4.0 ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

The first subsection of this chapter describes the environmental effects of the Proposed Action, mining of the West Rocky Butte LBA tract and the Rocky Butte lease tract as an LMU. Effects are described for each of the environmental and socioeconomic disciplines described in the preceding chapter. The second subsection of this chapter describes the environmental effects of the No Action Alternative. Cumulative effects of the Proposed Action are described in Chapter 6.

Some of the effects are discussed in the context of their duration. Short-term impacts are those that occur during the 52-year period from premining development through the end of mine life, assuming a 10-year period for reclamation evaluation and bond release after reclamation activities are completed. Long-term impacts of the project are those that persist beyond the end of mine life.

The geographical limits for the analysis of impacts in this EIS are dependent upon the type of impact being analyzed. For some resources the impact analysis is confined to the permit area. Geographical limits for detailed analysis for resources where the analysis extends beyond the permit area are as follows:

- Air Quality - Impacts are analyzed for the six-mine cluster extending from Rocky Butte on the north to Coal Creek on the south.

- Water Resources - Impacts are analyzed for a region that encompasses the entire area within which the Wyodak-Anderson coal aquifer is subject to 5 feet or more of drawdown resulting from mining at the same six mines included in the air quality analysis plus the Wyodak Mine to the north.

- Wildlife - Impacts are analyzed generally within a locality consisting of a 2-mile wide buffer zone around the Rocky Butte life-of-mine area. Buffer zones for specific features of interest can extend beyond this limit.

- Socioeconomics - Impacts are analyzed for the Rocky Butte Mine and for a region encompassing Campbell County and the city of Gillette where most of the employment impacts will occur.

- Transportation - Impacts are analyzed for the local infrastructure which serves the Rocky Butte Mine and the region encompassing the Campbell County mines in general, with particular emphasis on Highway 59, the BN and CNW railroads, and county roads on and near the life-of-mine area.

- Visual Resources - Impacts are analyzed for the life-of-mine area and for a region encompassing the six-mine cluster included in the air quality impact assessment.

- Noise - Impacts are analyzed for the area where noise from the mine would exceed ambient levels.

Impacts are also discussed in terms of their significance. The basis for conclusions regarding significance are the criteria set forth by the Council on Environmental Quality (CEQ) (40 CFR 1508.27) and professional judgement of the specialists performing the analyses. Significance of various impacts may range from insignificant to severe, and impacts can be significant during mining and reduce to insignificant following completion of reclamation.

Finally, some impacts are discussed in terms of their magnitude. The magnitude of an impact can range from negligible, such as effects on noise levels in the region, to major, such as effects on vegetation within the disturbed area during the mine life.

Table 4-1 summarizes the impact analysis and compares impacts for the two primary alternatives. Certain cumulative impacts are included in Table 4-1, but the analysis of cumulative impacts is not presented until Chapter 6.

As presented in the following analysis, mining would not severely interfere with the future usability of the region's or Nation's resources. The use of some resources, such as soils and vegetation for

example, would be decreased on the permit area for the 42-year life of the mine and into at least a portion of the reclamation evaluation period. However, the permit area would support the main land uses of the region, grazing and wildlife habitat with some dryland cropping, after reclamation is completed.

Table 4-1. Summary of Impact Analysis for the Proposed Action and No Action Alternatives

Impact Topic by Environmental Resource	Significance or Magnitude and Duration of Impact	
	Proposed Action Alternative	No Action Alternative
GEOLOGY AND MINERAL RESOURCES		
Remove and replace topsoil, overburden and coal, replace topsoil and overburden.	Moderate; affects all horizons above base of coal within lease boundaries; major; long-term	No impact
TOPOGRAPHY		
Reduced slopes and decreased diversity on area affected by mining.	Moderate; long-term; affects all regional mines	No impact
SOILS		
Remove, mix and replace suitable topsoils; bury unsuitable soils.	Moderate; long term; affects all regional mines; insignificant	No impact
VEGETATION		
Reduction in vegetation diversity after reclamation.	Moderate short-term; minor long-term; affects all regional mines; insignificant	No impact
Reduction in shrub density	Minor; short-term; moderate to major long-term until shrubs become established; affects all regional mines; insignificant	No impact
WATER RESOURCES		
Reduction in streamflows due to water captured in mandated sedimentation ponds.	Minor; short-term	No impact
Lowering of water levels in surrounding aquifers.	Minor due to requirements for replacing damaged water supplies; long-term over a region extending well beyond the mine boundaries.	No impact
Replacement of coal and overburden aquifers with a spoil aquifer.	Insignificant during mining since need for this water is removed by mining. Moderate long-term since alternative sources must be used until spoil aquifer reaches equilibrium.	No impact
ALLUVIAL VALLEY FLOORS		
While a final determination has not been made by WDEQ/LQD, it is believed that there are no AVFs on the proposed permit area.	No impact	No impact
FISH AND WILDLIFE		
Reduction in deer habitat; increase in road kills due to increased traffic.	Minor; short term on the mine site and in entire region	No impact
Reduction in pronghorn winter/yearlong habitat, and conversion of winter/yearlong habitat to primarily summer habitat.	Minor; short term on the mine site; moderate to major; long-term in entire region until shrubs become established	No impact
Removal of at least five active raptor nests and reduction of raptor habitat.	Moderate; short term on the mine site and entire region	No impact

Table 4-1. Summary of Impact Analysis for the Proposed Action and No Action Alternatives (cont.)

Impact Topic by Environmental Resource	Significance or Magnitude and Duration of Impact	
	Proposed Action Alternative	No Action Alternative
Removal of two potentially active sage grouse leks, and associated sagebrush nesting and brood rearing habitat.	Major if leks are active and/or state shrub reclamation goals are not met, otherwise moderate; long-term until habitat is reestablished on the mine sites	No impact
T & E species	Moderate short-term for species which potentially breed in the area	No impact
Loss of nesting habitat or foraging areas for certain MBHFI.	Minor to moderate; short term; on the mine sites	No impact
Loss of habitat for predators and small mammals.	Minor to moderate; short term; on the mine site	No impact
CULTURAL RESOURCES		
At least 9 sites believed eligible for NRHP are in the area to be disturbed and must be mitigated or the area cannot be affected.	Impacts to cultural resources are not permitted; at least 9 sites would be mitigated through data recovery.	No impact
PALEONTOLOGICAL RESOURCES		
Overburden excavation could potentially expose fossils for scientific examination.	Significance and magnitude would depend on rarity and condition of any discoveries; short term; on the mine sites	No impact
RECREATION		
The area disturbed at any one time would be unavailable for hunting.	Insignificant on mine site; area is privately controlled and could be removed from hunting at any time. Moderate for region during mining since herd levels can exceed target values	No impact
Wildlife viewing from Highway 59 would be curtailed for the disturbed areas.	Minor; long-term, until wildlife habitats have been restored; on the mine site	No impact
AIR QUALITY		
Airborne particulates would increase but would remain within State and Federal Standards.	Moderate inside permit boundary; minor within 5 miles of permit boundary; negligible beyond 5 miles; short term	No impact
VISUAL RESOURCES		
Reduction from Class IV to Class V due to construction of high-profile structures and large stockpiles.	Major for nearby residents and travelers on local public roads; short term; on mine site and adjacent areas.	No impact
NOISE		
Increased noise levels for nearby residents.	Minor to moderate within 1.9 miles of active mine areas; short term	No impact
TRANSPORTATION		
Increased number of unit trains to haul coal from the Rocky Butte Mine.	Minor (10 percent increase); short term	No impact
Increased traffic on roads and highways due to mine employees.	Minor over most of the region, possibly moderate for short reaches of Highway 59 and Four Corners Road; short term	No impact
LAND USE AND OWNERSHIP		
Loss of agricultural productivity for disturbed lands.	Negligible impact on agricultural productivity of region; short term	No impact
Loss of occupied dwellings on mine site.	Major impact to individual homes, minor significant since owners have agreed to relocate; long term	No impact
SOCIOECONOMICS[1]		
Additional payroll of about $18 million per year.	Moderate; short term; affects entire county	No impact

Table 4-1. Summary of Impact Analysis for the Proposed Action and No Action Alternatives (cont.)

Impact Topic by Environmental Resource	Significance or Magnitude and Duration of Impact	
	Proposed Action Alternative	No Action Alternative
Average increase in retail and service trade of about $12 million per year.	Moderate; short term; affects entire county	No impact
Population increase of 1,300 in Gillette and 1,500 in Campbell County.	Moderate; short term	No impact
Increased need for public facilities and services.	Minor; short term	No impact
Revenues from royalties and taxes to the Federal government would average $14 million per year.	Moderate; short term	No impact
Revenues from royalties and taxes to the State government would average $6.7 million per year.	Moderate; short term	No impact
City of Gillette would receive sales and use tax revenues averaging $200,000 per year.	Moderate; short term	No impact
Housing market could experience availability constraints during beginning of operations.	Moderate; short term	No impact

[1] Employment and revenue impacts assume market exists for coal from Rocky Butte Mine and employees and production are not merely redistributed from existing mines.

4.1 Environmental Impacts of the Proposed Action

4.1.1 Geology and Mineral Resources

Approximately 2.6 billion cubic yards of sedimentary deposits, including topsoil, overburden and coal, would be disturbed over the life of the mine. With the exception of the coal, these materials would be backfilled into the resulting open cut. The natural lateral continuity of individual lithologic units in the overburden would be lost due to disruption by the mining process.

Compaction structures in the coal-bearing formations such as those which have allowed gas in the coal seam to vent at the surface near Rawhide Village (Law, 1976) have not been identified in the Rocky Butte area even after extensive drilling and subsurface investigations. The compaction structures are associated with no-coal channels (Law, 1976), also not found in the Rocky Butte permit area. In the absence of such structures, and because there are no reported gas vents in the immediate vicinity, it is unlikely that the situation that occurred at Rawhide Village could be repeated in the subdivisions near the Rocky Butte Mine. However, some of the coal monitor wells at the Rocky Butte site do produce gas, indicating that gas is present in some areas in the coal seam. It is possible that as drawdowns of water levels in the surrounding coal occur (refer to Section 4.1.5), water wells completed in the coal could start to produce gas. This is unlikely since drawdowns at a well caused by mining will in most cases be less than drawdowns historically caused by pumping the well. This could affect approximately 10 percent of the wells within three miles of the permit area (see Section 3.5).

NWR would handle approximately 1.956 billion bcy of overburden in the course of mining. According to Dollhopf and others (1978), most unsuitable overburden disturbed by mining and reclamation activities is diluted as a matter of course, because it is mixed with suitable overburden in the spoil. After regrading and contouring, some spoil may still remain unsuitable for use in reclamation; this spoil would be characterized by high-clay texture, excessive acid-base potential, excessive nitrate-nitrogen concentrations, and selenium. NWR would bury the most undesirable spoil below the vegetation rooting zone, away from ground-water postmining phreatic surface, and outside the area of drainage channels or their floodplains. Sufficient suitable overburden material is available to place at least 4 feet of this material at the surface prior to replacing the topsoil. With 4.3 feet of topsoil

available, this means that the top 8.3 feet of regraded surface materials will meet Wyoming DEQ/LQD suitability guidelines.

It is concluded that the impact of unsuitable overburden at the proposed Rocky Butte Mine on revegetation success and ground-water quality would be insignificant over the long term. Any overburden unsuitability issues can be resolved during the mine permitting process.

Currently producing oil wells are present within the permit area (see the "Land Use" section of Chapter 3 for their locations). Comparison of the mine sequence with the planned production schedule of these wells indicates that two wells are projected to maintain production throughout the life of the mine. If they are still producing when encountered by the mine, these wells could be capped below the lowest coal seam and mined through. The oil-and-gas production zone underlying the proposed permit area occurs in the Muddy Sandstone, which is over 6,000 feet below the lowest coal seam to be mined, and from the Minnelusa sandstone, which is about 9,500 feet below the coal. Given the depth of these production zones, no damage to future oil-and-gas production would occur as a result of mining.

It is concluded that the impact of the proposed Rocky Butte Mine on geology and minerals other than coal within the proposed permit area would be insignificant. Geology from the base of coal to the surface would be subjected to a minor, long-term change, but there are no significant environmental impacts associated with this change.

4.1.2 Topography

Approximately 7,333 acres would be disturbed by mining and mining-related operations at the proposed Rocky Butte mine. The result of these operations would be that the final postmining elevation would average about 35 feet lower than premining elevation. The overall postmining topography would be slightly flatter than premining topography. Figure 4-1 shows a perspective view of the surface as it now exists, and Figure 4-2 shows the same view as it would appear at the conclusion of mining and reclamation.

Premining slopes average 2.3 percent, whereas the postmining slopes are expected to average 1.8 percent. The postmining slopes would range from 1 to 18 percent, thus maintaining some topographic diversity (Figure 4-2). The postmining surface has been designed by NWR to resemble the premining surface and restore surface drainage patterns.

Adverse impacts resulting from topographic moderation include the loss of wildlife habitat, (e.g., conversion of winter/yearlong range to primarily summer range), a reduction in vegetation and habitat diversity, and a potential decrease in big game carrying capacity. However, the generally flatter topography that will result from mining and reclamation could have two beneficial impacts on the reclaimed land surface. First, a flatter land surface would allow for greater infiltration of precipitation, thereby increasing the viability of the postmining vegetation. Second, a flatter land surface could result in a reduction in erosion of reclaimed soils by surface runoff.

The postmining topography of the proposed Rocky Butte mine (Figure 4-2) shows a ridge approximately a mile long, located in the western third of the proposed mine area essentially where the premining ridge occurred, simulating the original premining topography. The approximate original drainage pattern will be restored with stock ponds and retention reservoirs replaced to provide for future livestock requirements. The reduction of overall postmining slopes should minimize erosion by runoff and may accelerate recharge of the local ground-water system following mine completion. It is concluded that the impacts of slightly flatter slopes and larger closed basins will be long-term and moderate.

