AGENDA
REGULAR MEETING OF THE BOARD OF LAND COMMISSIONERS
Monday, December 21, 2009, at 8:15 a.m.
State Capitol Building, Rotunda/Room 303
Helena, MT

A concert performed by the Russell Ayers Choir from Charles M. Russell High School and informal reception with refreshments will begin at 8:15 a.m. in the Capitol Rotunda. Following the choir performance will be the presentation of the of the 2009 revenue checks at approximately 8:45 a.m.

Following the check presentation in the Rotunda, the fiscal year 2009 highlights presentation (1209-1B) and the remainder of the meeting will occur in Room 303.

INFORMATIONAL ITEMS

1209-1 **A. 2009 REVENUE CHECKS PRESENTATION TO SUPERINTENDENT OF PUBLIC INSTRUCTION**
Benefits: Montana Public Schools and School Facility and Technology Acquisition Fund
Location: N/A

B. FISCAL YEAR 2009 HIGHLIGHTS PRESENTATION
Benefits: Montana Public Schools and School Facility and Technology Acquisition Fund
Location: N/A

ACTION ITEMS

1209-2 **FWP: BLACKFOOT CLEARWATER HWY 83 LAND EXCHANGE**
Benefits: N/A
Location: Missoula County
APPROVED 5-0

1209-3 **FWP: STIPEK FISHING ACCESS SITE ADDITION**
Benefits: N/A
Location: Dawson County
APPROVED 5-0

1209-4 **DLI: APPROVAL FOR SALE OF LOT AND BUILDING IN HAMILTON**
Benefits: N/A
Location: Ravalli County
APPROVED 5-0

1209-5 **80-ACRE WOODS TIMBER SALE (SALVAGE)**
Benefits: Public Buildings
Location: Lewis and Clark County
APPROVED 5-0

1209-6 **ADMINISTRATIVE RULES PROPOSAL: CABINSITE RULES**
Benefits: Common Schools, MSU 2nd, MSU Morrill, Public Buildings, School of Mines, School for the Deaf and Blind, Soldiers Home, State Industrial, State Normal, and University of Montana
Location: Beaverhead, Big Horn, Blaine, Broadwater, Cascade, Chouteau, Custer, Daniels, Dawson, Fallon, Fergus, Flathead, Gallatin, Golden Valley, Hill, Judith Basin, Lake, Lewis and Clark, Liberty, Lincoln, Madison, McCone, Meagher, Mineral, Missoula, Musselshell, Phillips, Pondera, Powder River, Powell, Prairie, Richland, Rosebud, Sanders, Sheridan, Stillwater, Sweet Grass, Toole, Valley, Wheatland, Wibaux, and Yellowstone Counties
APPROVED 5-0

1209-7 **SET MINIMUM BID FOR LAND BANKING PARCEL**
Benefits: Common Schools
Location: Powell County
APPROVED 5-0

1209-8 **EASEMENTS:**
A. RIGHTS-OF-WAY
Benefits: Common Schools and Public Buildings
Location: Beaverhead, Carter, Granite, Missoula, Petroleum, Powell, Roosevelt, and Yellowstone Counties
APPROVED 5-0
B. USFS KOOTENAI NATIONAL FOREST COST SHARE AGREEMENT: SUPPLEMENT NO. 30
Benefits: Common Schools
Location: Lincoln County
APPROVED 5-0

1209-9 **OIL AND GAS LEASE SALE (DECEMBER 1, 2009)**
Benefits: Common Schools, MSU Morrill, Public Buildings, State Normal School, State Industrial School, and Veterans Home
Location: Big Horn, Blaine, Carbon, Cascade, Chouteau, Daniels, Dawson, Fallon, Fergus, Glacier, Hill, Lewis and Clark, Powder River, Prairie, Richland, Sheridan, Stillwater, Teton, and Wibaux Counties
APPROVED 5-0

1209-10 **OTTER CREEK LEASING PROPOSAL**
Benefits: Common Schools
Location: Powder River County
APPROVED 4-1 (Ms. Juneau dissenting). The motion by Ms. McCulloch, which was seconded by Ms. Lindeen was as follows:

- ✓ **to use the amended version of the proposed lease form that is before us,**
- ✓ **to set a minimum bonus bid amount of 25 cents per ton,**
- ✓ **to set a 45 day limit on the bid process, to allow the bids to be reviewed at the February 2010 Land Board meeting, and**
- ✓ **funding from the bonus bid must be used to support and benefit Montana K-12 schools.**

1209-11 **HISTORICAL SOCIETY: PROPOSED LAND DONATION**
Benefits: N/A
Location: Jefferson County
APPROVED 5-0

PUBLIC COMMENT

OTTER CREEK LEASING PROPOSAL

At the November 2009 meeting, the Land Board discussed the Otter Creek Lease proposal. The Board moved to allow additional public comment and review of the lease. During the past month, the Department met with the Attorney General's Office and Land Board staff to review technical aspects of the lease. These discussions produced several revisions, which are highlighted on the attached coal lease form. The following revisions are proposed:

¶8 – Readjustment of Rental and Royalty Terms. The sentence was edited to clarify the Board's discretion by adding the phrase: "The Board reserves the right to. . ." adjust the rental and royalty terms.

¶11 - Inspection. The paragraph was edited to clarify that the Lessor had the right to review the Lessee's records and documents related to operation and administration of the Lease.

¶14 - Termination. This paragraph was re-titled as Cancellation, and it was edited to clarify that any breach of the Lessee's obligations could be a cause for cancellation after notice and opportunity to cure had been given to the Lessee.

¶16 - Protection of the Surface, Natural Resources, and Improvements. The last sentence of this paragraph was edited to clarify that nothing in this paragraph would interfere with the lessee's obligation to comply with any permit.

¶22 - Waste Prohibited. The last sentence in this paragraph was struck to clarify that this section did not conflict in any manner with paragraph 14 – Cancellation.

¶24 – Weed Control. This paragraph was amended to clarify that weed control must occur in consultation with any local weed control board.

¶25 – Coal Mine Gas. This paragraph was struck because it was inconsistent with the habendum clause of the lease which only leases coal rights.

¶26 – Indemnification. This paragraph was edited to clarify that the Lessee's indemnification of the Lessor extended to willful or wanton acts or omissions by the Lessee, its contractors, agents, or subcontractors.

The other documents contained in the proposed bid package remain as originally submitted to the Land Board in agenda item 1109-6.

The department recommends soliciting bids on the Otter Creek tracts utilizing the proposed revised lease form and associated documents, and pursuant to a minimum acceptable up-front bonus bid as directed by the Land Board.

State of Montana
COAL LEASE

DS-459
Amended DRAFT

No. _____

THIS LEASE is made and entered into between the State of Montana, by and through its lawfully qualified and acting Board of Land Commissioners, hereinafter referred to as "Lessor", and

<Lessee Name and Address>

hereinafter referred to as "Lessee", under and pursuant to the authority granted Lessor by the terms and provisions of Title 77, Chapter 3, Part 3, MCA, and all acts amendatory thereof and supplementary thereto, and all rules adopted pursuant thereto.

IT IS MUTUALLY UNDERSTOOD, AGREED AND COVENANTED BY AND BETWEEN THE PARTIES TO THIS LEASE AS FOLLOWS:

1. GRANTING CLAUSE. The Lessor, in consideration of the rents and royalties to be paid and the conditions to be observed as hereinafter set forth, does hereby grant and lease to the Lessee, for the purpose of mining and disposing of coal and constructing all such works, buildings, plants, structures and appliances as may be necessary and convenient to produce, save, care for, dispose of and remove said coal, and for the reclamation thereafter, all the lands herein described as follows:

Land Located in: County:

Description of land:

Total number of acres, more or less, , belonging to Grant.

