and behaviors, and unauthorized use of tribal facilities probably would increase. Tribal law enforcement personnel would have to deal with higher levels of misconduct, and the tribal police do not have jurisdiction over non-Indians. Medical emergencies on the reservation would be likely to increase somewhat, and the tribal ambulance service responds to all calls on the reservation (Northern Cheyenne Tribe 1983a). Therefore, this capacity might be exceeded, along with firefighting capability.

At the same time, it should be recognized that additional federal leasing under this and other alternatives would have potential benefit for the Northern Cheyenne. Off-reservation employment opportunities, as at Colstrip, could result in dependable jobs for a significant number of persons. This would help the Northern Cheyenne maintain their cultural distinction by allowing them to live on the reservation while securing

Environmental Consequences

their economic livelihood elsewhere. However, without an employment agreement, the likelihood of this happening is very limited.

There are currently few other economic development alternatives in sight. Non-Indian migration to the reservation might attract retail and other capital investments. The tribe is actively seeking such commercial sitings. Perhaps leverage would be increased toward improving schools, law enforcement, health care, and similar programs. Under Montana law, the tribe is now a potential recipient of grants and loans from the Montana Coal Board. Thus, the effects on the Northern Cheyenne would not be entirely negative, but tribe members would not be likely to benefit from surrounding development without special action.

Alternative 4

Wyoming

Development of the tracts included in Alternative 4 would generate consequential population increases in Wyoming.

Sheridan County

Effects of Alternative 4 on Sheridan and Sheridan County from both Wyoming and Montana mining operations would be particularly evident because tax revenues from Montana would not be shared with a county and community that would bear much of the impact of Montana development. Sheridan has a high capacity to absorb growth and change, but the addition of 5,000 to 6,000 persons above baseline during the next decade would present growth management issues for the county and the city.

The area has become increasingly urban and occupationally industrial in the past decade. The level of growth above baseline projections due to Alternative 4 would move the area even more decidedly toward a social environment inconsistent with widespread notions that Sheridan remains an enclave of the Old West. National retail chains and franchises, labor unions, and a fairly high number of technical specialists are in evidence now and will remain. Interpersonal relations would be even more segmented and transient if this alternative should be implemented than without additional federal leasing. There would be intense pressure on officials—and the rest of the county's citizens—to deal with rapid growth. Thus, the capability of Sheridan and the county to respond effectively to these near-term stresses would be tested.

Campbell County

The effects of Alternative 4 on Gillette and Campbell County would be similar to those on Sheridan and Sheridan County, except that the city and county governments are better able to capture the revenues generated by additional coal operations. Social effects and tax revenues would coincide in Campbell County, which also has powerful siting legislation.

Broad-based acceptance of rapid growth is more likely in Campbell County than in Sheridan County. Campbell County's leaders and officials have more experience than their Sheridan counterparts, as was discussed in chapter 3. For these reasons, development under this alternative would not cause as much difficulty in Gillette as in Sheridan or in counterpart Montana areas.

Expansion, even extensive expansion, of the industrial base of Campbell County is socially compatible with both the present community structure and the social environment of the foreseeable future.

Montana

In general, the social effects in Montana from Alternative 4 would be similar to those of Alternative 3. However, there would be minor difference in magnitude and location.

Big Horn County

Again, the consequences in Big Horn County relative to the baseline generally would be moderate. Population increases, which cause social effects, are projected to be about 7% above baseline by 1990 for Big Horn County under Alternative 4. Hardin, with intermediate capacity to absorb change, would be noticeably affected, but not to the point of disruptiveness.

Powder River County

Powder River County, both in Broadus and in the rural areas, would bear the brunt of the effects of development of the tracts under Alternative 4. The Broadus population by 1990 would be roughly double that which would otherwise be expected. The likelihood of new subdivisions in the western part of the county would be high. For the entire county, but particularly for the few persons living in western Powder River County, these changes would be real, immediate, and intense.

Environmental Consequences

The effects described for Alternative 3 would also occur under this alternative, but the magnitude and intensities would be marginally greater. Given the capacity of this area for social change, it is clear that development under this alternative would lead to wholesale and, at least for the next several decades, durable changes for Powder River County. As the economy moved from predominantly agricultural activities toward industrialization, the social environment would shift toward more diversity, uncertainty, transience, impersonalization, and segmentation.

Rosebud County

The central location of change in Rosebud County would be Ashland, where the population would be more than double the baseline level. While the Ashland area is expected to grow considerably by 1990 regardless of federal action, this alternative would push the community's population to a level three or four times higher than that of 1980. Ashland simply is not prepared for this level of growth. It remains small, unincorporated, and socially fragmented.