4.1.3 Soils

Construction and mining would progressively disturb topsoil on 7,333 acres during the life of the mine. Maximum annual surface disturbance would occur during the first two years of construction and mine development when 412 and 509 acres would be disturbed. After the sixth year, a cumulative total of about 1,497 acres would be disturbed. Reclamation would begin in the seventh year, and there would then be a progressive pattern of new disturbance and reclamation work each year. Throughout the remainder of the life of the mine,

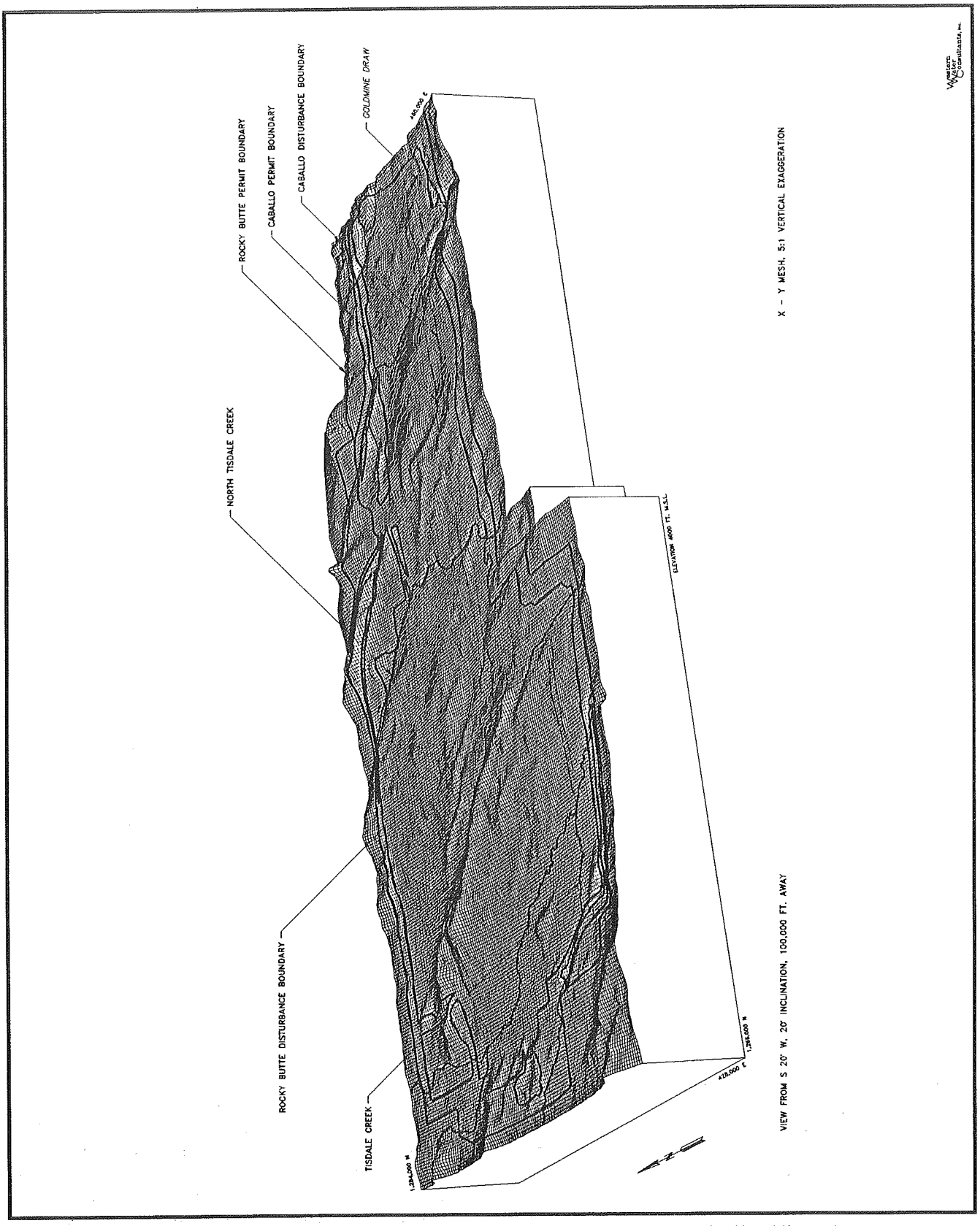

Figure 4-1. Premining 3-Dimensional Perspective View of Rocky Butte Mine Area

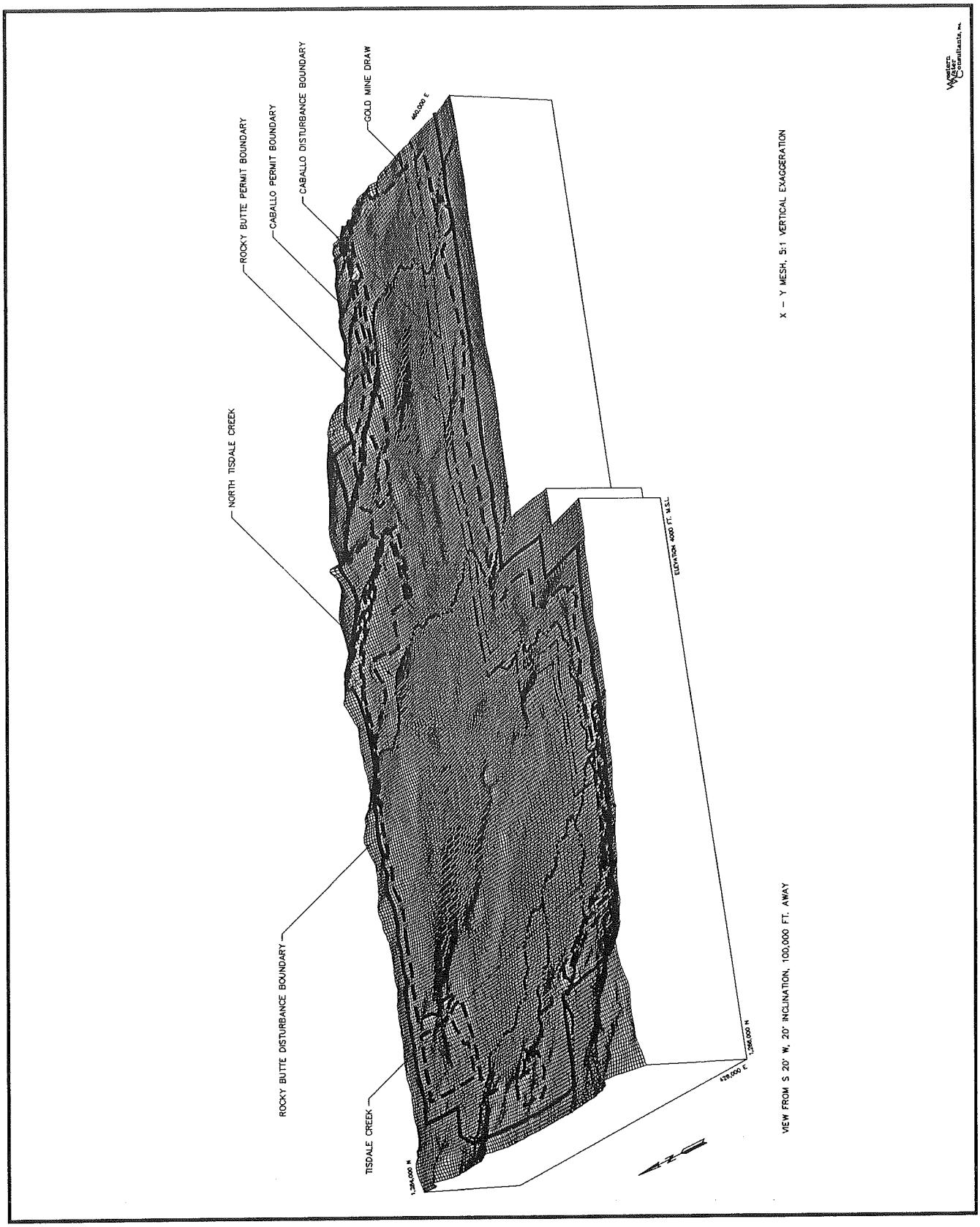

Figure 4–2. Postmining 3–Dimensional Perspective View of Rocky Butte Mine Area

there would be about 1,850 acres of disturbed land, on which reclamation has not been initiated, at any given moment.

Impacts would result from the removal of topsoil and vegetation and from the handling of topsoil. Mining would disturb soil horizons and other soil characteristics that are the result of centuries of soil forming processes. Stockpiling topsoil for several years before it is redistributed would have negative effects on nutrient content, viability of plant seeds, and microbial activity in such topsoils. Some topsoil stockpiles would remain throughout the life of the mine. Erosion from both wind and water would increase on disturbed lands as compared to those same lands prior to disturbance.

Reclaimed soils would be unlike premining soils in texture, structure, color, organic matter content, and chemical composition due to mixing and storage. They would be more uniform in type, thickness, and texture than before disturbance. Dilution of the upper soil horizons by less fertile substratum material would decrease soil fertility. Subsoil material is also very low in organic matter, microbial activity, and major plant nutrients and may have undesirable physical composition. The destruction of soil aggregate structure would occur if heavy equipment was driven over moist soil during reclamation and would result in decreased permeability and infiltration. This would decrease air exchange rates and water holding capacity in the soils and would negatively affect vegetation production.

If all suitable topsoil from disturbed areas is salvaged and replaced uniformly over the disturbed area it would cover that area with about 4.3 feet of topsoil. This would be more than adequate to restore productivity from a soil thickness standpoint. With proper soil handling and reclamation techniques, postmining productivity on the reclaimed area would probably remain about the same as premining productivity, although productivity may change locally because:

- Reclaimed topsoil depths would be more uniform than premining soils.
- Shallow soils and poor soils (such as those with clayey texture or high salinity) would be buried or mixed with other topsoil materials to a more uniform physical and chemical composition.
- Uniformity of soil texture would be increased after mining: clayey or sandy soils and those with well-developed topsoil-subsoil substratum horizons would inevitably become mixed with other materials during handling. Once these soils were redistributed across disturbed areas, soil productivity and soil erodibility would be more uniform.

Replaced topsoil in the permit area should support a stable and productive vegetative cover capable of sustaining planned postmining land uses, which include livestock grazing, cropland, and wildlife habitat. As the vegetation cover becomes reestablished, erosion would not significantly affect productivity.

It is concluded that impacts to the topsoil resource would be moderate, confined to the permit area, and the changes would be long term although productivity would be restored at the end of mining. Because vegetative productivity must be restored as a condition of bond release, the impact of the changes to topsoil is not significant.

4.1.4 Vegetation

Because the proposed mine permit area would be required to be reclaimed to meet state revegetation success standards, long-term impacts to most vegetation types would be negligible. If state shrub reclamation goals are not achieved, moderate to major long-term impacts to shrub communities would result. Additionally, state shrub standards may be inadequate for establishing sage grouse nesting and big game wintering habitats; however, the reclamation plan (Appendix B) would ensure that diverse, productive, and ecologically sustainable vegetation communities are established on reclaimed areas. Postmining communities would be compatible with the proposed postmining land uses of cropland, pasture, grazing land, wildlife habitat, and recreation and would also meet landowner requirements. All riparian vegetation communities would be reclaimed.

A reduction in topographic diversity, due to an overall lowering of the topography and loss of relief during recontouring, coupled with topsoil mixing

would limit vegetative diversity for years after mining. Geomorphic processes and natural succession would slowly create topographic and vegetative heterogeneity, such that permanent impacts to diversity would be minor or negligible.

Construction and coal production operations would cause localized major impacts to vegetation until affected areas were reclaimed. Approximately 1,850 acres of disturbance would exist through the life-of-mine. Impacts associated with the removal of vegetation over this acreage are loss of wildlife habitat, potential for increased soil erosion, and invasion by undesirable plant species. Because it takes several years for reclaimed areas to develop the structure and function of self-sustaining vegetation communities, moderate impacts to vegetation would persist for approximately five years following reclamation (SCS, 1982).

Cropland would be affected more than other types, with approximately 3,752 acres being disturbed during the life-of-mine (Table 3-2). This acreage represents 39 percent of land within the project area. Construction and life-of-mine impacts on agricultural production due to temporary removal of lands from crop production would be minor because agricultural uses will be restored as soon as practical (Section 4.1.14).

There are no known T & E or sensitive plant species within the project area, and therefore impacts to T & E or sensitive plants would be negligible. If any such species are discovered during construction and mining, mitigation measures would be taken immediately to ensure that there would be no adverse impacts to the population (Appendix D).

Major impacts to trees would occur when trees are removed during construction and stripping. During reclamation, all trees would be replaced such that tree density on the project area would be equal to or greater than premining density (one or more saplings established for each tree lost). The presence of saplings in place of full-sized trees would be a moderate impact that would exist in localized areas throughout the life-of-mine.

It is concluded that there would be a moderate, short-term reduction in vegetative diversity within the permit area. Over the long term the diversity would be restored, such that the impacts of this change are not significant.

4.1.5 Water Resources

The incremental impacts to the surface drainage system caused by mining activities at the Rocky Butte Mine will be minor and short term. Two of the primary streams on the mine area, Tisdale Creek and North Tisdale Creek, have already been affected by mining within the adjacent Caballo Mine permit area. The lower reach of North Tisdale Creek near its confluence with Tisdale Creek has been mined through and reclaimed by The Carter Mining Company. Plans for the reclamation of Tisdale and North Tisdale Creeks and the protection of the Gold Mine Draw alluvial valley floor have been approved by the Wyoming DEQ/LQD during permitting of the Caballo Mine. These plans are designed to provide channel and drainage-basin erosional stability compatible with premining conditions. A formal application for a permit to mine containing similar restoration plans is being prepared by NWR for the proposed Rocky Butte Mine. These reclamation plans typically include postmining impoundments to replace existing stock reservoirs. As required by Wyoming DEQ/LQD regulations, the postmining impoundments will be compatible with proposed postmining land uses and the restored hydrologic system.

Impoundments placed on streams and utilized for flood and sediment control must be permitted with Wyoming DEQ/LQD and typically must be dewatered following major runoff events to provide storage space for the subsequent event. The water thus released will be available to meet the needs of any existing downstream water users. Additionally, impoundments used for mining must be permitted with the Wyoming State Engineer's Office. Permits issued by the State Engineer's office are conditioned and administered such that senior water rights are protected. Records of the State Engineer's Office show no adjudicated water rights on Caballo Creek downstream from the mouth of Tisdale Creek (Wyoming State Board of Control, 1990).

Surface water quality would not be significantly affected by mining, based on studies conducted by the USGS for the Belle Fourche River Basin (Bloyd, et al., 1986). Although reclaimed soils may be more

erosive for the first few years after reclamation, the larger sediment production would probably not be delivered to area streams due to sediment deposition as a result of flatter slopes on reclaimed lands and sediment trapping by mandated sedimentation ponds.

It is concluded that the Rocky Butte Mine would cause a minor, short-term reduction in streamflows due to water captured in sedimentation ponds. There would be no long-term surface water impacts due to regulatory requirements for rehabilitation of the drainage system.