All rights granted to Lessee under this Lease are contingent upon Lessee's compliance with the Montana Strip Mine Siting Act and the Montana Strip and Underground Mine Reclamation Act (Title 82, Chapter 4, Parts 1 and 2, MCA) and upon Lessor review and approval of Lessee's mine operation and reclamation plan. The rights granted under this Lease are further subject to agency responsibilities and authority under the provisions of the Montana Environmental Policy Act.

2. EFFECTIVE DATE AND TERM. This Lease takes effect on <Lease Effective Date> and is granted for a primary term of ten (10) years and so long thereafter as coal is produced from such lands in commercial quantities, subject to all of the terms and conditions herein set forth. A lease not producing coal in commercial quantities at the end of the primary term shall be terminated, unless the leased lands are described in a strip mine permit issued under Section 82-4-221, MCA, or in a mine site location permit issued under Section 82-4-122, MCA, prior to the end of the primary term, and the lease shall not be terminated so long as said lands are covered and described under valid permit.

3. LEASE EXTENSION. The Board of Land Commissioners may grant reasonable extensions of the primary term of this Lease upon a showing that Lessee, despite due care and diligence, is or has been directly or indirectly prevented from exploring, developing, or operating this Lease or is threatened with substantial economic loss due to litigation regarding this Lease or another lease in the same strip mine permit or mine site location permit held by the Lessee, state compliance with the Montana Environmental Policy Act, or adverse conditions caused by natural occurrences.

4. RIGHTS RESERVED. Lessor expressly reserves the right to sell, lease, or otherwise dispose of any interest or estate in the lands hereby leased, except the interest conveyed by this Lease; provided, however, that Lessor hereby agrees that subsequent sales, leases or other dispositions of any interest or estate in the lands hereby leased shall be subject to the terms of this Lease and shall not interfere with the Lessee's possession or rights hereunder.

5. BOND. Lessee shall immediately upon the execution of this Lease furnish a surety bond in the amount of $2,000, conditioned upon compliance with the provisions of this Lease, or, in the option of the Lessor, a cash deposit in the amount of $2,000, or an irrevocable letter of credit in a form approved by Lessor drawn upon an approved bank in the same amount. All rentals, royalties and interest must be paid and all disturbance must be reclaimed to the satisfaction of Lessor prior to release of any bond. Additional bonding may be required, or reduced bonding allowed, whenever Lessor determines it is necessary, or sufficient, to ensure compliance with this Lease.

6. RENTAL. Lessee shall pay Lessor annually, in advance, for each acre or fraction thereof covered by this Lease, beginning with the date this Lease takes effect, an annual money rental of $3.00 per acre. Rental terms are subject to readjustment as provided in Paragraph 8, but in no case shall it be less than two (2) dollars per acre.

7. ROYALTY. Lessee shall pay Lessor in money or in kind at Lessor's option a royalty on every short ton (2,000 pounds) of coal mined and produced during the term of this Lease, calculated upon the f.o.b. mine price of the coal prepared for shipment, including taxes based on production or value. Lessee shall pay a royalty of 12.5 % upon coal removed by strip, surface, or auger mining methods and a royalty of 10% for coal removed by underground mining methods. Royalty terms are subject to review and readjustment as provided in Paragraph 8, but in no case shall the royalty for the coal mined be less than ten (10) percent of the f.o.b. price of a ton prepared for shipment.

8. READJUSTMENT OF RENTAL AND ROYALTY TERMS. The Lessor reserves the right to readjust the rental and royalty terms of this Lease ~~shall be subject to readjustment~~ to reflect fair market value at the end of the primary term of ten (10 years) and at the end of each five (5) year period thereafter if the lease is producing coal in commercial quantities.

9. OFFSETTING PRODUCTION. The obligation of Lessee to pay royalties under this Lease may be reduced by the Board for coal produced from any particular tract within the Lease upon a showing by Lessee to the Board that the coal is uneconomical to mine at prevailing market prices and operating costs unless Lessor's royalty is reduced. Under no circumstances may Lessor's royalty be reduced below ten (10) percent of the coal produced and sold f.o.b. the mine site, prepared for shipment, including taxes based on production or value.

10. LESSOR NOTIFICATION AND REPORTS. Lessee shall notify Lessor prior to the commencement of any prospecting, exploration, development or production operations. As soon as any mining operations are commenced, Lessee shall submit to Lessor, on or before the last day of each month, a royalty report and payment covering the preceding calendar month, which report shall be in such form and include such information as Lessor shall prescribe. Upon request, Lessee shall also furnish to Lessor, reports, plats, and maps showing exploration data, development work, improvements, amount of leased deposits mined, contracts for sale and any other information with respect to the land leased which Lessor may require. Lessor's point of contact for all matters related to this Lease is:

Department of Natural Resources & Conservation
Minerals Management Bureau
P.O. Box 201601
1625 Eleventh Avenue
Helena, MT 59620-1601

Lessor will notify Lessee of any subsequent change in point of contact.

11. INSPECTION. Representatives of the Lessor shall at all times have the right to enter upon all parts of the leased premises for the purposes of inspection, examination, and testing that they may deem necessary to ascertain the condition of the Lease, the production of coal, and Lessee's compliance with its obligations under this Lease and to review the Lessee's records relating to operations upon and administration of the lease premises. Representatives of Lessor shall also, at all reasonable hours, have free access to all books, accounts, records, engineering data, and papers of Lessee insofar as they contain information relating to the production of coal under this Lease, the price obtained therefor, and the fair market value of the production. Lessor shall also have free access to agreements relating to production of coal under this Lease. Lessor may copy at its own expense any book, account, record, engineering data, papers, or agreements to which it has access pursuant to this paragraph.

12. CONFIDENTIALITY. Lessor agrees that Lessee may request any materials obtained by Lessor pursuant to this Lease be designated as confidential. Lessor shall agree to keep any information so designated strictly confidential if Lessor determines that confidentiality is not unlawful. Further, the parties agree that the information Lessee is obliged to provide pursuant to this Lease is only that information relating to the reasonable administration and enforcement by Lessor of the provisions of this Lease and state law.

13. ASSIGNMENT. This Lease may not be assigned without the prior approval of Lessor in writing. Assignments must be made in accordance with any statutes or administrative rules pertaining to assignments in effect at the time of assignment. Each Lessee executing this Lease, or accepting an assignment of an interest in this Lease, is jointly and severally liable for all obligations attributable to the entire working interest under this Lease. Assignments may not extend the expiration date of this Lease.

14. ~~TERMINATION~~ CANCELLATION. Lessee may surrender and relinquish this Lease by giving written notice to the Lessor at least thirty (30) days prior to the anniversary date of the Lease. It is understood and agreed that the Lessor hereby reserves the right to declare this Lease forfeited and to cancel the same through the Board of Land Commissioners upon failure of Lessee to fully discharge ~~all~~ any of the obligations provided herein, after written notice from the Department and reasonable time fixed and allowed by it to Lessee for the performance of any undertaking or obligation specified in such notice concerning which Lessee is in default. Lessee, upon written application therefor, shall be granted a hearing on any notice or demand of the Department before the Lease may be declared forfeited or canceled.