Widespread and intense disruptions for the community for newcomers and long-term residents could be expected. In addition, cultural conflicts between Northern Cheyenne and non-Indians would be heightened because the presence of so many newcomers adjacent to the reservation would lead to a variety of misunderstandings and resentments. Ashland would become a most difficult living environment, particularly between 1985 and 1995. Stability eventually would be established, but not without much stress.

The Forsyth and Colstrip areas would be moderately affected by development under Alternative 4. Their capacities to absorb change are intermediate, as are the projected growth levels. It is unlikely that development under this alternative would present more than routine management and absorption issues in the rest of the county.

The Northern Cheyenne Indian Reservation

It is projected that some non-Indians would move to the reservation and that there would be some return migration of non-reservation Northern Cheyenne, with the same type of effects as were described for Alternative 3. Assuming the reservation would have several hundred additional residents, growth management problems could be expected, particularly along the main transportation corridors. The number of persons projected

above the baseline is not high, but the area's capacity to deal with growth is very limited. Problems would be evident in housing, law enforcement, emergency medical care, education, and racial friction.

The Crow Indian Reservation

A moderate level of in-migration of both Indians and non-Indians could be expected on the Crow Reservation under Alternative 4, but the ongoing presence of substantial numbers of non-Indians would serve to reduce what otherwise might be more substantial consequences. The present non-Indian land ownership and population on the reservation means that the Crow, more than the Northern Cheyenne, are familiar with having non-Indians in their routine pattern of life. Traffic loads, minor retail investments, conflicts between landowners and recreational users, and pressure on housing and public service and facilities would be evident. However, except in certain situations these effects would not be intense.

Alternative 5

Wyoming

Given the similarities between the forecast population effects of Alternative 5 in Wyoming and those projected under Alternative 4, current social assessment methods offer no processes to differentiate between the alternatives. The only difference is that Sheridan would be in a somewhat stronger position to capture benefits associated with Alternative 5, because a lower proportion of the production and population effects from Alternative 5 would originate in Montana. The siting process and attendant taxation procedure would help Sheridan and Sheridan County to deal with the changes. Otherwise, the effects in Wyoming would be virtually the same as those described for Alternative 4.

Montana

Local social effects in Montana from Alternative-5 would be considerably less severe than those from Alternative 4. This is due to the exclusion of the Mud Springs tract, on which interest in a power plant has been expressed. The absence of the high labor levels associated with construction of the plant reduces the overall multi-county consequences. Still, the expected effects of this alternative, shifting toward a more balanced pattern

Environmental Consequences

across the three-county area, are substantial, and in several cases problematic.

The increases in population in Broadus and the rest of Powder River County would be much lower than those projected for Alternatives 3 and 4. The effects in Powder River County would be similar to, but less intense than, those described for Alternative 3. All of Powder River County has limited capacity to absorb rapid change, both now and into the foreseeable future.

Ashland and the Northern Cheyenne Reservation are the only Rosebud County areas that would be significantly affected by this alternative. The effects in Ashland would be equivalent to those described for Alternative 4. The Northern Cheyenne Reservation and the tribe would experience changes similar to those described for Alternatives 3 and 4, but somewhat less intense.

Consequences in Big Horn County would be considerable in both the cities and the rural areas. The Hardin area should be able to respond effectively to the projected level of growth, since the levels are moderate and the city and immediate area have resources to employ in response. There would be effects on the Crow and the Crow Reservation parallel to those described for the Northern Cheyenne under Alternatives 3 and 4, but again the ongoing presence of many non-Indians on the Crow reservation would serve to reduce the relative consequences.

In summary, the Montana areas most heavily affected under this alternative would be Ashland and, to a lesser extent, Powder River County. The social effects elsewhere would be moderate but still significant. Community instability and personal disruptive behavior should be expected to be in evidence, along with issues such as public safety, housing, and education. These issues, which would require the ongoing attention of officials, would perhaps be most problematic on the two Indian reservations, where capacity to respond is limited.

Alternative 6

Wyoming

The Wyoming areas that would be significantly affected by Alternative 6 are Sheridan and Campbell counties. Both areas are protected by Wyoming's siting law, have firm relations with the state government, have experience with industry, and have relatively large, diversified, and occupa-

tionally industrialized labor forces. The capacities of these two counties to deal with local social changes are the highest in the Powder River Region, and both areas are expected to experience substantial population growth whether or not there is additional federal coal leasing.

Even so, population increases in the range of 20% over the baseline by 1990 are formidable. More intensified growth for a longer period would ensure that both Sheridan and Campbell counties would continue to be largely transient (as in schools) and socially unsettled. In such a community, newcomers could be expected to experience personal difficulties such as a lack of identification with place, a sense of isolation, much disruptive behavior, and poor housing. Longer-term residents, perhaps looking forward to stability, would have to face a new wave of latecomers.