The proposed Rocky Butte mining operation would completely remove the Wyodak-Anderson coal aquifer and any Wasatch overburden aquifers from an area of approximately 5,300 acres. The aquifers would be replaced with spoils whose origin is the overburden and interburden strata that are stripped away with the removal of the coal. The physical and chemical characteristics of mine spoils are highly dependent upon the parent material from which they are derived. Data collected thus far from Powder River Basin area mines show that once resaturated with ground water, mine spoils are usually able to provide small yields of ground water of a quality suitable for stock watering purposes. Martin et al. (1988) concluded that the final permeability of the mine spoils will likely be within the range of permeabilities for the undisturbed Wasatch aquifer and the Wyodak-Anderson coal aquifer.

Overall, the permeability of the spoils at the Rocky Butte Mine is expected to fall within the broad range of spoil permeabilities found at the other regional operating mines. The average permeability of the spoils over the west half of the Rocky Butte Mine would be expected to be skewed towards the higher end of the regional range of values because the overburden in these areas is especially sandy. There appears to be somewhat less sand in the overburden of the east half of the permit area, and there the final spoils permeabilities would be expected to fall near the lower limit of the regional values.

Considerable variability does exist in the replaced spoil, as is evidenced by the fact that spoil permeabilities vary by three orders of magnitude at the Gillette area mines. This variability is partially due to the extreme differences in the textures of the overburden materials. Another factor causing hydraulic variability in spoils is the degree to which the spoils are mechanically sorted during backfilling. The mechanical sorting is the process by which large spoil fragments tend to roll farthest down the backfill bench where they accumulate at the bottom of the replaced spoil sequence. The sorting is most pronounced in dragline-cast spoils but is also observed in truck-dumped spoils. In truck-shovel spoils, overall permeabilities are generally lower than dragline spoils because the vehicular traffic of the truck-shovel emplacement causes some spoil compaction. The Rocky Butte Mine will be a combined truck-shovel/dragline operation, with approximately the lower half of the overburden removed by dragline. The product of the mechanical sorting is a spoil aquifer whose porosity and permeability decrease upwards from the pit floor.

Additional variability in spoil hydraulics exists because the geologic strata of the overburden are not completely mixed by the spoil placement process. The spoils would probably contain small zones of higher-permeability sands within a matrix of finer-grained material, similar to the sandstone channels contained in the premining Wasatch overburden.

The types of water that have been observed in resaturated spoils are chemically similar to those found in the premining Wasatch. However, the total dissolved solids (TDS) concentrations of the postmining ground waters are occasionally much larger than is found in the undisturbed Wasatch or Wyodak-Anderson coal aquifers. Ground waters that initially saturate replaced spoils have relatively high TDS concentrations derived from the dissolution of minerals exposed by the breaking up of the spoil materials in the mining and backfilling processes. At the Caballo Mine, average TDS concentrations in spoil ground waters were initially about 4,630 mg/L for the first two years after spoil emplacement, but they declined to 3,750 mg/L four years after spoil emplacement (TCMC, 1985). Some of the principal solutes of concern in these spoil ground waters include sulfate, nitrate and selenium. At other Gillette area mines the average TDS values in spoil ground waters have ranged from 700 to 25,000 mg/L (GAGMO, 1991a). Most spoil wells exhibit TDS values between 3,000 and 6,000 mg/L and, similar to the premining Wasatch aquifer, meet Wyoming Class III standards for use as stock water. The principal

cations in the postmining ground waters are typically calcium, magnesium and sodium, while the predominant anions are sulfate and bicarbonate. Similar to the Caballo Mine, a number of other Gillette area mines have noted that TDS concentrations in their spoil ground waters have declined with time. Using data compiled from ten surface coal mines in the eastern Powder River Basin, Martin et al. (1988) concluded that spoil ground water quality improves markedly after the spoils are leached with one pore volume of water. One pore volume of water is the volume of water which would be required to fill the pore space or saturate the spoils following reclamation. Future postmining ground waters are therefore expected to be of better quality than what is observed today.

There are approximately 53 private water supply wells lying within 5,000 feet of the boundary within which blasting will occur over the life of the proposed Rocky Butte Mine. The closest private well lies some 1,400 feet west of the overburden removal boundary (approximate blasting boundary) of the proposed mine. Within this area the maximum allowable peak particle velocity for ground vibration from surface coal mine blasting is 1.00 inch per second (WDEQ/LQD, 1989). In general, a peak particle velocity below 2 inches per second (in/sec) will not cause damage; major damage will occur at a peak particle velocity of 7.6 in/sec and minor damage at 5.4 in/sec. Many variables, including type and condition of the structure, can affect these values (Pfleider, 1972).

In the coal fields of the eastern United States and in the Powder River Basin as well, there have been occasional instances where water well owners in such close proximity to operating strip mines have complained about the effects of blasting on the performance of their water wells. There is little published data pertaining directly to effects of blasting on wells or ground-water aquifers, and among the documented complaints there has been very little clear evidence that the well problems were blast related. In their studies of complaints of blast damaged wells in Appalachia, Philip Berger and Associates, Inc. (1980, 1982) concluded that natural factors and poor well design and construction practices were most often the factors responsible for changes in well behavior in blasting complaint cases. The authors based their studies on private wells and on a number of test control wells located at operating coal strip mine pits. The authors reported no observable change in well conditions in their tests, even though the maximum ground vibration levels at the wells from blasting were as great as 5.4 in/sec. The 53 private wells that are in close proximity to the Rocky Butte Mine are not expected to be damaged by blasting vibrations. In keeping with the Rules and Regulations of the Wyoming DEQ/LQD (1989), owners of property lying within one-half mile of the Rocky Butte permit boundary are entitled to and may request a pre-blasting survey that includes documentation of the performance and condition of water wells.

Impacts to the sub-coal Fort Union (Tullock) sand aquifers will be limited to drawdown induced by withdrawals from wells. At this time NWR does not plan to complete a well in these sands unless mine water requirements cannot be met by near-surface sources. Under this plan, no impacts to the sub-coal sands would result from the Rocky Butte Mine.

NWR has operated a computer ground-water flow model of the coal and overburden in order to predict the magnitude and extent of drawdowns outside the permit area. The USGS computer model MODFLOW (McDonald and Harbaugh, 1988) was used in this analysis. This model simulates a three-dimensional, multi-layer system such as the coal/overburden complex using a set of finite-difference equations which describe ground-water flow. Vertical leakance between layers is simulated as are discharge and recharge sources.

Approximately 1,160 square miles are included in the modeled area which is shown on Figures 3-4 and 3-5. In order to simulate cumulative coal and overburden water level drawdowns, mining was simulated at the six closest surrounding mine sites in addition to proposed mining at Rocky Butte. Mining was simulated for the Wyodak, Caballo, Belle Ayr, Rojo Caballo, Cordero, and Coal Creek Mines. The permit areas for these operations are shown on Figures 3-4 and 3-5.

Model calibration was verified by comparing predicted 1990 drawdown in the Wyodak-Anderson coal seam to the five-foot drawdown contour reported by the Gillette Area Groundwater Monitoring Organization in its 10-Year Report (Hydro-Engineering, 1991b). This comparison is presented graphically on Figure 4-3. Making this comparison

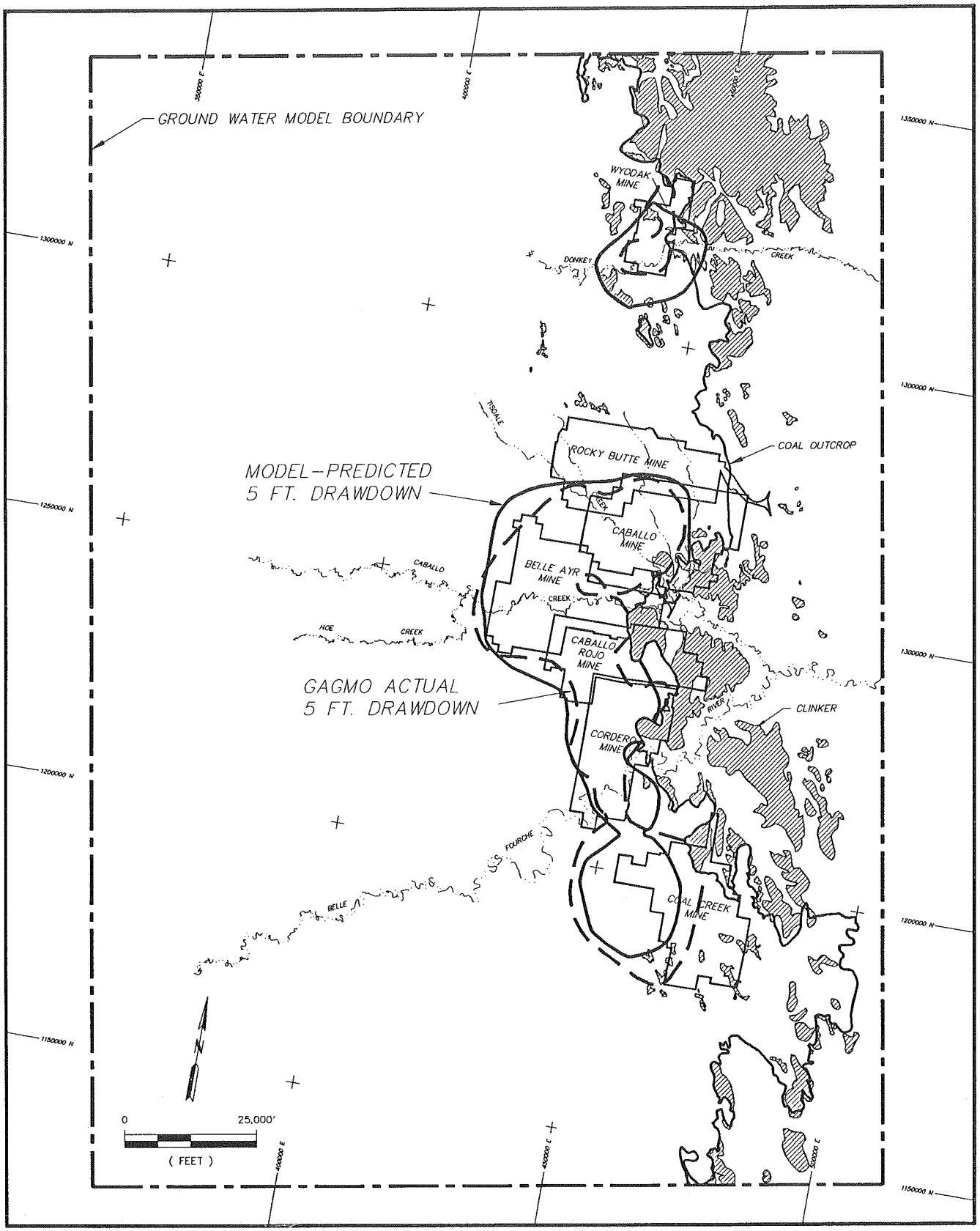

Figure 4-3. Predicted Drawdowns vs. Actual Drawdowns in the Wyodak-Anderson Coal at the End of 1990

reveals very close agreement between predicted and observed drawdown in the Wyodak-Anderson coal seam. In general, the model is conservative since drawdown is slightly over-estimated in most areas. This over-estimation is probably due to local faults, partings and no-coal zones present in the Wyodak-Anderson coal seam but not simulated in the model due to lack of data outside the mine permit area. Geologic features of this type tend to lower the transmissivity of the coal on a regional scale.

The overburden is not a regionally extensive aquifer like the coal seam (refer to Section 3.5). Aquifers in the Wasatch Formation are characterized as discontinuous sand channels separated by shales and claystones of low permeability. For this reason, and since the modeled overburden drawdown is of much smaller extent than that in the coal, no attempt was made to compare the model-predicted drawdowns to the observed drawdowns for the overburden.

NWR operated its predictive model to simulate mining at each of the six mines mentioned above while excluding the proposed operations at Rocky Butte. The predicted extent of drawdown for this situation as represented by five-foot drawdown contours in the coal and overburden are presented on Figure 4-4.

The procedure was repeated with the Rocky Butte Mine included. The resulting five-foot drawdown contour for both the Wyodak-Anderson coal seam and the Wasatch overburden is presented on Figure 4-5. By comparing this figure to Figure 4-4, the approximate impacts due to the proposed Rocky Butte operation alone can be determined. Figure 4-4 can be considered the expected drawdown under the No Action Alternative for this EIS. For purposes of comparison, the five-foot drawdown contour predicted by the USGS in its CHIA study (Martin et al., 1988) of the Powder River Basin is also presented on Figures 4-4 and 4-5. With or without the Rocky Butte Mine, the extent of the 5-foot drawdown contour is similar to or less than the maximum extent shown in the CHIA.

As a requirement to obtain a permit to mine, the applicant must compile a list of all water rights within three miles of the permit area. One hundred fourteen wells recorded with the Wyoming State Engineer in this area have reported completions in the overburden. An additional 24 permitted wells are reportedly completed in the Wyodak-Anderson coal within this limit. Coal wells lying within one mile of the permit area would undergo significant drawdowns possibly to the point of complete dewatering near the pit limits. Similarly, the overburden aquifer would experience significant drawdowns within one mile due west and northwest of the permit area. In all other directions only those overburden wells within 2,000 feet of the permit boundary are likely to observe mining-induced drawdown. Drawdowns will reach a maximum as mining makes its closest approach to each well. However, water levels will likely stabilize or even recover after that time.

Severity of water-level drawdowns depends upon amount of drawdown relative to amount of available drawdown. There are no guidelines that stipulate how much drawdown is acceptable for any given location. All coal mining companies are required to install wells to monitor drawdowns from their operations. All mining permittees are required to commit that the operator will replace the water supply of an owner of a well that is affected by contamination, diminution or interruption resulting from the mining operation. If an owner of a water-supply well believes that his or her well has been impacted by a mining operation, the owner can file a complaint and pay a $100 fee to the State Engineer. The State Engineer's Office will then assemble available data, including well construction information and water-level monitoring data collected by the mine operator and submitted to WDEQ/LQD, and make a determination as to the amount of damage, if any, and the cause. If the State Engineer's Office determines that mining has impacted the well to the point that historic, beneficial uses are no longer possible, the mine operator would be required to take steps to correct the situation. The mine operator could be required to deepen a well, lower a pump or even drill a new well in a deeper, underlying formation (most likely the sub-coal Fort Union Formation).