15. SURRENDER OF PREMISES. Upon the termination of this Lease for any cause, Lessee shall surrender possession of the leased premises to Lessor, subject to Lessee's right to re-enter (1) for the purpose of removing all machinery and improvements belonging to Lessee, hereby granted at any time within six (6) months after the date of such termination, except those improvements as are necessary for the preservation of the deposit and access to the deposit, which improvements shall become the property of Lessor; and (2) for the purpose of complying with State and Federal laws adopted pursuant to the police power of State or Federal government. If any of the property of Lessee is not removed from the leased premises as herein provided, the same shall be deemed forfeited to Lessor and become its property.

16. PROTECTION OF THE SURFACE, NATURAL RESOURCES, AND IMPROVEMENTS. Lessee agrees to take such reasonable steps as may be needed to prevent operations from unnecessarily: (1) causing or contributing to soil erosion or damaging any forage and timber growth thereon; (2) polluting the waters of springs, streams, wells, or reservoirs; (3) damaging crops, including forage, timber, or improvements of a surface owner; or (4) damaging range improvements whether owned by Lessor or by its grazing permittees or lessees. Upon any partial or total relinquishment or the cancellation or expiration of this Lease, or at any other time prior thereto when required by Lessor and to the extent deemed necessary by Lessor, Lessee shall fill any sump holes, ditches and other excavations, remove or cover all debris, and, so far as reasonably possible, reclaim the disturbed area to a condition in keeping with the concept of the best beneficial use, including the removal of structures as and if required. Lessor may prescribe the steps to be taken and reclamation to be made with respect to the land and improvements thereon. Nothing in this section limits Lessee's obligation to comply with any applicable state or federal law, rule, ~~or~~ regulation, or permit.

17. TAXES. Lessee shall pay when due all taxes lawfully assessed and levied upon improvements, output of mines, or other rights, property or assets of the Lessee.

18. SUCCESSORS IN INTEREST. Each obligation hereunder shall extend to, and be binding upon, and every benefit hereof shall inure to the heirs, executors, administrators, successors and assigns of the respective parties hereto.

19. COMPLIANCE WITH LAWS AND RULES. This Lease is subject to further permitting under the provisions of Title 75 or 82, Montana Code Annotated. Lessee agrees to comply with all applicable laws and rules in effect at the date of this lease, or which may, from time to time, be adopted and which do not impair the obligations of this lease and do not deprive the Lessee of an existing property right recognized by law.

20. WATER RIGHTS. Lessee may not interfere with any existing water right owned or operated by any person. Lessee shall hold Lessor harmless against all claims, including attorney fees, for damages claimed by any person asserting interference with a water right.

21. MINE SAFETY. Lessee agrees to operate the mine in accordance with rules promulgated by the Mine Safety and Health Administration for the health and safety of workers and employees.

22. WASTE PROHIBITED. All mining operations shall be done in good and workmanlike manner in accordance with approved methods and practices using such methods to insure the extraction of the greatest amount of economically minable and saleable mineral, having due regard for the prevention of waste of the minerals developed on the land, the protection of the environment and all natural resources, the preservation and conservation of the property for future use, and for the health and safety of workers and employees. ~~If the Lessor has reasonable belief that the operations are not so being conducted, it shall so notify the Lessee in writing, and if compliance is not promptly obtained and the delinquency fully satisfied, the Lessor may, at its option, cancel the Lease pursuant to the provisions of paragraph 13 of this Lease.~~

23. SURRENDER OF DATA. All geological data pertaining to the leased premises, including reports, maps, logs and other pertinent data regarding trust resources shall be given to the Lessor upon surrender, termination, or expiration of the Lease. Lessor may refuse to release bond until surrender of such data to the Lessor. All drill core unused or undamaged by testing shall be saved. Upon surrender, termination, or expiration of the lease, Lessee shall contact the State Geologist, Montana Bureau of Mines and Geology, Butte, Montana, to determine if such drill core is of interest to the State Geologist for the drill core library. Any drill core determined by the State Geologist to be of interest shall be forwarded by Lessee, at Lessee's cost, to the drill core library.

24. WEED CONTROL. Lessee is responsible for controlling noxious weeds on the leased premises and shall prevent or eradicate the spread of noxious weeds onto land adjoining the leased premises in consultation with any local weed control board.

~~**25. COAL MINE GAS.** Lessee may remove and vent, flare, or sell coal bed gas from the coal formation being mined only if such removal is a necessary safety procedure directly related to the normal physical process of mining the coal under this Lease. If Lessor owns oil and gas rights to lands herein described, Lessee must pay Lessor a royalty on any coal bed gas removed and sold. Coal bed gas royalty will be calculated according to Lessor's then current oil and gas lease terms. Venting or flaring of coal bed gas that is uneconomical to sell must comply with all applicable laws and rules. The right to remove and vent, flare, or sell coal bed gas, except under the circumstance described above, is expressly retained by Lessor.~~

~~26~~ 25. SURFACE OWNER AND SURFACE LESSEE RIGHTS. Lessee shall notify the surface owner, if the surface owner is not the Lessor, and any surface lessee of the location of any facilities or access roads on the leased premises prior to their construction.

~~27~~26. DAMAGES. Where Lessor owns the surface estate above the leased premises, Lessee shall compensate Lessor or Lessor's surface lessees or permittees for all damages to authorized improvements on the leased premises, including penalties and charges assessed by the FSA on CRP lands, as a result of Lessee's prospecting, exploration, development or mining operations. All such damages will be assessed by and paid directly to the Lessor. Lessee shall also make all payments required by law to surface owners and lessees if Lessor is not the owner of the surface estate above the leased premises.

~~28~~27. INDEMNIFICATION. The Lessee shall protect, defend, and save the Lessor, its agents and employees harmless from and against all claims, liabilities, demands, causes of action, and judgments (including the cost of defense and reasonable attorney fees) arising in favor of or asserted by third parties on account of damage to property, personal injury, or death, which injury, death or damage, in whole or in part, arises out of or in any way results from the negligent, wanton, or willful acts or omissions of the Lessee, its contractors, agents or subcontractors.

~~29.~~ 28. SPECIAL CONDITIONS.

(A) DILIGENCE. The Lessee hereby commits to a work program on the Otter Creek Area Coal Tracts with a minimum expenditure of $2.0 million per lease year, for a period of five (5) years following the date this Lease takes effect, and at least $500,000 per lease year thereafter. For the purposes of this Lease

commitment, the Otter Creek Area Coal Tracts includes all State and non-State coal located within the areas identified as "Tract #'s 1, 2, and 3" on the attached Exhibit A. Within 120 days following the end of each lease year, the Lessee shall provide Lessor an accounting of Work (as later defined) performed on the Otter Creek Area Coal Tracts for such lease year. Any amount in excess of the minimum expenditure amount is referred to as the "Excess Amount" and any shortfall is referred to as the "Shortfall Amount." Within 120 days following the end of each lease year, the Lessee shall pay to Lessor the amount, if any, equal to the Shortfall Amount for such lease year, less the sum of the Excess Amounts for all prior lease years (to the extent such Excess Amounts have not been previously applied against a Shortfall Amount). For purposes of calculating the minimum expenditure, the Lessee may only include costs for work directly attributable to the Otter Creek Area Coal Tracts. Work to be performed on the Otter Creek Area Coal Tracts may include, without limitation, environmental baseline studies, exploration drilling, initiation of permitting and all permitting actions, acquisition of surface rights and access rights over or to the Otter Creek Area Coal Tracts, title curative actions, market studies, compiling mine economics, preparation of feasibility studies and any other works, study or verifiable third party expense required to commence operations for the mining of coal on the Otter Creek Area Coal Tracts (collectively, the "Work"). The accounting of Work does not include payments made to non-State Lessors for shortfalls in work program expenditures. In the event any of the Work is conducted by Lessee's employees, the actual verifiable salaries, wages and personal expenses of Lessee's employees either temporarily or permanently assigned to the development and operation of the Otter Creek Area Coal Tracts may be included in the minimum expenditure. Lessee shall not include any internal overhead of any nature in calculating the minimum expenditure. If it is anticipated that the Work conducted by Lessee's employees will exceed 50% of the minimum expenditure, the Lessee will seek Lessor's approval for such amounts over 50%. In addition, taxes and assessments Lessee pays shall not be included in calculating the minimum expenditure. Copies of all analyses, data and other information produced or compiled as a result of Lessee's work program on the Otter Creek Area Coal Tracts will be provided to Lessor within 120 days after the end of each lease year. However, such analyses, data and other information submitted to Lessor shall be subject to the confidentiality provisions of Paragraph 12 and 77-3-308, MCA.