It is likely that for many individuals this development would represent a persistence of past adaptive difficulties, while for the counties and communities, as different entities, the growth might be manageable except occasionally. The units of government probably are better prepared to deal with the level of growth, both short term and midterm, than are the residents within their jurisdictions.

Eventually, perhaps in the mid-1990s, stability would prevail, closely associated with a consistent demand for the coal resource. However, if production should drop during the life of the mines, an entirely different set of problems would appear. Public financial resources probably would diminish, and officials would face severe distributional questions as the demand for public assistance increased. Both Sheridan and Campbell counties would be further dependent on the operations of the mines and this economic activity for the economic lives of the counties and communities and their residents.

As under all alternatives, there would be severe dislocation problems at the time the facilities closed. Without plant closure legislation or enhanced diversification of the economic base, these events are virtually unavoidable. There would be severe effects at that time on retail, public finance, public facilities, real estate, and other components of community and individual life.

Montana

Alternative 6 would have profound, inventive, and durable local social effects in Montana during the next decade, during operation of the mines,

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and upon closure of the facilities. Regional economic development would be enhanced, but the local social effects, compared to the present and to the future without additional federal leasing, would be extremely adverse if the goal is to maintain future options that approximate those of the present and the recent past.

Elsewhere, the population changes would be even greater than those for other alternatives, jeopardizing the stability that otherwise would be expected to prevail under the baseline or the lower production alternatives. Big Horn County and the Crow Reservation, in particular, would face an increase of roughly 15% more than the baseline by 1990.

Powder River County

Much of the social assessment for other alternatives applies to this one as well; for example, the elaborate and widespread effects described for Powder River County under Alternative 4 would be virtually the same under Alternative 6.

Rosebud County

Effects in Rosebud County would be widespread. Ashland would undergo a transformation equivalent to that described for Alternatives 4 and 5. This level of growth would simply alter the physical and social environment until it was unrecognizable. Long-term residents would have to cope with many transient newcomers, uncertainty, information of unknown reliability, and a more urbane atmosphere. It probably would be intolerable to some. For example, Northern Cheyenne on the east side of the Tongue River might move to the reservation because of feelings of minority status and alienation resulting from increasing numbers of non-Indians.

The Colstrip and Forsyth areas would be affected, but growth there probably would be accommodated without wholesale change or disruption. These communities have higher capacities to absorb change than Ashland does. The effects during both the pre-operation and operation stages would be manageable and probably would be seen as generally beneficial.

The Northern Cheyenne Indian Reservation

Alternative 6 would cause substantial changes on the Northern Cheyenne Reservation. Effects described for Alternatives 3, 4, and 5 would be evident, but even more intense and widespread.

The addition of several hundred non-Indians to the reservation would further stress racial-cultural relations and the tribal government's ability to operate effectively. It also could put further pressure on the limited base of services and facilities. Areas along transportation corridors would be immediately and decidedly affected as traffic increased and residential and retail settlement took place. The Northern Cheyennes' sense of propriety toward the homeland would be reduced.

Perhaps of greatest importance is the likelihood that Northern Cheyenne who would not be able to take advantage of potential benefits would feel further deprived of economic comparability, as discussed under Alternative 3. This deprivation might be relative, but it would be very real to the persons who experienced it. It could further mire individuals in a cycle of poverty, lack of motivation and skills, and dependent behaviors that are widespread on the reservation. The presence of additional persons and families and the visibility of regional in-migrants to Colstrip, Ashland, Sheridan, and other communities would cause such feelings of deprivation.

The Crow Indian Reservation

While Hardin and its immediate environs have moderate capacities, the Crow and their reservation are vulnerable. Implementation of this alternative would result in even larger numbers of non-Indians on the Crow Reservation. This could present difficulty in cultural maintenance and cause heightened uncertainties on jurisdictional issues such as law enforcement and health care.

Tribal, Big Horn County, and Hardin officials would be under considerable pressure to manage the growth. Transience, impersonalization, and additional fragmentation would be apparent. Both absolutely and relatively, divorce and other family instabilities probably would increase.

Some increase in employment opportunity would be possible for the Crow. Some capital investment might be drawn to the reservation, and some improvement might occur in public facilities and services as a result of the development. However, distribution of these benefits would be uneven, perhaps resulting in many Crow experiencing increased frustrations beyond those now in evidence or those that would be expected without such change.

Additional gaps in wealth and access to public resources would be very likely to increase the

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sense of poverty and absence of a future among the Crow who would not benefit directly from the development. At best, only a relatively small segment of Crow would be direct and indirect recipients of jobs.