During mining, the mine pit acts like a big well, and flow directions in the surrounding aquifers are down-gradient toward the pit. Thus there is no mechanism for contaminants to migrate away from the pit. The water which seeps into the pit must be dealt with in order that it does not interfere with mining operations. Typically, the water is collected

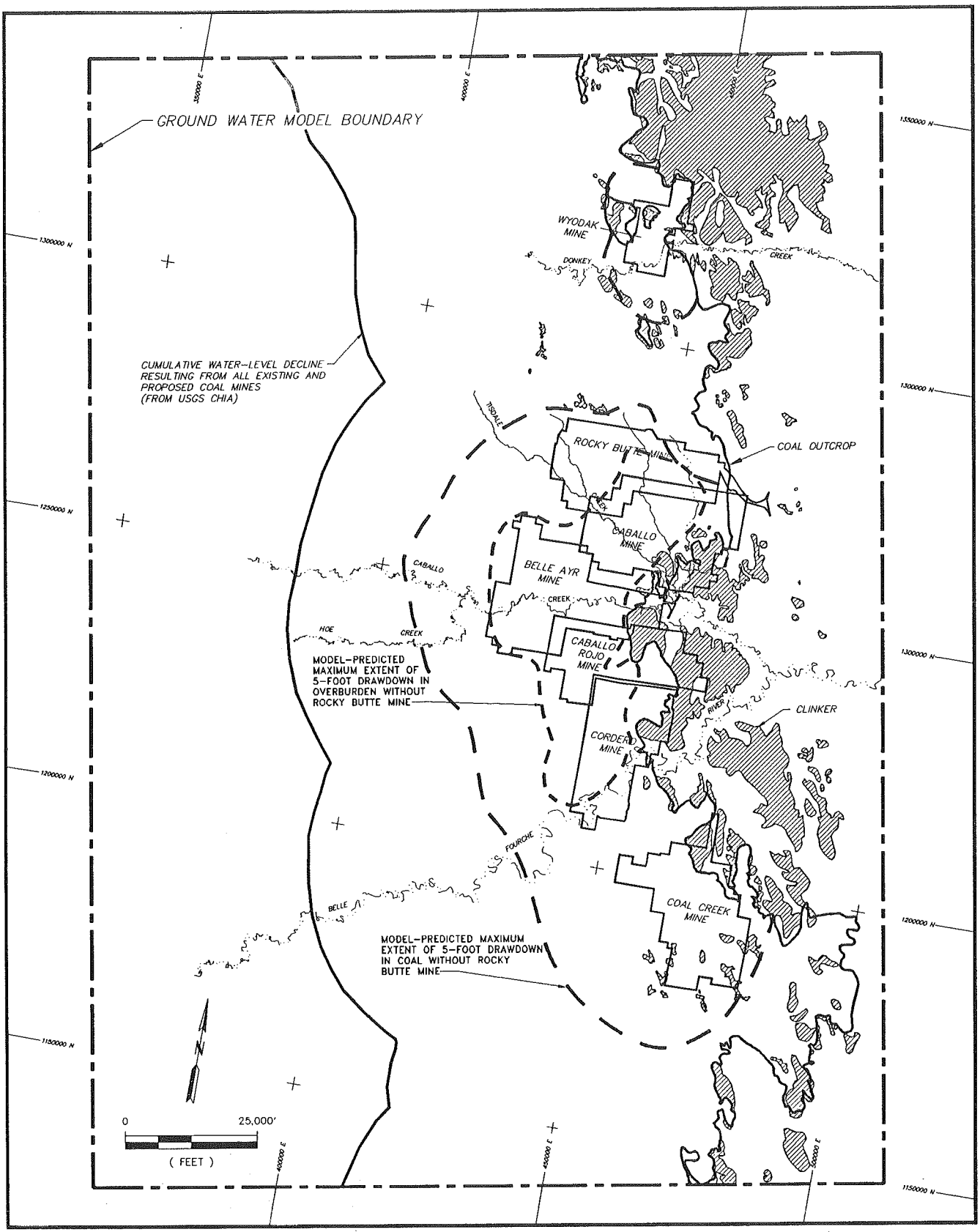

Figure 4-4. Model-Predicted Maximum Extent of Drawdown in Coal and Overburden Without Rocky Butte Mine

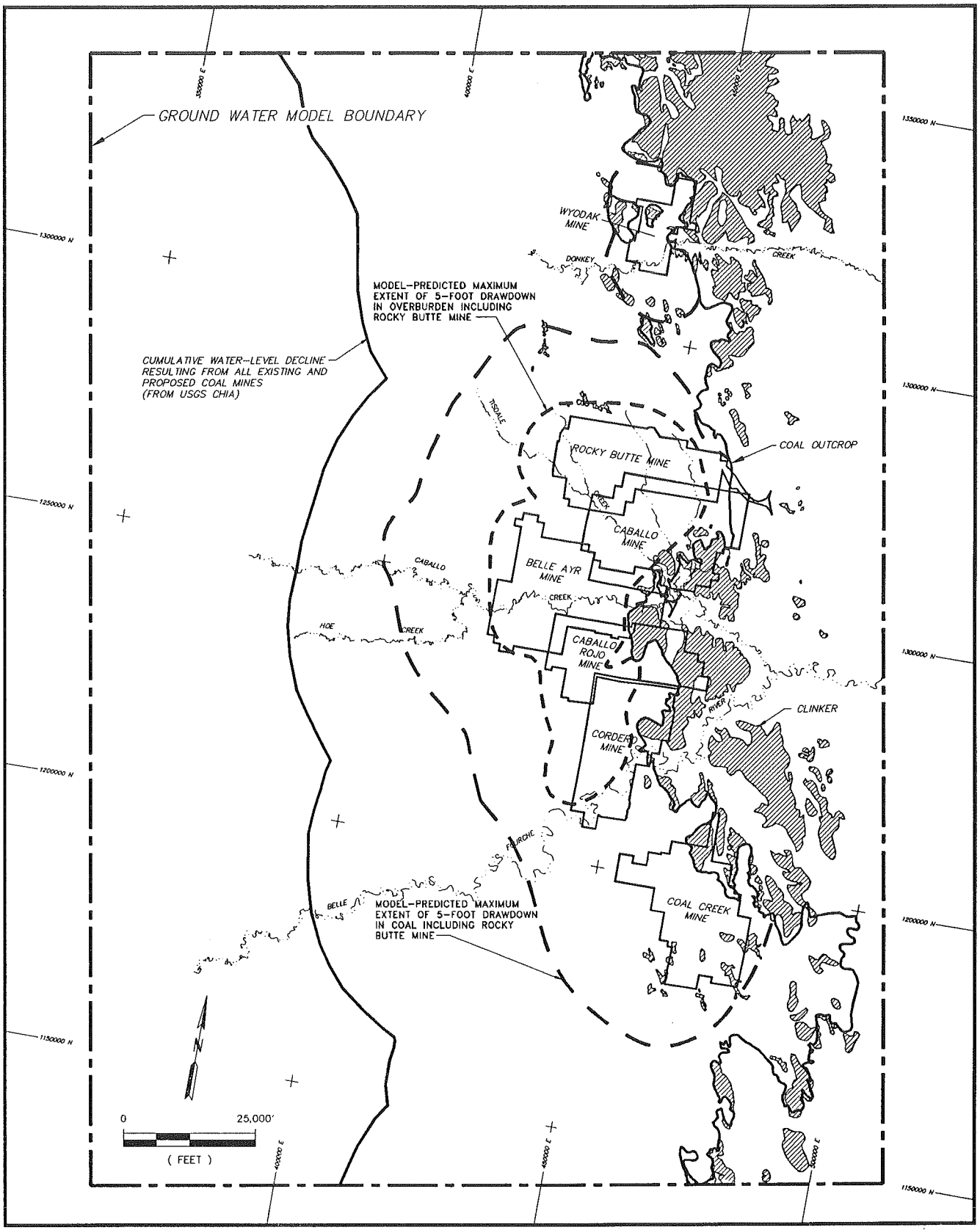

Figure 4-5. Model-Predicted Maximum Extent of Drawdowns in Coal and Overburden With Rocky Butte Mine

in a sump on the pit floor and pumped to a settling pond to remove suspended solids. Much of the water is used for beneficial uses such as dust control. Water in excess of that needed for operations may be discharged subject to effluent limitations under the National Pollutant Discharge Elimination System. The water is a combination of overburden and coal water (refer to Section 3.5.2), and after conventional settling should pose no threat to surface waters (if discharged) or to ground waters (if it percolates downward from a settling pond to the water table).

Where extensive saturated sands are encountered in the overburden, such as those in the west half of the Rocky Butte property, dewatering wells may be installed in advance of mining to reduce pit inflows and promote highwall stability. The disposition of water from dewatering wells would be the same as that for pit inflows, except that it would not require treatment for suspended solids removal.

It is concluded that impacts from mining-induced drawdowns are minor since they must be mitigated by the operator if a water user is injured. Water levels in surrounding areas will not recover until sometime after mining ceases, and therefore this is a long-term impact. Within the mine area the coal aquifer and any overburden aquifers will be removed and replaced with spoil materials. Wells within the mine area which are completed in these zones will be destroyed by mining, but there is no impact from this since the need for the wells (i.e., stock or domestic water supplies) is also removed during mining. Abandoned wells and drill holes in the pit area that are not totally removed by mining must be capped and sealed according to State statutes (W.S. 35-11-404) to ensure aquifer separation. The wells used to define the ground-water hydrology of the permit area or to provide water for mining activities must be sealed according to State Engineer and WDEQ procedures. If the land owner desires the use of some of the wells, the mine operator may request the transfer of use at the end of their mining usefulness.

In time, the spoils will become saturated and the ground-water flow system will be reestablished. At least the first pore volume of water in the spoils will be elevated in dissolved constituents and will probably not be acceptable for uses other than stock water. The first water to flow out of the spoils into the surrounding aquifers may temporarily degrade the water in these aquifers, particularly the coal. This effect should be temporary, although long-term, and there are some indications that conditions exist in the coal to reduce some of the dissolved constituents (Martin, et al., 1988, p. 93). In time, the soluble constituents will be leached out and a new equilibrium water quality will be established. This reduction in water quality will be long term but is a moderate impact since alternative sources of water are available.

The mining companies have no obligation to construct water-supply wells in the replaced spoils, but they are required to construct monitor wells to enable evaluation of water levels and water quality in the backfill. As water levels recover in the spoils after mining, the occupants of the land at that time may construct water-supply wells in the spoils. The EPA considers any ground water containing less than 10,000 mg/L TDS as a potential drinking water source. The backfill water is expected to meet this criterion, and should be suitable for livestock water without treatment.

Mining does not directly affect aquifers in the Fort Union Formation below the coal. Most of these aquifers are in the Tullock Member of the Fort Union Formation and are hydraulically isolated by the Lebo Confining Layer (refer to Section 3.5.2).

4.1.6 Alluvial Valley Floors

The mine permitting regulatory authorities (state and federal) have not yet formally declared whether or not there are any AVFs within the Rocky Butte Mine. However, within the proposed permit boundary of the Rocky Butte Mine the streams all appear to be hydrologically insignificant and are similar to areas approved for mining downstream. Therefore, it is doubtful that any portions of them meet the statutory criteria of an AVF.

Streamflows in Tisdale Creek, North Tisdale Creek and Gold Mine Draw at the Rocky Butte Mine will be diverted around the active mining areas in temporary diversion ditches or captured in flood-control reservoirs above the pit. If flood-control impoundments are used, it will be necessary to evacuate them following major events to provide space for the subsequent flood. Consequently,

disruptions to streamflows which might supply downstream AVFs are expected to be negligible. Ground waters intercepted by the mine pits will be routed through settling ponds to meet state and federal quality criteria, and the pond discharges may actually slightly increase the frequency and amount of flows in these streams. Dry Donkey Creek will be temporarily impacted with the construction of the railroad spur. The upper reaches of this stream channel and its tributaries may be diverted in ditches around the spur, and in some areas the flows will be conveyed beneath the spur through culverts. These changes to the natural system will cause temporary increased sediment yields. The effect will be minor during the construction phase of the railroad and negligible thereafter.

Studies have shown that there is an absence of saturated alluvium within the Rocky Butte Mine permit area. There is no evidence of stream base flows sustained by ground-water contributions. There is no evidence of subirrigation outside of the stream channels themselves, and the agricultural productivity of the valley floors is not significantly better than the upland areas.

It is concluded that no AVFs will be impacted by the Rocky Butte Mine pending a final determination by Wyoming DEQ/LQD.

4.1.7 Fish and Wildlife

Although 27 of the approximately 35 ponds and all ephemeral drainages occurring on the project area would be temporarily removed and/or relocated during the life of the mine, no impacts to fisheries are anticipated from the proposed mining operation because no known fisheries exist on the area.

Approximately 3,165 acres of native habitat (i.e., 2,154 acres sagebrush, 959 acres grassland, and 52 acres riparian) and 3,752 acres of cropland (primarily hay species), the primary habitats used by pronghorn antelope and mule deer on the project area, would be disturbed during the life of mine (Table 4-2). This represents 1.1 percent of the 650,000 acres of pronghorn habitat and 0.2 percent of the 1,968,000 acres of mule deer habitat in the Hilight and Thunder Basin herds, respectively. Additionally, topographic moderation would reduce habitat diversity and result in the conversion of winter/yearlong range to summer range until shrubs become established. Reclamation, including the establishment of palatable forage species, would begin approximately six years after project initiation (Appendix B), allowing no more than about 1,850 acres to remain disturbed at any one time over the life of the mine. Young grasses, forbs, and shrubs present on the newly reclaimed areas would provide forage for antelope and mule deer while mining operations continue elsewhere on the area.

Since no crucial habitat for the Thunder Basin mule deer herd exists within the project area and herd populations are near current WGFD objectives, impacts to mule deer populations resulting from the proposed project would be minor. Impacts to pronghorn antelope of the Hilight herd resulting from the conversion of winter/yearlong range to primarily summer range would result in a moderate to major long-term impact until shrubs become established. Greater mortality would likely result from increased road kills due to increased traffic levels. Animals in the disturbed areas would likely be temporarily displaced to suitable habitats adjacent to operations for the life of the mine. Minor impacts are also anticipated for antelope and mule deer in the Pumpkin Buttes herds due to increased competition caused by displaced animals moving off the project area. Additionally, if hunting on the proposed permit area is prohibited, the area may be used as a refuge by pronghorn antelope and mule deer, making adequate harvest levels difficult and increasing the likelihood of large winter die-offs.

Impacts to white-tailed deer are expected to be minor over the life of the mine since no WGFD designated white-tailed deer range exists on the project area, and only 52 acres of riparian habitat (i.e., habitat in which white-tailed deer were most frequently observed) is present (Table 4-2). Those white-tails that do occur on the area would likely be displaced to suitable habitats adjacent to operations. White-tailed deer may utilize newly reclaimed riparian areas as such areas are established (Appendix B). Minimal increases in mortality (i.e., road kills) resulting from increased traffic may occur as a result of the proposed operation.