(B) **SETTLEMENT AGREEMENT.** After the conclusion of any exploration operations and before conducting any mining, construction or other operations on any portion of the Otter Creek Area Coal Tracts (singly and collectively "Operations"), the Lessee or its agents in close consultation with the Northern Cheyenne Tribe ("Tribe"), shall develop and submit for approval to the Lessor, obtain Lessor approval of, and thereafter implement the five written Operating Plans as detailed in the attached Exhibit B of the Settlement Agreement dated February 19, 2002, between the Lessor and the Northern Cheyenne Tribe.

~~30~~29. **NON-WARRANTY OF TITLE.** Regardless of any of the above provisions of this Lease, actual or implied, the State of Montana does not warrant title to its lands.

IN WITNESS WHEREOF, the parties hereto set their hands and Lessor has caused this agreement to be executed with the official seal of the State Board of Land Commissioners on this ___ day of _____, 2010.

THE STATE OF MONTANA Lessor	<lessee name> Lessee
By Its State Board of Land Commissioners	By: _____
	Its: _____
_____ DIRECTOR	

MINUTES
REGULAR MEETING OF THE BOARD OF LAND COMMISSIONERS
Monday, December 21, 2009, at 8:45 a.m.
State Capitol Building, Room 303
Helena, MT

PRESENT: Governor Brian Schweitzer, Attorney General Steve Bullock, Auditor Monica Lindeen Secretary of State Linda McCulloch, and Superintendent of Public Instruction Denise Juneau,

INFORMATIONAL ITEMS

1209-1 A. 2009 REVENUE CHECKS PRESENTATION TO SUPERINTENDENT OF PUBLIC INSTRUCTION

The 2009 revenue checks were presented to Superintendent of Public Instruction on behalf of the schools of Montana:

- Public Schools - $61.2 million; and
- School Facility and Technology Fund - $24.2 million.

Ms. McCulloch moved for approval of the minutes from the November 16, 2009, meeting of the Board of Land Commissioners. Seconded by Ms. Juneau. Carried unanimously

B. FISCAL YEAR 2009 HIGHLIGHTS PRESENTATION

Tom Schultz, Trust Land Management Division Administrator, presented highlights from Fiscal Year 2009 (*see Related Materials, Attachment 1*). Mr. Schultz recognized DNRC staff and the lessees of school trust land for their efforts to bring these revenues to fruition.

Mr. Schultz noted that in Fiscal Year 2009 there were 141,899 children enrolled in public schools, with the average state share is $4998 per pupil. Montana generates the second highest revenue per capita for school trusts among all the western states. The fund for the maintenance and enhancement of school facilities and technology was created by HB152 (2009), and the Trust Land Management Division provides the only funding into that particular account.

ACTION ITEMS

1209-2 FWP: BLACKFOOT CLEARWATER HWY 83 LAND EXCHANGE

Hugh Zackheim, Department of Fish, Wildlife and Parks (FWP), stated that the Montana Department of Transportation (MDT) intends to rebuild a portion of Highway 83 north of Clearwater Junction to improve traffic safety. The project requires additional right of way from FWP's Blackfoot-Clearwater Wildlife Management Area. MDT and FWP have agreed to a land exchange through which MDT would purchase a 52-acre tract adjacent to the highway and transfer it to FWP to provide replacement habitat for land lost to the right of way. The value of the lands exchanged is disproportionate, and the difference would be credited to MDT in the event of future land exchanges.

Motion made by Ms. Lindeen to approve the land exchange. Seconded by Mr. Bullock. Carried unanimously.

Governor Schweitzer noted that the state receives income regardless of development. He asked if a tract would be offered for bid again if an undeveloped lease lapses?

Mr. Mason said that is correct.

Motion to approve the oil and gas lease sale carried unanimously.

1209-10 <u>OTTER CREEK LEASING PROPOSAL</u>

Ms. Sexton stated that in November the Land Board voted to allow more time for public comment and review of the bid packet (*see November 16, 2009, Land Board minutes).* Discussions with the board members and their staffers resulted in several revisions to the bid packet. DNRC recommends the solicitation of bid for the Otter Creek tracts utilizing the proposed, revised lease form, and pursuant to a minimum acceptable up-front bonus as directed by the land board.

Jeannie Alderson, Tongue River Valley rancher, said that she appreciates the challenging decisions that the Land Board must make, and asked the board to vote against leasing the Otter Creek tracts. The language in the lease, as well as simply the act of leasing the tracts, makes it very clear that it is those who live in the area who will pay the highest cost for the lack of foresight if the tracts are leased.

Ms. Alderson said that before leasing it would be prudent to assess and understand not only the environmental impacts that strip-mining coal will have on the land and communities, but also the social impacts.

- The proceeds from the Otter Creek coal are supposed to benefit Montana's schools, but it is in fact the legislature that appropriates money for the schools, so the school trust money does not automatically go the schools.
- Also, the Tongue River Railroad (TRR), which is a part of this project, will pass a few feet from the rural school her sons attend. That is 21 trains per day (one per hour), which would an unbearable disturbance to the school.

Ms. Alderson asked that if the board does decide to lease the tracts that the lease include a stipulation that the state of Montana will in no way subsidize the TRR. She also asked that there be no tax breaks given to Otter Creek development.

Clint McRae, Colstrip area rancher, stated that there are two issues to examine:

- the possibility that Arch Coal, which has a great deal of interest in Wyoming coal, may lease the tracts and then use the TRR to move Wyoming coal without developing the Otter Creek tracts; and
- whether the TRR be funded with taxpayer money. If it is, that would legitimize a for-profit, private corporation to use federal eminent domain through condemnation to take private land on the Tongue River.

Mr. McRae stated that all sides of the issue need to be considered. He invited the board to tour the land the TRR would cross, including one school trust section.

Mark Fix, Tongue River rancher/irrigator, NPRC Coal Bed Methane Taskforce chair, stated that he is present to fight to protect his ranch, and all the ranches along the Tongue River. The EIS for the TRR is inadequate and needs to be redone. NPRC is currently challenging the EIS in the Ninth Circuit Court. There has never been any analysis done on the TRR spur that would go to Otter Creek. The TRR EIS stated that there will be 20,000 tons of sediment created during construction (five to ten thousand tons every year after construction) of the seventeen miles of rail below the Tongue River

Dam. He asked how will the flow of the Tongue River and Otter Creek be affected by development. The ranches and farms rely on clean irrigation water to grow crops and provide livelihood. Although TRR intends to have sightings in several places along the route, they have not stated where those sightings will be placed. Mr. Fix spoke of obstacles that would affect his daily ranching and movement of cattle and urged the Land Board not to go forward with the proposal.