Impacts to raptors resulting from the proposed project would be moderate in intensity and remain for the life of the mine. Six raptor nests would be removed within the disturbed area (Table 4-2), five of which were active in 1991. Four additional nests

within 0.25 mile of the project area may also be unsuitable for use by some raptor species; however, species such as golden eagle are known to be tolerant of mining operations as shown by their nesting on highwalls within active pits (Mariah Associates, Inc., 1988a, 1988b). Increased mortality of raptors may also result from traffic fatalities and/or power line electrocutions and collisions. Mitigation measures have been designed to minimize these hazards (Appendix D).

Approximately 1,850 acres (Table 2-1) would, at any point in time, be unavailable as hunting and foraging habitat for some raptors (Table 4-2); however, many raptors will continue to use areas of active mining (Phillips and Beske, 1990). As lands are reclaimed and small mammals and birds reinvade these areas, greater numbers of hunting and foraging raptors would be expected to again utilize these sites. Mitigation measures designed to lessen impacts to raptors (e.g., raptor monitoring plan [Appendix D]) would reduce negative impacts resulting from the proposed project.

The proposed mining activity would have major, long-term impacts to sage grouse on the project area resulting from the loss of sage grouse leks (Table 4-2) and associated nesting and brood rearing habitats. Studies conducted in 1979 and 1980 on western and northeastern portions of the project area indicated that the two historic leks on the project area, as well as the historic lek occurring within the two-mile buffer (Figure 3-8), were not active (Harner-White Ecological Consultants, 1980). Additionally, breeding birds have been known to relocate if leks are disturbed and other suitable habitat exists nearby. Project impacts to sage grouse would last until sagebrush of adequate density and height becomes reestablished (approximately 10 to 20 years) (Appendix B). These impacts would result primarily from the loss of nesting , brood rearing and foraging habitat. Some additional mortality may also result from traffic accidents; however, mitigation designed to reduce these impacts would keep fatalities at minimal levels (Appendix D).

Table 4-2. Acreage of Life of Mine Disturbance Within Wildlife Habitats on the Proposed Rocky Butte Mine, Campbell County, Wyoming, 1991.

Species	Total Occupied Area (Acres)	Area of Occupied Habitats on the Project Area (Acres)	Acreage of Disturbance Within Occupied Habitats on the Project Area (Acres)	Percent of Habitat Loss on the Project Area[9]	Percent of Habitat Loss Within Area of Occupancy[9]
Pronghorn Antelope	650,200[1]	8,958[2]	6,917	77.2	1.1
Mule Deer	1,968,000[3]	5,555[2]	4,269	76.8	0.2
White-tailed Deer	332,900[4]	66[5]	52	78.8	<0.1
Raptors	45,120[6]	9,647[7]	7,333	76.0	16.3
number of nests	27	8	6	75.0	22.0
Sage Grouse	23,726[8]	5,996	4,347	72.5	18.3
number of leks	6	2	2	100.0	33.3

[1] Hilight herd unit.
[2] Includes native and cropland vegetation types.
[3] Thunder Basin herd unit.
[4] Thunder Basin herd unit and riparian habitat on project area.
[5] Includes riparian vegetation.
[6] Includes project area and two mile buffer per WDEQ guidelines (1987).
[7] Includes entire project area.
[8] Area within two miles of lek centers on project area and two mile buffer.
[9] Maximum effect for life-of-mine.

No impacts are anticipated for sharp-tail grouse since they have not been observed on the project area. Impacts to mourning dove are expected to be minor since their numbers are relatively low and sufficient suitable habitat for the species exists outside the project area. Dove utilization of shelterbelts and other sites with trees on the project area would be interrupted until trees become reestablished on the area (approximately 10 to 20 years). Impacts to MBHFI vary from none for species not occurring on the area to moderate for nesting species. Impacts would result primarily from the loss of nesting and foraging habitat for the life of mine on no more than approximately 1,850 acres in any one year. Species which would likely be unaffected by the project are canvasback, whooping crane, Lewis' woodpecker, and dickcissel. MBHFI for which impacts could be minor (i.e., loss of foraging areas primarily during migrations) are white pelican, double-crested cormorant, bald eagle, osprey, American peregrine falcon, prairie falcon, Richardson's merlin, sandhill crane, mountain plover, and long-billed curlew. MBHFI for which impacts could be moderate (i.e., loss of nesting habitat) are ferruginous hawk, golden eagle, and burrowing owl.

Reclaimed areas would likely be used by most MBHFI foraging on the area soon after vegetation establishment, and additional mitigation designed for nesting species would further minimize impacts on these species. Increased mortality from traffic accidents (all MBHFI) could result from proposed activities, as could increased mortality from collisions (MBHFI raptors and cranes) and electrocutions (MBHFI raptors) resulting from powerlines. Appendix D discusses mitigation designed to alleviate these potential problems.

No impacts are anticipated for black-footed ferret from the proposed Rocky Butte Mine since no suitable habitat for the species is present. Minor impacts for bald eagles could result from the loss of foraging habitat on the project area for eagles wintering at the Belle Fourche roost and for migrating peregrine falcon. These impacts would last only for the duration of mining operations; however, continuous reclamation of mined areas would make many areas available for hunting and foraging by these species prior to cessation of mining operations.

No impacts are anticipated for State sensitive wildlife species; there have been no recent reports of these species on the project area and adjacent two-mile buffer (personal communication, Robin Jones, Nature Conservancy, 1991). Impacts to WGFD priority bird species including burrowing owl, ferruginous hawk, mountain plover, and long-billed curlew have been discussed above. Mountain plover, a candidate species for federal T & E listing, has not been observed in the area (Oakleaf et. al. 1991), and the USFWS has not identified it as a concern (personal communication, Ron Starkey, 1991). Upland sandpiper, also identified as a priority species by the WGFD (personal communication, Sharon Ritter, 1991), may occasionally breed on the area and could be moderately impacted over the life of mine. Mitigation for T & E and State sensitive/priority species is discussed in Appendix D.

Impacts to other wildlife species occurring on the area range from minor for highly mobile species that do not breed in the area (e.g., coyote, migrating birds), to moderate for breeding species and relatively sedentary species (e.g., red fox, numerous small mammal species, breeding birds). Impacts would remain for the life of the project and until habitat diversity is restored through reclamation and successional processes.

Predator species occurring on the project area would likely be displaced to suitable adjacent habitats during mining operations. Coyote and bobcat (i.e., nonbreeding species) would receive minor impacts, whereas red fox, badger, and striped skunk (i.e., breeding species) would receive moderate impacts. Increased mortality may result from increased competition for food in adjacent areas and increased mortality due to traffic.

Impacts to lagomorphs and other small mammals occurring on the area would also be moderate over the life of the mine, with increased mortality likely resulting during construction and mining operations and from increased road kills. Nongame birds and waterfowl known to breed on the project area would also suffer moderate impacts from the loss of nesting habitat for the life of the mine. As habitats are replaced these species can be expected to return to the area (Appendix B).

4.1.8 Historical, Archaeological, and Paleontological Resources

A total of 59 cultural resource sites have been inventoried within the Rocky Butte lease area and adjacent areas in which proposed developments may take place. These sites are about evenly divided between historic (26 sites) and prehistoric (29 sites); another four sites are multicomponent with both historic and prehistoric occupations.

Of the total, nine are believed eligible for the NRHP. Seven of these sites may be directly affected by the proposed undertaking. The affected sites include five prehistoric and two historic sites. The prehistoric sites include the probable Paleoindian complex (Sites 48CA2707, 48CA2708, and 48CA2723) which could prove to be quite important and one site (48CA472) that has been partially excavated (Hauff and Eckles 1982). Only the latter site, however, has been fully evaluated. All five sites potentially contain important excavation and research potential and are believed eligible under NRHP Criterion D. The two historic sites include an historically important road (Site 48CA2694) believed eligible under Criterion A and a twentieth century homestead/ranch (Site 48CA1974) believed eligible under Criterion A. The other known cultural resources are believed not to be significant.

The effects on the potentially eligible prehistoric and historic sites resulting from the proposed mine are complete destruction due to surface strip mining excavation and construction of the proposed railroad spur. These impacts would constitute adverse effects in the Section 106 process as defined by the Federal Criteria of Effect (36 CFR 800.8) and Criteria of Adverse Effect (36 CFR 800.9).

Impacts to cultural resources cannot be permitted. Sites which cannot be avoided must be mitigated in accordance with procedures discussed in Appendix D.

Potential impacts to paleontological resources consist of losses of vertebrate, invertebrate, and paleobotanical fossils of importance to scientific research. The losses would result from destruction, disturbance or removal of fossil materials as a result of coal mining activities, unauthorized collection, and vandalism. A positive impact of coal mining activities would be the exposure of fossils for scientific examination and collection which would otherwise not occur except as a result of overburden excavation and exposure of fossiliferous geologic strata.

No impacts to known significant paleontological resources are expected as a result of coal mining activities. However, there is potential for buried paleontological resources in the Eocene Wasatch and Paleocene Fort Union formations underlying the mine permit area.

4.1.9 Recreation

Game harvest on the proposed Rocky Butte Mine could be lost during the life of mine if the area is closed to hunting. However, access to the proposed permit area is currently controlled by private landowners and hunting on the area could be closed at any time. Since postmining reclamation and succession would eventually restore wildlife habitat to premining conditions, all impacts to this land use are considered minor, lasting until wildlife habitats have become reestablished (Appendix B).

During the years 1994 through 2004, mine pits, with associated stockpiles, are proposed for western portions of the Rocky Butte project area where indeterminant amounts of wildlife observation take place from Wyoming Highway 59. Until reclamation restores wildlife habitat sufficiently to support pronghorn antelope and other visible wildlife species (Appendix B), this recreational resource will be lost. However, impacts are expected to be minor over the life of mine, since no rest areas/observation points currently exist along Highway 59 near the Rocky Butte site.

4.1.10 Air Quality

Adding a sixth mine to the existing group of five mines south of Gillette would increase particulate concentrations in the vicinity of the proposed mine during the operating life of the new mine. The amounts and patterns of increase would vary as the mining proceeded. Insignificant amounts of other regulated atmospheric pollutants, sulfur oxides, sulfuric acid mist, sulfation, hydrogen sulfide, photochemical oxidants, hydrocarbons, nitrogen

oxides, fluorides and carbon monoxide would be generated.

Modeling indicates maximum particulate emissions from mining activities would occur in year 7 of the mine plan. Calculated PM_{10} concentrations for that year show the contribution from the proposed Rocky Butte Mine falling below the significance level, 1 $\mu g/m^3$ annual arithmetic mean, at a radius of approximately 10 kilometers. A plot of isoconcentration lines for year 2001, mining year 7, is shown in Figure 4-6. At the Boundary of the Lands That are Necessary to Conduct Mining Operations, hereafter referred to as the Boundary and coincident with the proposed Rocky Butte Mine permit boundary, a maximum contribution of 9.8 $\mu g/m^3$ was calculated for mining activities in year 2001. Calculations for year 2009, mining year 15, indicated concentrations up to 13.0 $\mu g/m^3$ may be generated when mining proceeds close to the Boundary.

When the background PM_{10} and emissions from the five neighboring mines to the south are added to the calculated emissions from Rocky Butte Mine, the maximum concentration along the Boundary, excluding that part of the Boundary contiguous with Caballo Mine, is 28.7 $\mu g/m^3$ in the year 2001. The corresponding value for the year 2019 is 33.7 $\mu g/m^3$. In both cases the PM_{10} concentration would be below the State and Federal standard of 50 $\mu g/m^3$, annual arithmetic mean.

Lands within the Boundary would not be accessible to the general public. Consequently, that area is not subject to State air quality standards. Instead, emissions in that area are governed by MSHA respirable dust regulations. In 2001 Rocky Butte Mine operations would be relatively near Caballo Mine operations, and the major emission sources from the two mines would be roughly aligned with the prevailing winds. The result would be high concentrations of PM_{10} near the mining operations and along the contiguous boundary. When either the proposed Rocky Butte Mine or Caballo Mine is considered alone, neither mine generates enough PM_{10} emissions along the common boundary to cause a violation. Hence, even though the combined maximum, 53.3 $\mu g/m^3$, is greater than the ambient air standard of 50 $\mu g/m^3$, both mines meet the standard.

The State of Wyoming no longer requires short term air quality modeling for a permit application, contending the results are not meaningful. Nevertheless, compliance with the State 24-hour TSP and PM_{10} standards of 150 $\mu g/m^3$ must be demonstrated by the required air quality monitoring program. Non-mining sources, such as agricultural and oil field disturbances can contribute to high 24-hour particulate concentrations. One exceedence of the 24-hour standard is allowed per year.

PM_{10} impacts would be moderate within the Boundary during the mine operations. Exceptions would be areas in close proximity to operations. These areas may be impacted heavily for a number of years while the mining operations are nearby. Outside the Boundary, impacts would be minor. In the long term, impacts from PM_{10} emissions from Rocky Butte Mine operations would be negligible. Impacts on neighboring mines would be moderate for the adjoining Caballo Mine and diminish to insignificant levels within the Belle Ayr Mine. Operations are scheduled to be ending in the neighboring mines from 2009 through 2025 resulting in a gradual decline in PM_{10} concentrations in the region during that period. In general, if the proposed Rocky Butte Mine is constructed, the Eastern Powder River Basin air quality will be decreased in the immediate vicinity of the proposed mine, but will still continue to meet Federal and State standards.

4.1.11 Visual Resources

Alterations in the natural character of the landscape due to mining and associated activities would change the Visual Resource Management classification of the proposed permit area from the existing Class IV to Class V and require rehabilitation to bring it back to the more stringent classification. The primary factors affecting this reduction in visual resource value include the mine pit, service and haul roads, overburden piles, and structures such as powerlines, offices, warehouses, and, especially, facilities to crush, handle, and load coal, including the silos and a new railroad spur. The movement of haul trucks and loaders across the landscape would also change the character of the area from premining status. The visual impact of the coal loadout facilities and large stockpiles could be considered major by nearby residents and travelers on local public roads during the life of mine.