Bob Adams, Montana Conservation Voters, read a prepared statement *(see Related Materials, Attachment 3).*

Beth Kaeding, NPRC, read a prepared statement *(see Related Materials, Attachment 4).*

Jay Bostrom, Big Sky High School teacher (Missoula), stated that as a teacher he is not interested in taking money from coal. Every scientific society in this nation now recognizes and acknowledges that carbon dioxide is affecting global warming. The possibility that the coal will end up in China fueling sweatshops adds an additional aspect to the moral dilemma. He stated that he demands accountability from his students, and would also demand accountability from the Land Board. Mr. Bostrom stated that the best natural resource in this state is the clean environment. He stated that he would rather take a pay cut than pull coal from the ground to fund computers and books for his classroom.

Cameron Lundby, Oftedal Construction vice president (Miles City), stated that the company is one hundred percent employee owned, with just over 300 people. Oftedal maintains several contracts with other developments and mining projects in the area. While there is no guarantee that Oftedal will be involved in the Otter Creek project, the area needs every opportunity it can get.

Mr. Lundby stated that in the past 18 years, work outside Montana has increased tenfold, while work has consistently declined in Montana. Each year it becomes harder to justify keeping the corporate headquarters in Miles City. Virtually everything purchased sends money out of the state. The state needs industries to bring tax revenue back to Montana, and citizens need good paying jobs. In eastern Montana, both schools and child and family services organizations need funds. He addressed the current worldwide debate regarding human contribution to global warming, and stated that no matter the outcome of this debate, people will continue to burn an unknown amount of coal for the foreseeable future. This coal lease will not increase the amount of coal burned, but rather only change where that coal is mined. The Otter Creek coal was given to Montana by the federal government for the benefit of our citizens.

Jenny Harbine, Earthjustice attorney, urged the Land Board to not lease the Otter Creek tracts because Otter Creek is an alluvial valley floor. State and federal laws place severe restrictions on mining that impacts alluvial valley floors. She noted that the law is concerned with impacts not just on the land to be mined, but on adjacent lands that are impacted from coal mining activities. In the Otter Creek region there is a large area that is hydrologically connected by groundwater that would be affected by potential coal mining of the Otter Creek tracts.

Under the law, coal mining will not be permitted if it will interrupt farming, or if it will disrupt the essential hydrological functions of an alluvial valley floor. In this context, those functions include the collecting and storing water, the collection of runoff and the retaining of moisture within the soils. It also includes the role in regulating the flow and source of groundwater. Additionally, coal mining will not be permitted if it will materially damage the quality and quantity of surface and ground water in an alluvial valley floor.

Because the conditions of mining an alluvial valley floor are so onerous, coal mining is most often prohibited in these areas and may well be prohibited here as well.

Ms. Harbine asked the Land Board to consider carefully whether by leasing the Otter Creek tracts, the goal is to grant a right to mine on lands that state and federal law have determined are unsuitable for mining. She urged the board to decline the proposal.

Anne Hedges, Montana Environmental Information Center (MEIC), read a prepared statement (*see Related Materials, Attachment 6*). She also provided supporting information for the Land Board's consideration (*see related Materials, Attachment 7*).

Allison Lawrence, Students for Social, Economic, and Environmental Justice (SSEEJ) from Big Sky High School in Missoula, expressed her concern about the massive extraction of coal in eastern Montana. She stated that the 30-year process is going to supple jobs for only half of one generation, but is promising to stimulate the entire economy. She expressed concern that during that time people will be working in dangerous jobs. She noted that the land cannot speak for itself, and that much of Montana's revenue comes from tourists coming to see the magnificent state. Montana would not really profit from the coal, were it to be mined.

Percy Bennett, Environmental Law Center attorney (Bozeman), referenced Ms. Harbine's testimony about the alluvial valley floor regulated by the Federal Surface Mining Control and Reclamation Act, through which permits are issued. She elaborated that water quality and habitat would face dramatic alterations that would have huge impacts. Altering the hydrology of the alluvial valley would have long term effects on resources [she noted that such alteration was probably illegal].

Rep. Chuck Hunter, HD 79, presented a letter signed by 24 Democrat legislators *(see Related Materials, Attachment 8).* He stated that the letter is neither for nor against the development, and recognizes the challenges involved in a decision of this magnitude. He stated that it has been suggested that the Land Board disregard climate change in their deliberation, and stressed that the signed legislators think otherwise. The legislators believe that the issue of climate change should, and must be a part of the determination.

Michael Phelps stated that global warming is an issue and that job creation itself does not justify leasing Otter Creek since coal is the primary source of greenhouse emissions, and the global warming is real and caused by human activity. Mr. Phelps stated that leasing Otter Creek is in direct conflict with the Land Board's obligation as leaders of Montana who are looking out for the well-being of the people and future generations. He asked the board to please consider that, and vote against the proposal.

Jenny Godwin, SSEEJ, stated that what concerned her most when learning about Otter Creek was the rumor that coal emissions do not affect climate change. Coal mining cannot be spoken of without addressing climate change. Ms. Godwin detailed the peril faced by those whose homes, lives, ancestral grounds and history are threatened. She said a new type of refugee will surge into prevalence.

Kyla Wiems, MEIC, urged the board to vote against leasing the Otter Creek coal tracts. She presented to the board copies of the book *Waste Land (see Related Materials, Attachment 9 for book details).*

Diana Hammer (Helena) stated that leasing Otter Creek is a bad idea. She detailed steps taken by her family to help protect the resources in Montana. She stated that coal

is not the way forward. Montana is known as the "Last Best Place", and she does not want it to become known as the "Last Best Place to Mine Coal".

Andy Anushko (Helena) referenced Ms. Hammer's statement, that the family has taken several deliberate steps to meet all their electricity needs from renewable sources. He recognized that development of the tracts may create new jobs on-site, but said it simultaneously puts other small business and contractors in jeopardy.

Frances [?], SSEEJ (German exchange student), stated that she was shocked when she learned about the planned for Otter Creek. The potential impacts reach far beyond the borders of Montana

Andrea Church, Big Sky High School, stated that as a student she does not want the money that will come from Otter Creek, but would rather have a livable future.

Verner Bertlesen, former Montana Secretary of State, stated he is all too aware of the challenges the Land Board must consider. There is a tendency when money is involved, and issues become important, to be pressed into making a decision that affects things far into the future. He said that the coal at Otter Creek has been there a long time, and if the board makes no decision regarding the coal today, it will remain there for the future of Montana. He cautioned the board to be careful and certain that they are protecting the land, the environment, the water, and the citizens.

Jill Van Alstyne, Helena High School teacher, echoed Mr. Bostrom's comments, in that she would rather have a salary cut than receive money from the development of Otter Creek.

Cary Hegreberg, Montana Contractor's Association, urged the Land Board to support the leasing of Otter Creek. While approaching the Capitol he faced protesters chanting "no coal". He said these are some of the same individuals who in the past have said "no gold mining", which is what led to the state's acquisition of the Otter Creek tracts. These same groups have said "no" to drilling on the Rocky Mountain Front, new power plants, tire burning at cement plants, gravel pits, and, timber sales on state and federal lands.

Mr. Hegreberg posited that the recent closing of Smurfit-Stone Container near Frenchtown is directly tied to those movements to try and stop timber sales. He said all that has been accomplished is that the forests burn, lumber is imported from Canada, and 400 good, high-paying jobs in Missoula were lost.

Otter Creek will lead to an additional 500 to 1000 jobs throughout the state. Mr. Hegreberg suggested the Land Board members review testimony given at the legislative hearings regarding the sustained yield law for state land timber (HB537, 2003 Legislative Session). Mr. Hegreberg contended that Montana has the ability to manage its natural resources in a responsible manner that generates money for the schools and institutions. Unemployment in the construction industry is currently running at eighteen percent in Montana, and continuing to grow. He asked the board to say "yes" to responsible development in Montana.