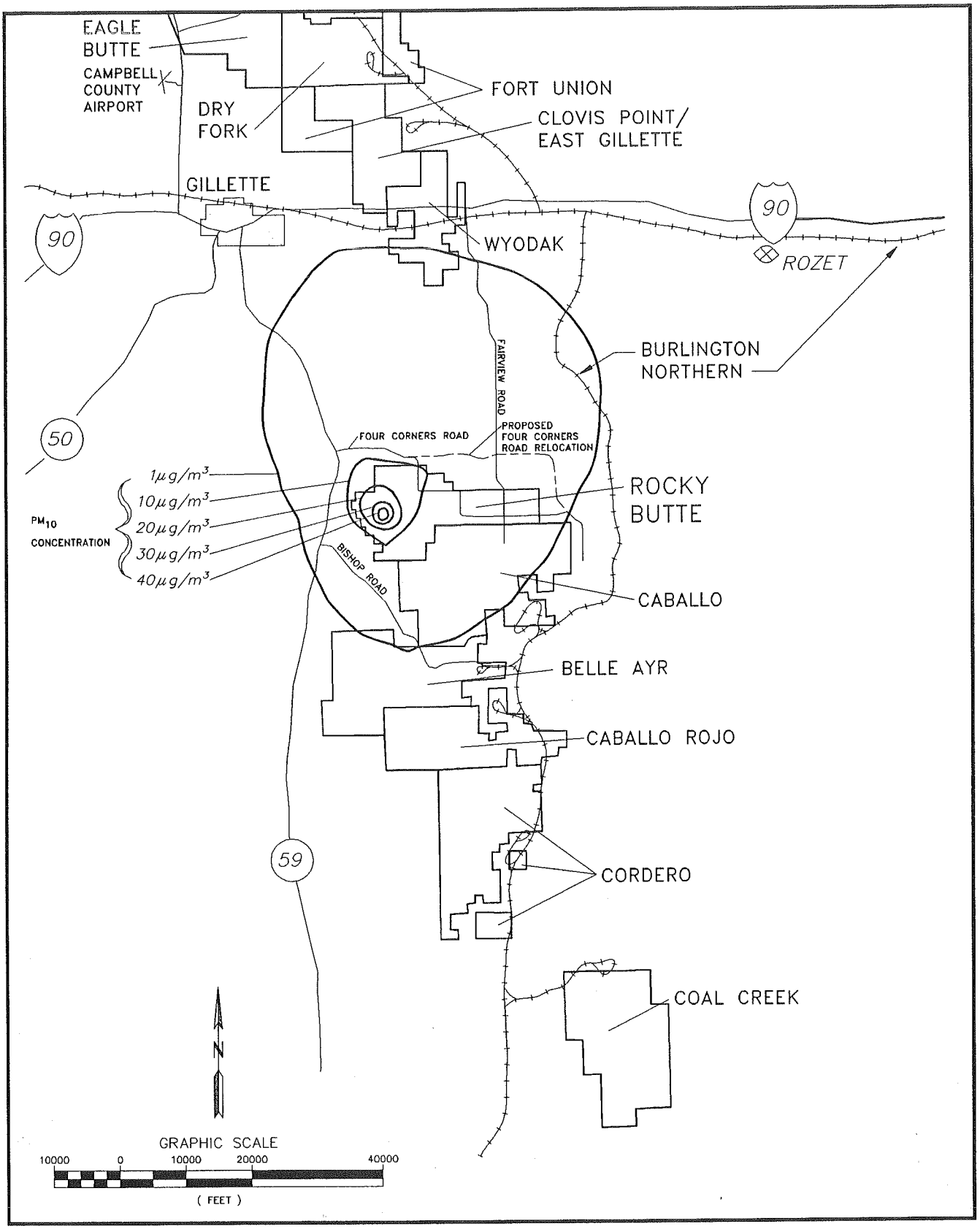

Figure 4–6. Isoconcentration Lines of PM_{10} Emissions Generated from Planned Rocky Butte Mine Operations in Year 2001

Reclamation and cessation of mining would restore the landscape to a scenic quality similar to the premining quality for the seven factors on which scenic quality is determined: landform; vegetation; water; color; adjacent scenery; scarcity; and cultural modifications. Premining evaluations of these factors resulted in each receiving the lowest possible score in the rating system except for landform and cultural modifications which were awarded intermediate values (Appendix C). Sensitivity levels would not be expected to change, nor would visual distance zones, so the management class would return to the premining Class IV after reclamation.

4.1.12 Noise

Ambient noise levels are believed to be in the 40 to 70 decibel range, depending upon location within the property with respect to Highway 59 and to Caballo Mine operations. The noise level in the immediate vicinity of mining operations is in the range of 85 to 95 decibels. The psychological property of sound called *loudness* is intimately connected with the *intensity* of a sound wave. For a pure tone of given frequency, loudness increases with increasing intensity, but in general the relation between the loudness of a sound and its intensity is not simple. Loudness cannot be measured in physical terms, since it depends on the ear and judgement of the individual observer.

Using intensity as an indicator, it is possible to estimate approximately the distance one would have to be from a sound source of 100 decibels in the mine area to have the sound reduced to ambient levels. This estimate is based on the fact that energy is inversely related to the square of distance and that the logarithm (base 10) of the ratio of two sound intensities is called the difference in intensity level, or *bels*. Ten times this logarithm is called the difference in intensity level in decibels, and this difference is ordinarily used to compare intensities of two sounds. A sound 10 times as intense as another has an intensity level 10 decibels (db) higher. A sound 100 times (10^2) as intense as another has an intensity 20 db higher. Thus a sound of 100 db has an intensity level one million times (10^6) higher than a sound of 40 db. If the 100-db sound is measured, say, 10 feet from the source, the sound intensity would be reduced to 40 db at a distance of about 10,000 feet (1.9 miles) from the source, assuming no attenuation of the sound. In other words, the sound of 100 db at 10 feet from the source would be reduced to near ambient levels within 10,000 feet from the source. Thus, residents of homes more than 1.9 miles from the active mine area would be unlikely to hear the sounds of the mine above ambient sound levels. There are several occupied homes closer than this distance from the mine. The nearest residence is only 500 feet from one mine activity, the construction of a topsoil stockpile during the first year of pit construction. This residence is also within 500 feet of Highway 59 and so has a higher ambient noise level than is normal for the region. Assuming that there is a sound level of 90 db measured 10 feet from the highway, the sound would be reduced to about 56.6 db at a residence 500 feet from the highway. Since the highway is a part of the existing environment for this particular residence, the 56.6 db may be considered the ambient noise level for this residence. If the construction of the topsoil pile imposes a sound source of 100 db at the same distance from the house as the house is from the highway, the new noise source would be reduced to 66.6 db at the residence. This is 10 db higher, or 10 times as intense, as the calculated ambient level. According to Table 3-7, this would place the noise level at the house at between the "quiet" and "nuisance" level.

Once the stockpile is built, sound levels at this residence would be reduced as the distance from the residence to actual mine activities increases. The presence of the overburden and topsoil stockpiles, once built, could help attenuate noise effects by deflecting and absorbing sound waves from the mine. All the calculations above neglect the effects of attenuation of sound waves.

Based on these calculations and assumptions, it is concluded that the six residences along the northwest and west sides of the Rocky Butte Mine would experience increased noise levels during certain periods of the mining operation. These noise levels would be increased most notably during the earliest and latest years of the operation, when an overburden stockpile and topsoil stockpile are built and then removed. The noise levels at the residences from those operations could reach the lower limit of what is generally considered the nuisance level. This impact could be of moderate significance for the nearest two or three residences for periods of up to a year or more during the life of the mine.

With proper design and operation procedures, blasting will not cause unacceptable noise levels. The blast itself occurs within the overburden or coal where the sound is muffled by the material being blasted and by stemming (replaced drill cuttings) in the blast holes. Historically, the major source of noise in blasting has been from detonator cord on the surface. Recently, noise reduction from blasting by 50 percent and more is possible with the use of noiseless non-electric initiation systems. With this system and proper care, noise from blasting is reduced to a very tolerable level (Doug Emme, personal communication, May 19, 1992).

4.1.13 Transportation Facilities

Construction and operation of the proposed Rocky Butte Coal Mine could induce increases in both rail and highway traffic in and around the Gillette area. Minor increases in air travel could be expected from increased business and social travel. In general, minor to moderate increases in congestion, noise and probability of accidents would result.

At full production, the proposed Rocky Butte Mine would add 30 to 31 round trips per week over the Orin-Gillette branch line using the present railroad rolling stock, or about a 10 percent increase in unit train traffic. Because the Rocky Butte Mine spur would be less than 10 miles from the Gillette main line, it is likely most of the resulting increased train traffic would use that line. From the mine location the train traffic radiates to points-of-use. Impacts from railroad operations would be greatest near the proposed mine, but would occur along the entire routes of the coal shipments. The 10 percent increase in train traffic is considered minor.

Highway traffic accidents and delays at grade crossings have been identified as the most severe problems resulting from train traffic. For those communities which straddle the railroad lines, intermittent isolation of parts of the community may result, particularly where grade-separated crossings are not available or are inadequate. Inconvenience and delays in the delivery of essential community services may result (OSM, 1988). If train traffic increases, these problems would be aggravated. In addition, increased noise and decreased air quality along the railroad routes could be expected.

Both the Gillette main line and the Orin-Gillette branch line have sufficient capacity to handle the projected increase from the proposed Rocky Butte Mine. However, the BNR has begun a test program for coal rail cars with a 35 percent greater capacity than the 100-ton cars now in use. These cars, together with precision loading facilities at most mines, will significantly increase the tonnage hauled per train. Even with increased coal production, the number of unit trains per day could temporarily decline over the next few years. With this development the impacts from increased coal haulage on the railroad system from the proposed Rocky Butte Mine would be minor or negligible (Basford, 1991).

Increased traffic volumes would occur within the regional road network beginning in 1993 with the start of mine construction. The greatest impact would result from employee and industrial service travel to the proposed mine site over the section of State Highway 59 south from the intersection with I-90 to the Four Corners Road intersection and along the Four Corners Road to the proposed Rocky Butte Mine entrance. Increases in traffic volumes would generally decrease as the distance from this main artery increased. Secondary increases in traffic volumes would result from increased population in Campbell County and the City of Gillette, both from direct employment at the proposed mine and multiplied secondary economic activity. The increased traffic volumes could result in increased traffic congestion, noise and accidents, decreased air quality and increased maintenance requirements for the road network.

By the seventh year of mining (year 2001) the Rocky Butte Mine could cause from 500 to 600 additional vehicle trips daily along Highway 59 and the Four Corners Road to the mine entrance. LOS analysis by the Wyoming Department of Transportation for this scenario shows 770 vehicles per hour, approximately 43 percent of the highway capacity (vs 1990 values of 645 and 36, see Section 3.13.2). The LOS would decline from a low C value to a high D value (Lane, 1991).

Improvements are planned for the Four Corners Road to make the road suitable for carrying the projected traffic load. Planned improvements include widening and paving the road from the intersection with Highway 59 to the mine entrance, a distance of

approximately 3.4 miles, and relocating the road out of the mining area, removing the majority of the ninety-degree corners in the process. With these improvements the Four Corners Road is expected to be adequate for the increased traffic flow.

Although isolated problems can be expected to occur, previous development of the road network in Campbell County, induced by rapid growth of the energy industry and implemented by local, State and Federal governments, has equipped the County with a road infrastructure that is generally adequate for estimated future use. Particular attention has been given to traffic circulation within the City of Gillette, over Highway 59 south from the I-90 intersection and outward to the mines to the northeast and northwest of Gillette. In the long term, the impact of increased traffic flow over the County wide road network and over the internal circulation routes of the City of Gillette is expected to be minor. In the short term, impact within the City of Gillette is also expected to be minor, and the impact on the County wide network is expected to be minor with possible moderate areas on Highway 59 and the Four Corners Road.

By the seventh year of mining, year 2001, the Rocky Butte Mine is estimated to cause an increase of 3 to 4 percent in departures and arrivals on commercial flights. A higher percentage increase is expected during the construction phase, possibly as high as 20 percent, caused by increased construction-related travel. The load capacity factor would be increased for United Express, which may help to stabilize air service at its present level (Kemp and Bell, 1991). Continental Express is currently considering adding another plane to their schedule. If they have not done so by the time construction begins on the Rocky Butte Mine, the increase in airline passengers would probably trigger the addition of a plane to their schedule (Morgan, 1991). Minor increases may be seen in charter and private aircraft use of the Campbell County Airport. Planned improvements to the terminal and commercial passenger loading/unloading areas along with the rest of the existing infrastructure would be adequate to serve projected growth in air travel from the Rocky Butte Mine. The increases could be handled with the present facilities with some increase in congestion in the terminal.

4.1.14 Land Use and Ownership

The principal impact to land use would be the loss of the agricultural productivity of land during mining and prior to reclamation (Table 4-3). However, because affected agricultural lands would be restored to the approximate acreage existing prior to mining (Appendix B), long-term impacts to agricultural productivity would be negligible.

Table 4-3 Areas of Projected Disturbance of Land Use Types Within Campbell County, the Rocky Butte Permit Area, and Within the Total Permitted Acreage of All Mines in Campbell County, Wyoming.

Land Use Type	Acreage Occupied by Type, Campbell County[1] (Acres)	Disturbance of Type, Rocky Butte		Portion of Campbell County Disturbed (Percent)	Disturbance of Type, All Mines		Portion of Campbell County Disturbed (Percent)
		(Acres)	(Percent)[2]		(Acres)[3]	(Percent)[2]	
Cropland	158,000	3,643	2.3	0.1	5,457	3.5	0.2
Grazing land	2,747,840	3,020	0.1	0.1	62,477	2.3	2.1
Pastureland	23,020	327	1.4	<0.1	5,877	25.5	0.2
Developed Water	1,800	52	2.9	<0.1	159	8.8	<0.1
Residential	18,110	12	0.1	<0.1	32	0.2	<0.1
Industrial/Commercial	58,070	104	0.2	<0.1	131	0.2	<0.1
Transportation Systems	Included in Industrial/ Commercial Use	130	0.2	<0.1	239	0.4	<0.1
Disturbed	NA[4]	45	NA	<0.1	4,012	NA	0.1
Total	3,043,840[5]	7,333	--	≈0.2	78,384	--	≈2.6

1 Personal communication, October 25, 1991, with Tom Jewett, Deputy State Conservationist, USDA Soil Conservation Service, Casper, Wyoming.
2 Relative to the acreage occupied by the type in Campbell County.
3 Data in this table were compiled from mine permits held by WDEQ-LQD, Cheyenne; and the permit, in preparation, for the Rocky Butte project. Due to variability in permit presentation of land use data, acreages presented herein represent a general summary of data for all mines in Campbell County, Wyoming.
4 Data not available.
5 Total includes acreage for woodlands (36,000 acres in Campbell County, Wyoming).

Assuming that 20 percent of the project area is affected in any given year (Table 2-1), construction and life-of-mine impacts to production would be minor or moderate (Table 4-4). To facilitate comparison of potential losses, crop and forage production values are expressed as AUMs. The reduction in crop production would range from 1,275 to 2,732 AUMs, depending on the type of crop lost. Loss of native grazing land productivity would range from 121 to 242 AUMs. Loss of productivity from pastures would range from 13 to 19 AUMs.