Leo Berry, Great Northern Properties (GNP) attorney, stated that Chuck Kerr was unable to be present due to inclement weather. The original intent behind the granting of sections 16 and 36 in each county was to sell the lands and create a monetary trust used to support common schools. Other states had not handled their lands responsibly, so Congress placed a minimum of ten dollars on the sale price of any land. At that time, land in Montana could not be sold for ten dollars. The result was the formation of the

Board of Land Commissioners to address the land stewardship and generate revenue to support common schools.

While the Otter Creek lands are not part of the original grant, they do fall under the provisions of the school trust lands. Mr. Berry stated that this is a once in a lifetime opportunity to lease these lands and generate revenues for the common schools. GNP acquired their Otter Creek tracts in 1992 (and recently leased them to Arch Coal), and Montana acquired their tracts in 2002. This is the first time that any company possessing the financial capability to develop this kind of project have stepped forward.

Much of the conversation has been what the minimum bid ought to be. There is no legal requirement for a minimum bid. The focus should really be on the revenues generated by the royalties. In order to receive the royalties, the coal must be mined. In order to mine the coal, the tracts must be leased. The school trust currently has approximately four hundred million dollars, and this project alone can triple the amount of money in the trust. Regarding the environmental concerns, there are very strong laws which protect alluvial valley floors. Additionally, that is not the issue the board is deciding on at this time. GNP encourages the board to move forward with the bid package.

Kaylyn Curry, SSEEJ, stated that she is a student who does not want books bought with "blood money from coal" which will ultimately create an unlivable future based on short-term gain versus long-term consequence.

Mike Scott, Sierra Club, complimented the students who have spoken. He stated that this decision is about more than the school trust fund, it is about the kind of future we want to have. Rarely does the Land Board have the opportunity to make a decision of this level of importance. Mr. Scott noted that this meeting coincides with the worldwide climate negotiations in Copenhagen. He stated that the board has the opportunity to make a concrete difference, and a meaningful change in the course of climate change. He urge the board to make the only right, moral, and ethical decision, which is to keep this coal in the ground where it belongs.

William Walksalong, Northern Cheyenne Tribe Executive Administrator, noted that this has been and continues to be a very controversial issue. He stated that he has been involved with this issue since 1997. Mr. Walksalong stated for the record that the Cheyenne have always been in litigation over energy issues, from coal leasing to water quality standards. He referenced a letter to the board by Tribal President Leroy Spang *(see Related Materials, Attachment 10)*, which addresses issues like employment opportunities. Mr. Walksalong noted that Mr. Spang's perspective is from mining, as that is his background.

Mr. Walksalong addressed the draft Montana Mineral Exchange and Northern Cheyenne Fund Act, which is also before the board. The provisions in the act are:

- employment program;
- contracting program;
- environmental monitoring program; and
- cultural resources program.

He stressed that the tribe expects those provisions to be adhered to.

Dan (Yellowbear) Carlson, Northern Cheyenne Tribe, noted that he attended school in Colstrip with Mr. McRae. At that time Colstrip was beginning to expand due to mining, in a manner in which the Otter Creek area may also expand. Mr. Carlson stated that expansion may bring money, but money often brings destruction. He noted some of the less savory elements that came to Colstrip came along with the mining. He said that he

has also visited Riverton, Wyoming, where there has been coal development for many years. That region is also rife with destruction and social issues, as a result of the inability to evolve along with the mining boom. Mr. Carlson stated that while Mr. Spang may have spoken for some of the Northern Cheyenne, there are many in the area who wish Otter Creek to remain pristine. He stated that the decision the board makes today will affect generations to come.

John Roeber, Boilermakers Local 11 Union business manager, said he is speaking on behalf of president Bob Winger, who could not be present *(see Related Materials, Attachment 11)*. There are 256 members in the local, and approximately 75 of those are currently unemployed. He asked the Land Board to vote to move forward with leasing the coal. The board will decide to develop Montana's vast coal treasure, or decide to delay the great economic expansion of Montana in our lifetime. Mr. Roeber referenced the closing of two smelters and Smurfitt-Stone Container, noting all the jobs that have been lost. He asked to board to vote to find ways to bring jobs back to Montana

Alicia Nelson, SSEEJ, asked what gives the Land Board the right to choose what is best for Otter Creek and for the rest of the world? She expressed dissatisfaction that speakers are limited to only three minutes when they speak for an entire nation of people. This extraction of coal will have harmful ramifications which the board members will not experience, as they will no longer be here. She asked the board to think of future generations and the future of their own children, and not to put short-term monetary gain over the lives of the people.

Abigail Adams stated that the Land Board has heard appeals to science, economics, morals, social issues, and cultural preservation. She urged the board not to lease the Otter Creek coal tracts. The issue can be distilled to values – whose values are being deprived, and whose values are being indulged. She illustrated the many reasons she is proud to be from Montana, and why she feels such a connection to the land. She asked the board members to consider what legacy they wish to leave.

Susie Rosa, stated that she has arrived recently in Montana, and noted that Wednesday December 23 is the one year anniversary of the Tennessee slurry dam eruption. This disaster spilled over five million cubic acres of toxic slurry into the Tennessee River Valley. She cautioned that such an event could also happen in Montana, and urged to board to vote not to lease Otter Creek.

Willie Duffield, Montana Association of Oil, Gas, and Coal Producing Counties (MAOGPC), said, "Let's do it."

Jennifer Nitz (Helena) stated that the Land Board has a once in a lifetime chance to preserve the land for present and future generations. She asked the board to please leave the land intact.

Brad Sauer, NPRC, stated that he runs cattle on Rosebud Creek, near the thirty-five miles of unreclaimed mine at Colstrip. The land contains a 60-foot well, which is abundant for that region. He stated that this probably is not the right time for developing this coal. While Mr. Hegreberg was correct in many ways, the board needs to find different ways of doing things. As an example, he suggested using the Fuels for Schools Program as an alternative means of generating revenue.

Bud Clinch, Montana Coal Council Executive Director, stated the council's support of the state's leasing program, including the Otter Creek proposal. He expressed his agreement with some of the speakers about the effectiveness of the Surface Mining Control Act. There is an effective set of state and federal regulations in place to address

many of the environmental issues raised today. Those issues will all be addressed during the very exhaustive permitting processes. All of those considerations will also come before the board. Merely leasing these lands does not automatically ensure the right to mine. Mr. Clinch stated that the board should go forward, receive a windfall payment, and then address the environmental issues in the appropriate permitting programs analyses and public process to follow.

Steve Gilbert (Helena) stated that he sat in a legislative hearing in the past decade as the Coal Council (then represented by Jim Mockler) stated that there are a myriad of reasons that Otter Creek has not been developed, for many of the reasons discussed today. Mr. Gilbert said that development was a bad idea then, and it is a bad idea now.

Don McDowell, Powder River County Commissioner, stated that the commissioners have always stood for development of natural resources, and he believes that between MEPA, the EPA, and DNRC that development will be done correctly.

Janet McMillan, NPRC, stated that the if kind of thing proposed here were allowed to proceed to this point in Greenough—where she lives—there would have been tremendous opposition. If the proposed takings initiative is validated and passed, and the Otter Creek coal tracts are leased, the state could potentially be sued by the lessee on a takings claim.

Alexis Bonogofsky, representing National Wildlife Federation (NWF), stated that hunters and anglers have identified the Powder River Basin as the prime spot for upland game bird hunting. The area also has the best mule deer population in the state, and a great deal of revenue is generated from this industry. Montana must focus on sustainable jobs for the future. She asked the board to vote against leasing the Otter Creek coal tracts.