Because wildlife habitat would be an important postmining land use that would be recreated during reclamation, permanent impacts to wildlife habitat would be negligible (Section 4.1.7). There would be major short-term impacts to habitat during construction and throughout the life of mine due to loss of vegetation, water resources, and topographic features used by wildlife. With respect to available habitat in the region, the short-term loss of this habitat is insignificant.

Table 4-4. Estimated Reduction in Agricultural Productivity Due to Mining in Campbell County and in the Rocky Butte Project Area.

Projected Affected Area	Cropland/(Acres)				Grazing land (Acres)		Pasture land (Acres)
All Mines (including Rocky Butte)	5,457				62,477		5,877
Rocky Butte	3,643				3,020		327
	Wheat[1]	Hay	Barley	Oats	Native Range[2] (Shallow Soils)	(Deep Soils)	Crested Wheatgrass[3]
Potential Loss	Animal Unit Months						
20% of all Mines	4,093	3,656	3,001	1,910	2,499	4,998	235-353
20% of Rocky Butte	2,732	2,441	2,004	1,275	121	242	13-19
Percent loss due to mining at Rocky Butte	67	67	67	67	5	5	6

[1] Assumes yields of 25 bu/ac wheat, barley, and oats, and 1 ton/ac hay. Estimated forage values were 0.15 AUM/bu wheat, 3.35 AUM/ton hay, 0.11 AUM/bu barley, and 0.07 AUM/bu oats (WDEQ-LQD 1981).
[2] Estimated carrying capacities of 0.2 to 0.4 AUM/acre.
[3] Estimated carrying capacities of 0.2 to 0.3 AUM/acre.

Owners of occupied and abandoned residences in the affected area have already agreed to relocate. These residences would not be replaced during reclamation.

One Rourke Gap Field well (J.F. Rourke #4:5), within the permit area, and one WD Field well (Wolf #34-34:34) are projected to maintain economic production throughout the life of the mine and beyond the final anticipated year (2034) of mining. If production projections are correct, a potential conflict could exist between oil production from these two wells and planned mining activity (see Table 3-11).

However, economic forecasts for the productive lives of individual wells are highly variable and are based on estimated operating costs and current technology. Significant changes in prices, taxes, technology, operating costs, or other factors could significantly affect these projections (communication, Zora 1992). Additionally, production decline curves (indicating projected future production) for each well are generated by a computer modeling system that is based, in part, on the production history of that

well. Therefore, for a well with a short production history, such as the WD Field well (Wolf #34-34:34), the production decline curve cannot be accurately projected (communication, Zora 1992).

Both Rainbow Ranch Field wells within the permit boundary are located outside the proposed disturbance boundary for the Rocky Butte Mine. All other existing wells within the permit area in the Rourke Gap, Butte Creek, and WD Fields are projected to be depleted (or would be operating at or below economic production) by the first year of initial mining disturbance. Three of the eight producing wells are currently classified as stripper wells, producing less than 10 barrels of oil per day (BOPD) (Whitman, 1992) (see Table 3-13).

4.1.15 Socioeconomics

The socioeconomic impact area is composed of those political jurisdictions and population centers which will experience the bulk of the social and economic impacts from the proposed Rocky Butte Mine. The impact area includes communities in which project employees will reside, plus jurisdictions that will incur financial effects from mine-related tax revenues or public facility or service expenditures as a result of the project.

The delineation of the area of socioeconomic influence is normally based on a host of considerations, depending upon the local area under study. In this instance, the primary determinants are the size and distance of Gillette, settlement patterns of other similarly located coal projects in Campbell County, certain labor force conditions, and migration patterns.

As discussed in Sections 1.4 and 2.4, the Rocky Butte Mine plan analyzed in this EIS, in which coal production begins in 1995 and occurs at a constant rate of 16 million tpy from 1997 through the end of mining, is not consistent with coal demand forecasts for the Powder River Basin. This chapter presents an assessment of the socioeconomic impacts of the mine plan assuming that production occurs at these planned rates; however, employment and revenue projections which are based on this plan may not represent new impacts on the area. Unless coal demand growth exceeds BLM's current projections, or unless NWR is able to transfer to the Rocky Butte Mine new contracts not considered in current demand forecasts, the employment and revenue impacts from the Rocky Butte Mine may occur by transfer from other local or regional mines and may not represent new employment and new revenues.

Coal production from the Rocky Butte Mine, if it begins in 1995, will add to a situation in which supply capability exceeds demand in the Powder River Basin. Thus the Rocky Butte Mine could depress coal prices which are already under heavy pressure. Lower coal prices mean smaller severance tax and royalty revenues unless they are offset by increased production rates. Financial projections in this section are based on a constant coal sale price FOB the Rocky Butte Mine of $3.80 per ton, which is near the low end of the range of recent spot-market prices (McGraw-Hill, 1991).

The effects of the Clean Air Act Amendments on the market for low-sulfur PRB coal are not yet known. Under Phase I of the Act, coal-fired power plants are required to reduce stack emissions by January 1, 1995. Switching to clean coal will increase the demand for PRB coal, but some states are in the process of enacting legislation to require scrubbing of stack gases, thereby possibly preserving the market for higher-sulfur eastern coals (Geological Survey of Wyoming, 1991b). Coal-demand forecasts are subject to change as the effects of the Clean Air Act Amendments become known.

According to the Bureau of Census, the City of Gillette had an estimated 1990 population of about 17,635 persons (Table 3-15). The Gillette urban area, which includes the city and urbanized but unincorporated areas nearby, had an estimated population of 21,800 in 1990 (Gillette Community Development Department, Planning Division, 1990). These estimates are derived from different and conflicting sources. They are presented here in order to provide a rough approximation of the number of persons residing outside of but in proximity of the City of Gillette.

To serve these residents, Gillette offers a well developed housing market, commercial and service base, plus commensurate public facilities and services. Gillette is about a 15-minute drive from the proposed Rocky Butte Mine employee entrance. This suggests that the Gillette area would have a strong initial attraction to the mine employees.

Residency data from other coal mines near Gillette provide an indication of what might occur with the Rocky Butte Mine (Carter Mining Company, AMAX Coal Company, 1991). These data are shown in Table 4-5.

According to Wyoming Department of Employment data, there were about 16,500 persons in the Campbell County labor force in 1990 (Wyoming Department of Employment, Division of Research and Planning, 1990 and 1991a). About 1,060 of these were unemployed, for an unemployment rate of 6.4 percent. Based upon an interview with the local job service office in Gillette, there are an estimated 4,000 persons actively seeking work in Campbell County, primarily in the coal industry (Job Service of Wyoming, 1991).

In 1984, a comprehensive survey of the coal companies in Campbell County corroborated the settlement or commuting patterns indicated in Table 4-5 (Stearns Catalytic Corporation, 1984). About 90 percent of the mine employees working at coal mines located in the Gillette vicinity resided in the Gillette area in 1984. The majority of these were located within the City of Gillette. An additional seven percent lived in Campbell County but outside the Gillette area or the Town of Wright. An estimated three percent of the employees at coal mines in this region commuted to work from homes outside Campbell County. There is a sizeable labor pool within Gillette and Campbell County skilled in those industries needed by the Rocky Butte Mine. As of the second quarter 1989, there were about 2,800 persons employed at Campbell County coal mines.

Table 4-5. Settlement Patterns of Nearby Projects

Place of Residence	The Carter Mining Company Rawhide and Caballo Mines	Amax Coal Co. Belle Ayr Mine
Gillette Area	78%	84%
Other Campbell County	16%	3%
Subtotal Campbell County	94%	87%
Outside Campbell County	6%	13%
Total	100%	100%

A heavy construction workforce of about 320 persons was also evident, suggesting that these construction workers might not be readily available when Rocky Butte begins development. The workforce characteristics suggest that sufficient numbers of persons are both available and skilled within Campbell County to fill the coal mining jobs at the Rocky Butte Mine during the operational phase.

Based upon the Campbell County labor force characteristics and historical experience of other mines in Campbell County, almost all the operational workforce at the Rocky Butte Mine will be hired from among existing Campbell County residents. An estimated 90 percent of the operational or permanent workforce will come from persons living in Campbell County. Ten percent of this workforce will be in-migrants.

For the construction workforce, it is likely that the bulk will be hired from outside Campbell County. There could be additional pressure on the construction workforce from a planned expansion of the Black Hills Power & Light power plant at the same time. Outside contractors will also likely be used. This suggests that 75 percent of the mine construction force will be hired from outside Campbell County. These individuals will temporarily reside in the Gillette area for the project's development phase and probably leave thereafter unless other construction work can be found.

On the basis of the above data, the majority of mine-site employees, including operational and construction workers, are expected to reside in the Gillette area (Table 4-6). Therefore the area of socioeconomic influence is defined as the Gillette

Table 4-6. Projected Rocky Butte Commuting Patterns

Place of Residence	Portion of Direct Project Employment
Gillette Area	90%
Other Campbell County	5%
Subtotal Campbell County	95%
Outside Campbell County	5%
Total	100%

area and Campbell County, which would incur financial effects from the project.

The socioeconomic impact analysis is based upon the schedule depicted in Table 2-1. Mine impacts are projected and evaluated through the year 2000 when mine related impacts, tax revenues and secondary effects would have the sustained maximum effect. The level of impact would continue through the life of the mine at approximately the same level. Proportionate cumulative impacts would diminish as impacts are constant and baseline Campbell County conditions expand over time. Employment effects attributable to the Rocky Butte Coal Mine would consist of direct employment during the construction and operational phases of the mine as well as induced, or secondary, employment. This indirect type of employment stems from mine employee expenditures in the local area along with the mining company's direct purchases of goods and services in Campbell County. As these dollars circulate throughout the local economy, they generate additional jobs.

Direct employment at the mine includes temporary construction workers and the more permanent operational employees. The distinction is important from a socioeconomic standpoint because operational employees have larger, longer term socioeconomic impacts as compared with coal mine construction workers.

Construction employment is projected to be an annual average of 125 persons in 1993 and 130 persons in 1994. A peak construction employment of 200 persons is anticipated during 1994. The mix of heavy construction and special trades job opportunities will be typical for surface coal mine development projects in this region.

Table 2-3 depicts the operational employment schedule for the Rocky Butte Mine by year. Operational employment at the mine would begin during the development phase, primarily to accomplish overburden removal and to bring certain project facilities into operation. Employment buildup would occur until about 1997 when more than 400 total mine employees are anticipated. Between the year 2001 and project completion in the year 2034, total employment would fluctuate modestly but average about 420 persons.

Based upon the commuting patterns projected earlier, 90 percent of the operational or production employees will reside in the Gillette area while 5 percent will commute from homes elsewhere in Campbell County and an additional 5 percent will commute from outside Campbell County. Construction worker settlement patterns should be similar to these.

Based upon previous studies of the Campbell County economy, the basic employment to local service employment ratio, or employment multiplier, is assumed to equal 1.0 (Stearns Catalytic Corporation, 1984). That is, for every basic job such as those from the Rocky Butte Mine, one additional local service job opportunity would be generated. Hence, induced or indirect employment stemming from the Rocky Butte Mine would amount to over 400 persons at sustained operating capacity.

Total employment impacts from the Rocky Butte Mine include direct and indirect employment. During 1993, for instance, total employment effects equal

the sum of 125 construction workers, 161 mine employees, and 161 local service employees. Total employment attributable to the mine in 1993 is therefore 447 employees. Due to the modest construction work force of the mine, its temporary nature, and the size of the Campbell County economy, no local service response is anticipated from mine construction employment.

In 1995, total employment effects would equal 688 persons. Employment effects would drop in the next year as the construction work force diminishes and then gradually build up to a sustained maximum of approximately 820 total job opportunities.

Economic impacts from the Rocky Butte Mine would consist of increases in personal income levels and resulting gains in commercial activity. Both direct and indirect effects would follow from the establishment of this mine.

The direct effects of the mine stem in part from the wages and salaries paid to construction and production employees. It is estimated that the average wage or salary for construction and mine employees would be about $16,700 per year and $34,600 per year, respectively, excluding all benefits (Wyoming Department of Employment, Research and Planning Division, 1989). Applying these earnings assumptions to projected employment levels, the total payroll from the Rocky Butte Mine can be projected by year as presented in Table 4-7. At sustained maximum operation, the Rocky Butte Mine would add a payroll of about $14 million per year to the Campbell County economy directly from its employees.

In addition, the Rocky Butte Coal Mine would make direct expenditures for other goods and services throughout the life of the mine. During the construction phase, an estimated $150.7 million (1991 constant dollars) would be expended for various mine facilities and mining equipment, including an estimated $8 million for engineering services. During the course of the mine operation, additional capital expenditures would be made for equipment and facilities totaling about $4.4 million per year or $181.5 million in total for the life of mine. Assuming sales and use tax permits are required, the mine would generate substantial sales and use tax revenues for the state as well as local government entities. Additional but more modest expenditures will be made annually for mine supplies and contract services; except for the latter, almost all of the other expenditures will be made outside Campbell County.

Table 4-7. Estimated Wages and Salaries for the Rocky Butte Mine, Millions of 1991 Dollars

Year	Construction Workers	Operational Employees	Total Direct Wages and Salaries
1993	$2.1	$5.6	$7.7
1994	2.2	9.6	11.8
1995	--	11.1	11.1
1995	--	12.8	12.8
1997	--	14.9	14.9
1998	--	13.9	13.9
1999	--	15.4	15.4
2000	--	16.7	16.7
Average - 2001 to 2034	--	14.1	14.1
Total - Life of Mine	$4.3	$579.6	$583.9

Source: Based upon NWR estimates and Wyoming Department of Employment data for 1989, escalated to 1991 dollars.

Induced employment generated as a result of the Rocky Butte Mine will also add to the payrolls of Campbell County. Assuming an after-benefits annual wage of about $9,000 per year, total indirect wages and salaries will range from $1.5 million to $4.5 million per year with a life-of-mine total of about $155 million (Wyoming Department of Employment, Research and Planning Division, 1989). The average

annual earnings from indirect employees attributable to the Rocky Butte Mine will be approximately $3.6 million annually. The total payroll resulting from the mine (about $18 million per year) would have a moderate effect on total wages in the county.

Table 4-8 provides projected earnings, excluding benefits directly and indirectly attributable to the Rocky Butte Mine. These projections are believed to be understated in part because other purchases for goods and services at the mine are not accounted for.