Ms. McCulloch read a prepared statement:

> *"I have been on the Land Board for six years and a Legislator for six years before that, and Otter Creek has been a hot topic the whole time. In fact, it was hot before that. No matter what we decide today, Otter Creek will continue to be a hot topic for this and future Land Boards.*
>
> *We are well aware that the public is split on the decision to put up Otter Creek coal for lease. Many oppose it for reasons relating to potential impact on water and the Tongue River, or for reasons relating to the burning of coal. Others oppose it because they oppose building the Tongue River Railroad.*
>
> *Many other people support the option of leasing the coal, usually because of the money it could bring to Montana schools and/or because of the jobs it could bring to this area.*
>
> *Although I am no longer the Superintendent of Public Instruction with responsibilities for school funding, I am still a Land Board member. The Montana Constitution, in Article X, section 4, made us trustees for state lands, and as trustees we must have undivided loyalty to "support and benefit" the beneficiaries of the various state lands. In the case of the Otter Creek tracts, we are talking about Montana K-12 schools and the children they serve.*
>
> *Like many others, I have great concerns about the Tongue River railroad and about the potential for degradation of water from such a project. I have even more concerns about its potential negative impact on existing Montana mines. As a Land Board we have made clear that if we lease,* ***we will not do so at a price that will***

subsidize the railroad in any way. *It is the intent of my motion that the Tongue River Railroad stop at Otter Creek. Otter Creek should not be used to profit other states at the expense of Montana. However, I do not see how I can fulfill my responsibility as a land trustee unless I support this opportunity for Montana schools.*

Yes, we must mitigate the environmental consequences. That is the reason that we insisted that if there is a lease, the Land Board will retain the authority to approve the mining plan and the reclamation plan. If the project goes ahead, ***every step*** *will be carefully and publicly considered.*

Yes, we must limit the negative impacts and increase the positive impacts to the nearby Northern Cheyenne nation. In 2002, I was part of the negotiations and proudly made the motion to adopt the signed agreement we now have with the tribe that empowers employment and recognizes cultural issues, if there is mining. That same agreement helps assure that qualified non-tribal members in Ashland, Birney, or in Powder River County who live within 50 miles of Otter Creek will have an employment preference and access to job training as well as tribal members.

Having said that, we must not give away this precious resource. Our responsibility to the trust is both for short-term returns and for long-range income. I have struggled with the question of the bonus bid. In Wyoming since 2002, there have been 8 parcels of state land that were leased for coal for 70 cents per ton or more. Two of the bonus bids were over 90 cents, with the highest being 97 cents. These are not just the asking prices, but the amounts paid by mining companies in Wyoming. These higher bonus bids were based on the infrastructure already being in place in Wyoming and due to competition from adjacent mines. The playing field in Montana is different than that in Wyoming.

In considering what the bonus bid number should be, research shows that 25 cents per ton is an amount that is the average of three Montana state land leases for coal since 1999 ($0.10, $0.16, $0.18), adjusted for inflation and the spot price of coal. It is far, far above the price needed to assure that the Tongue River Railroad is in no way subsidized by the state's minimum bid amount.

The bonus bid of ten cents that is out publically between Great Northern Properties (GNP) and Arch Coal in no way takes into account the Montana Land Board's fiduciary responsibility to schools. I don't begrudge Arch Coal making a good deal with GNP, but that figure is no correlation to being Constitutionally mandated to support and benefit schools. The only thing in common between the supporters and opponents of developing Otter Creek is that the State of Montana should not give this up for cheap. No sweetheart deal will be made.

As many have pointed out, the future is uncertain for coal, given the need to address climate change issues. No one thinks that coal will be phased out until many decades into the future, but there could well be national legislation that makes the burning of coal more difficult or more expensive. In that case, it becomes less likely that this resource will be developed right away or at all. For that reason, I believe we should try to receive a large bonus bid while we can, recognizing that the mine operation itself and therefore the potential large royalty payments may or may not ever materialize. A twenty-five cents per ton bonus bid would yield approximately $143 million to Montana schools.

I noted with interest that none of the testimony at the November Land Board meeting discussed funding of schools and the letters we've received from Legislators failed to directly mention increased funding to Montana schools.

With that critical element in mind, my last point has to do with where the money from the bonus bid goes. As trustees, we must have undivided loyalty to the beneficiaries, but school trust money does not necessarily provide extra money to schools, because the legislature can remove that same amount from education funding and put it somewhere else in state government, if they so choose. I call it the brick in the toilet. You can put in a brick, but the water level doesn't go up unless the legislature says it does.

For that reason, and since this is bonus money that is not already designated by law like any royalty payments would be, it is the intent of my motion that the bonus bid money goes to increased funding to schools, NOT to be used as replacement monies. If the Legislature does not use this money for increased funding then this Land Board has not met their fiduciary responsibility which is the sole Constitutional reason the Land Board exists. As a Land Board we can only lease Otter Creek if the act benefits schools. This motion is a warning to the Legislature that this requirement must be met. In addition, I intend to set a time limit on the bid that gives the bidders a chance to consider its finances carefully.

Governor and members of the Land Board, the time has come to make a decision."

Ms. McCulloch moved that that Land Board:

- use the amended version of the proposed lease form (Agenda Item No. 1209-10):
  - to set a minimum bonus bid amount of 25 cents per ton; and
  - to set a 45 day limit on the bid process, to allow the bids to be reviewed at the February 2010 Land Board meeting; and
- that funding from the bonus bid must be used to support and benefit Montana K-12 schools.

Motion seconded by Ms. Lindeen.

Governor Schweitzer stated that at the November 16, 2009, meeting there was discussion about GNP moving forward with mining their tracts at Otter Creek even if the Land Board does not approve the leasing of the state tracts. Chuck Kerr of GNP stated that GNP would likely not move forward without the cooperation of the Land Board. He asked if GNP has received the funds for the upfront bonus bid from Arch Coal, and if so, are those dollars contingent on the state of Montana also putting its tracts up for bid?

Mr. Berry stated that it is his understanding that the monies committed in the agreement with GNP and Arch Coal are amortized over a five year period. GNP has received the first installment of that payment, and that money is not tied in any way to the leasing of the state's tracts.

Governor Schweitzer asked if GNP will continue to get those payments during the next five years if the Land Board chooses not to lease the adjoining state assets?

Mr. Berry said yes.

Governor Schweitzer asked if Arch Coal will continue in developing the tracts leased from GNP with or without the assurance that Montana has any intention to lease?

Mr. Berry stated that he has not been involved in the discussions with Arch Coal, so is unable to answer. Mr. Kerr indicated that there are contingency plans for GNP should

the state choose not to lease its lands. Mr. Berry said that he does not have the specifics of that information.

Governor Schweitzer asked if other miners in Montana be at risk of losing their jobs if Otter Creek were developed? He asked also if there is an additional market for higher sodium coal?

Mr. Clinch said that coal markets are changing. He referenced the controversy over mountain-top removal in the eastern United States, and the economics of continuing that particular type of mining. There has been a continued increase in the demand for Powder River Basin coal, as eastern coal has become more expensive, and the regulations that drive that mining continue to make it more difficult.

The coal market is forever changing based on individual regulations, particularly relative to the Clean Air Act; as well as the production from eastern states. Also the market may exist beyond the boundaries of Montana. As to whether Otter Creek would supplant production at current Montana mines, Mr. Clinch stated that if the process were carried out as smoothly as possible, it would still be five to ten years before coal began to be removed the ground. In the meantime, existing mine reserves will be depleted and the economics of the existing market will determine whether any of the existing mines come to their end of mine life. Mr. Clinch said that he does not believe that leasing Otter Creek would replace existing mining or production.