Expenditures for mine-related wages and salaries and other goods would stimulate the localeconomy in a positive way. Most household expenditures are devoted to retail purchases and various services. Projected increases to CampbellCounty retail and service trade attributable to the Rocky Butte Mine are set forth in Table 4-9. At sustained maximum operations, the Rocky Butte Mine would account for about $4.8 million in Campbell County retail trade and $7.6 million in service trade for a total contribution to the economy

Table 4-8. Total Earnings Attributable to the Rocky Butte Mine, Excluding Benefits, Millions of 1991 Dollars

Year	Direct Employees	Indirect Employees	**Total Earnings**
1993	$ 7.7	$ 1.3	$ 9.0
1994	11.8	2.8	14.3
1995	11.1	2.9	14.0
1996	12.8	3.3	16.1
1997	14.9	3.9	18.8
1998	13.9	3.6	17.5
1999	15.4	4.0	19.4
2000	16.7	4.4	21.1
Average - 2001 to 2034	14.1	3.8	17.8
Total - Life of Mine	$583.9	$155.0	$735.4

Source: NWR, Wyoming Department of Employment and BBC estimate, October 1991.

of about $12.4 million, a moderate impact that would be felt for the life of the mine. For the life of mine, Rocky Butte would contribute nearly $512 million to the commercial base of Campbell County. Mine related employment in many instances means that new households and additional population would be brought into the area. In this instance, almost all of the operational employees at Rocky Butte would likely be hired from among existing residents in the Gillette area and in Campbell County. The indirect employees attributable to the mine are also likely to be drawn from among the ranks of the unemployed and those currently outside the labor force but living in the County. Even so, at least a portion of the job openings left by those going to work at the Rocky Butte Mine would be replaced by others, which might include persons in-migrating to Campbell County.

Typically, there is a general switching and upgrading of jobs which occurs, resulting in lower unemployment, more workers per household, and an upgrading of jobs among existing residents. A certain amount of replacement of job openings with persons in-migrating from outside Campbell County would occur. Potential impacts may be mitigated when this happens. Those who upgrade jobs generally do not require additional governmental services but contribute more tax revenue. In-migrants who fill vacated jobs may or may not require services beyond the amount received by

Table 4-9. Total Campbell County Retail and Service Trade Attributable to the Rocky Butte Mine, Millions of 1991 Dollars

Year	Retail	Service	Total Trade
1993	$2,440	$3,874	$6,314
1994	3,841	6,096	9,937
1995	3,772	5,987	9,759
1996	4,321	6,858	11,179
1997	5,045	8,007	13,052
1998	4,863	7,432	12,295
1999	5,196	8,248	13,444
2000	5,628	8,934	14,562
Average - 2001 to 2034	4,786	7,605	12,391
Total - Life of Mine	$197,819	$313,996	$511,815

Source: BBC estimates based upon U.S. Department of Commerce data, 1991.

those who upgraded their jobs. Thus the net effect on service requirements is difficult to gauge.

To maintain a worst-case perspective for this EIS, it is assumed that all new jobs would ultimately be replaced by persons in-migrating to the County. In reality, this is only likely to occur to a partial extent. Incremental households and populations attributable to the Rocky Butte Mine are set forth in Table 4-10. At sustained maximum operations, approximately 530 households and almost 1,600 persons would be directly or indirectly attributable to the Rocky Butte Mine. A peak of about 1,850 persons would be attributable to the mine in the year 2000. A large proportion of the total households and population attributable to the mine would be located within Campbell County, and of these, the bulk would be situated within the City of Gillette. Based upon the commuting pattern established earlier 95 percent of the households and populationwould be located within Campbell County. An estimated 90 percent of the total households and population would likely be located in the Gillette area. It is assumed that the City of Gillette will account for 90 percent of the Gillette area in the future. Based upon these assumptions and the previous impact projections, households and population related to the mine are projected for Campbell County and the City of Gillette. At sustained maximum, the City of Gillette will have about 1,300 mine-related residents compared with 1,500 mine related residents in Campbell County. This is considered a moderate impact on population.

Incremental impacts on the local housing market would vary by project phase, by location, and by housing unit type. Impacts would generally be positive on the housing market which appears to be capable of responding to this stimulus.

Operational employees and local service workers in-migrating to Campbell County and the Gillette area would impact the single family and apartment markets to a large extent. If almost all of these workers come from among the existing residents in Campbell County and are not replaced by in-migrants, there will be little or no impact on the housing market. To the extent that replacement occurs from in-migrants, the impacts would be most pronounced at the beginning of the operational phase of the project and lessen over time. The private housing industry appears able to accommodate and respond to such demands. Temporary housing can be employed to lessen potential impacts.

During the construction phase of the project there would be an additional demand for about 80 temporary dwelling units in Campbell County, mostly in the Gillette area. These could include RV spaces, mobile homes, or apartments. There are a substantial number of empty mobile home spaces

Table 4-10. Projected Households and Population Directly and Indirectly Attributable to the Rocky Butte Mine

Year	Households			Population			City of Gillette		Campbell County	
	Direct	Indirect	Total	Direct	Indirect	Total	Households	Population	Households	Population
1993*	190	101	291	495	285	770	236	640	277	751
1994*	272	174	446	742	511	1,263	362	1,015	425	1,190
1995	215	202	417	657	590	1,247	338	1,010	396	1,185
1996	247	231	478	751	675	1,426	387	1,248	492	1,464
1997	288	270	558	876	787	1,663	452	1,347	530	1,580
1998	267	251	518	811	729	1,540	420	1,248	492	1,464
1999	297	278	575	899	808	1,707	466	1,383	546	1,621
2000	321	301	622	972	874	1,846	504	1,495	591	1,753
Average - 2001 to 2034	270	255	525	820	729	1,561	427	1,265	501	1,484

*Includes construction-related households at 1.5 workers per household, 2.0 persons per household and no local service response.
Source: BBC Estimates, 1991.

and RV spaces in the Gillette area, but demand in the early to mid 1990's for these types of units could be substantial, also.

The incremental impacts of the Rocky Butte project on public facilities and services would be felt by Campbell County, Campbell County School District #1 and the City of Gillette. The levels of these impacts are somewhat problematic because it is uncertain whether any in-migration would occur during the project operational phase. If none occurs, there should be little or no incremental impacts on public facilities or services as a result of the Rocky Butte Mine. Under worst-case circumstances, the incorporated jurisdictions within Campbell County would be required to provide services for the population and households directly and indirectly related to the mine.

If they occur, impacts to Campbell County would focus on protection services. Campbell County Sheriff's Department and Fire Department could have incremental demands associated with the mine. These would be particularly important during the construction phase when more than average per capita burdens are likely to occur. However, total construction worker households are likely to amount to fewer than 90 households in 1993 and 1994. Emergency health services could also be important during this time period, but the proximity of the mine and accessibility to Gillette would reduce that burden. In sum, impacts on Campbell County's public facilities and services, if any, would be minor.

Impacts on Campbell County School District #1 would be largely related to new students directly and indirectly attributable to the mine. During the 1993 and 1994 time frame, an additional 340 students might occur with a peak of about 480 by the year 2000. These students would be at different grade levels and schools mostly in the Gillette urban area. Classroom space and operating expenditures as well as other costs would be required to accommodate these students. Property tax revenues should be adequate to accommodate these burdens, should they occur.

The additional population in Gillette, should it occur, could represent a burden on the water, wastewater and utility system, protection services and recreational facilities. On the whole, the various Gillette utilities should be able to accommodate the incremental growth associated with the Rocky Butte Mine. The Gillette Police Department could be burdened during the construction phase of the project when disproportionate per capita demand might occur. The Police Department is understaffed, and these impacts deserve attention.

The Rocky Butte Mine, through the payment of various taxes, royalties and fees, would generate additional monies for federal, state and local governments. In addition, employees directly and

indirectly attributable to the mine would also pay taxes to various levels of government. Depending on the level of in-migration, modest cost increases might occur but should be more than offset by incremental revenues.

Federal revenues for royalties, black lung taxes and AML (abandoned mine land) taxes would average $14.0 million per year; these do not include federal income taxes from either the company or mine related employees. This is a moderate impact on federal revenues from the EPRB.

The State of Wyoming would receive revenues directly and indirectly attributable to the Rocky Butte Mine over its mine life. From severance taxes, and the state's share of royalties and sales and use taxes, the mine would generate a combined annual average revenue of $6.7 million. These projections exclude other state fees and revenue sources. The State's share of federal royalties is distributed to numerous accounts. The State Foundation Program receives nearly 50 percent of the State's share. The Rocky Butte Mine would generate severance tax revenues for the state averaging about $2.6 million over the life of the mine, expressed in constant 1991 dollars. Severance tax revenues are distributed to seven State funds. The General, Highway, Permanent Mineral Trust, and Water Development Funds are the largest beneficiaries. The revenues to the state would have a moderate impact on total state revenues lasting over the entire mine life.

Each incorporated jurisdiction within Campbell County would receive revenues as a result of the Rocky Butte Mine. Major mine-related revenues are projected in Table 4-11. These jurisdictions would be required to provide facilities and services for mine-related population which might or might not be in Campbell County already. Even if substantial in-migration results, these revenues should more than offset additional expenditures incurred by local governments.

Table 4-11. Selected Local Government Revenues Generated Directly from the Rocky Butte Mine

	Millions of 1991 Dollars Average Annual
Campbell County	
Property Taxes (mine and coal production only)	$0.1
Sales/Use Taxes	
Mine facilities and equipment	$0.1
Mine related employees	0.0*
Subtotal - County	$0.2
Campbell County School Districts	
Property Taxes (mine and coal production only, prior to State Foundation Program or recapture)	$1.7
City of Gillette	
Sales/Use Taxes	
Mine facilities and equipment	$0.1
Mine related employees	0.1
Subtotal - Gillette	$0.2
Wright	
Sales/Use Taxes	
Mine facilities and equipment	$0.0*
Mine related employees	0.0*
Subtotal - Wright	0.0*

* Less than $50,000

Source: BBC estimates based on information from NWR and local governments.

Campbell County would receive, at a minimum, property taxes on mine production, mine facilities, and equipment. These would diminish over time and are subject to changes in mill levies. Sales and use tax revenues would also accrue to the County, primarily in the early project phases. Total average annual revenues would approximate $1.0 million, representing a moderate increase in total local revenues.

The Campbell County School District would receive property taxes in a manner similar to the County but at much higher levels because of its mill levy. However, because of the Wyoming State Foundation Program only a portion of the net benefits would be realized.

The City of Gillette would have the largest responsibility for serving mine-related residents but would not receive the bulk of mine-related property tax revenues. Gillette would charge mine-related residents, similar to current citizens, for certain services such as water, sewer, power, and solid waste. Presumably, these charges would be set at a level to repay the City's investment. Sales and use taxes comprise about 50 percent of the City's general fund revenues; the Rocky Butte Mine would result in additional revenues of $200,000 per year on average.

A concern has been expressed by certain residents related to the various impacts of the mine on homes or other residential properties near the mine site. These impacts could stem from mine dust, noise, traffic congestion or visual impacts. Each of these is addressed in other sections of this EIS. However, in the aggregate, such impacts reflect upon quality of life and even property values. There are a small number of dwelling units in the vicinity of the mine. Visual impacts should be reduced for subdivisions and dwellings to the north because of the existing and planned changes to the terrain.

There are a number of coal mines in proximity to residential developments in the Gillette area. It is unclear whether or not these mines have had negative impacts on the quality of life or property values for these homeowners. Given the uncertain evidence of such impacts and the small number of dwellings affected, these impacts are assumed to be minor. Those homeowners requiring relocation because of the mine plan will be compensated accordingly, based upon fair market value.

4.2 Analysis of the No Action Alternative

4.2.1 Geology and Mineral Resources

The primary alternative to the Proposed Action is the No Action Alternative, in which case the Rocky Butte Mine would not open as planned. The geology and overburden within the mine area would not be disrupted, and the coal would remain available for mining at some time in the future.

4.2.2 Topography

Under the No Action Alternative topography on the proposed permit area would not be altered from its present condition.

4.2.3 Soils

If the Rocky Butte tract is not mined, use of the permit area would likely continue as in the past. Soil horizons would not be mixed, erosion would continue at present rates, and soils would continue to support livestock grazing and wildlife.

4.2.4 Vegetation

Under the No Action Alternative, there would be no impacts to vegetation.

4.2.5 Water Resources

Under the No Action Alternative, impacts to area water resources would be limited to those projected to occur due to existing mining operations. Tisdale Creek and North Tisdale Creek will be mined and reclaimed in the Caballo Mine permit area. Groundwater drawdowns will still occur, but without the incremental increases from the Rocky Butte Mine.

Without the Rocky Butte Mine, there would presumably be no potential for blasting impacts to local water supply wells. In a public scoping meeting, some area residents stated that they can feel ground vibrations from blasting conducted at the Caballo Mine. There was no indication, however,

that the vibrations have caused any damage. Without the Rocky Butte Mine the subject area will still be subject to some ground vibration from blasting as the Caballo Mine continues its mining progression in a general westwardly and northwestwardly direction.

4.2.6 Alluvial Valley Floors

Under the No Action Alternative streamflows in Tisdale Creek, North Tisdale Creek, Gold Mine Draw and Dry Donkey Creek would not be disturbed by mining at Rocky Butte. The quality and quantity of the streamflows would remain unchanged from existing conditions.

4.2.7 Fish and Wildlife

Impacts to wildlife under the No Action Alternative will be limited to those that will occur due to ongoing mining operations in the region.

4.2.8 Historical, Archaeological, and Paleontological Resources

The No Action Alternative would result in no effect on cultural resources. The No Action Alternative will negate the positive impacts to paleontological resources of possible exposure of specimens and data recovery resulting from excavation of fossiliferous geologic formations.

4.2.9 Recreation

Under the No Action Alternative, recreational opportunities for hunting and wildlife observation would remain unchanged.

4.2.10 Air Quality

Air quality effects of mining would be limited to those that will result from existing mines.

4.2.11 Visual Resources

Should the Rocky Butte Mine not be built, visual resources would likely remain similar to existing conditions, and the area would remain a Class IV area.

4.2.12 Noise

Under the No Action Alternative incremental noise sources from the Rocky Butte Mine would not be imposed.

4.2.13 Transportation Facilities

Should the proposed Rocky Butte Mine not be constructed, railroad traffic, road network traffic and air traffic would not increase above those levels produced by current economic and social activities in the region, and no associated impacts would occur.

4.2.14 Land Use and Ownership

Under the No Action Alternative, there would be no changes in land use above and beyond those that would occur due to current management practices.

4.2.15 Socioeconomics

The No Action Alternative would result in no socioeconomic impacts since the job opportunities, stimulus to the local economy and net public sector financial benefits stemming from the Rocky Butte Mine would not occur. This assumes that if West Rocky Butte is not leased and the Rocky Butte lease is not mined, the coal is never recovered.

Certain minor negative impacts would also not occur if the mine were not developed. The additional pressure on the temporary housing market during the construction would not occur. The eventual loss of jobs and revenue sources when the mine closes also would not occur.