Governor Schweitzer asked if it would make sense that a rail be built from Otter Creek to the south to connect into the existing rail system that already has capacity to deliver to the south and east?

Mr. Clinch stated that scenario is plausible, in that it is not unusual for coal companies to be looking many years ahead.

Governor Schweitzer asked if it plausible for Arch Coal to develop the sections of land leased from GNP without the opportunity to lease the state-owned sections?

Mr. Clinch stated that he does not possess the mining engineering expertise to know the magnitude of production and how the coal reserves lie. Large scale mines are not typically developed on a single section of land, as it would demand a variety of logistical problems as to the mining methods, and easements to access the other tracts of land.

Governor Schweitzer asked if the development of Otter Creek would affect Rio Tinto Energy's market share?

Todd O'Hare, Cloud Peak Energy[1], stated that Spring Creek is currently the state's largest operating coal mine. The coal quality is mixed, but is primarily higher sodium content coal. Cloud Peak Energy has deliberately not gotten involved with the Otter Creek discussions as they wish to support the mining industry in Montana as a whole. The overall impacts of developing Otter Creek remain to be seen, but Cloud Peak's marketing team does not appear to be too concerned about it, in large part because of changing markets, particularly overseas.

Governor Schweitzer asked if there is congestion on the south and east rail lines?

Mr. O'Hare stated that currently Spring Creek coal is destined primarily for markets that are accessed via the northern rail route. No coal is shipped south through Wyoming.

[1] Cloud Peak Energy, LLC broke off from Rio Tinto Energy and is now a stand-alone, publically traded company that exists solely within the states of Montana and Wyoming.

Wyoming coal enjoys the south and southeastern markets, while Montana coal primarily enjoys the upper-north and western markets. Wyoming has put forth great effort to ensure smooth transportation, but there can be congestion, depending on weather and/or market conditions.

Governor Schweitzer asked if the Northern Cheyenne Tribal Council has taken a position on behalf of the tribe as to whether the state of Montana should lease the Otter Creek tracts?

Mr. Walksalong stated that the tribal council has been advocating for the conditions in the Otter Creek Settlement Agreement (*see Related Materials, Attachment 12*). As with any governing body, there are varying perspectives and opinions.

Mr. Bullock stated that he will support the leasing of the Otter Creek tracts, assuming that it is done correctly. This includes continued oversight by the Land Board, MEPA review, the state receiving full market value, and reclamation concerns. The obligation of the Land Board members is to administer the lands to secure the largest measure of legitimate and reasonable advantage to the state.

After reviewing not only the NorWest Evaluation, but also Northern Powder River Basin Lease Data from other mines, DNRC has recommended establishing the minimum acceptable bid in the range of ten to thirty-five cents per recoverable ton. The difference between twenty-five cents and thirty-five cents is substantial. Mr. Bullock stated that there is no reason in his mind that the bonus bid should not be increased to thirty-five cents. Because Otter Creek is a Greenfield site, there are some that have argued that we should expect a lower bonus bid. However, this position ignores the potential costs savings available to other mines and coal purchasers, including Arch, if the Tongue River Railroad were completed. His research indicated that in 2007 there were 147,000 cars carrying 17.5 million ton of coal transported from the Sheridan, Wyoming area, and other sites, through Montana to places east. If the TRR had been available in 2007, the 167 miles of rail would have provided savings that would have either gone to the utilities, mines, or railroads for $36.6 million. Mr. Bullock estimated what could have been saved, dependent upon the destination of the coal:

- TRR to central North Dakota burns - $4.50 to $5.70 per ton;
- TRR to eastern North Dakota burns - $5.00 to $9.00 per ton;
- TRR to Minnesota burns - $2.00 to $4.50 per ton;
- TRR to Superior, Wisconsin and/or Duluth Minnesota - $1.20 to $3.30 per ton; and
- TRR to Indiana locations - $1.20 to $3.30 per ton.

Mr. Bullock also reported that there are another 15-20 million tons that Arch Coal has been shipping to Minnesota, Wisconsin, Illinois and Southern Indiana along the Southern Route that may be more cost effective for them to send along the TRR if it is built.

Mr. Bullock reiterated his constitutional obligation of maximizing value to the overall trust, not subsizidizing other interests, and made a motion for a friendly amendment to change to bonus bid to thirty-five cents per ton.

Ms McCulloch stated that she and her staff have done a great deal of research as to what is a fair amount. Originally, she had thought to propose ninety cents per ton. She wishes it to be clear to the coal companies that there will be no sweetheart deal. Ms. McCulloch maintained her commitment to twenty-five cents per ton.

Mr. Bullock's substitute motion died due to lack of a second.

Ms. Juneau read a prepared statement:

"This is a huge issue for many Montanans. I know we have all heard many arguments – both pro and con - from hundreds of citizens all across this state. I appreciated our public hearings in Miles City and Lame Deer, in addition to all the public comment at our meetings here in Helena. I value all of the input and advice that poured in from many different fronts – tribal, county, business, environmental, political, and industry. This decision is not easy – and I know each of us spent hours reading, discussing, and meeting about this issue – and I respect every board member's vote today. After weighing every component and factor, I have come to the conclusion that I must vote 'no' on going forward to lease the Otter Creek tracts.

Those who support development might say that I am not meeting my fiduciary responsibility by refusing a simple "yes" vote. A "yes" vote might result in bonus bid funds to off-set general fund obligations of the legislature. It is not that simple, however. A "yes" vote would not necessarily be in the best interests of the school trust beneficiaries. It is time for us to be visionary. We cannot vote as if we have blinders on and only see our present economic picture. We must take lessons from the past seven generations and also look forward and provide for the interests of the next seven generations.

Of course there is value in mining the coal – potentially a lot of money over the next 40-50 years, but there is also value in keeping Montana "Montana." A large part of Montana's economic history is from extracting non-renewable resources. We are all familiar with Berkley Pit, the mining consequences at the Milltown dam, and the physical and financial repercussions of the vermiculite mine in Libby.

There is an argument that the immediate value gained in extracting this finite resource might be lost in other, tangible costs to the state and its people – including school children. Montana's future economy and the sustainable value to the school trust lands could very well be in preserving the land for future beneficiaries. Whether for other purposes or future development, technology continues to advance. The coal is not going anywhere. It is entirely possible that these lands will only become more valuable.

Some might also say a 'no' vote means I don't support our schools. Of course I support our schools. I support our schools so much that I ran for the office that oversees all of our public schools. We need to remember the amount of funding going to our schools is a decision for the legislature and is not based on this vote.

I am not turning my back on money for schools. I am upholding my duty and my responsibility to the children of this great state and saying that the greatest value and the best use of that land should not be determined by this board today.

This land board has been diligent in its development of resources and leasing of lands all across this state. We could sell every parcel of state land and log every tree on state lands, but we don't. We don't because we want to sustain Montana's lands for the future beneficial use. That is sound stewardship.

In this case, development is a one shot deal. The determination of the real value of this land should not hinge on this vote. I cannot in good faith vote to disregard the future potential of these lands."

Ms. Juneau thanked the Governor for allowing her to make her statement.

Ms. Lindeen thanked all the people in attendance that came to speak on both sides of the issue, noting that being involved and participating in the process is one of the most important things a citizen can do. She said that while there may be disagreements, everyone will always be Montanans and neighbors.

Ms. Lindeen expressed her understanding of the challenges of this issued by the board members. Being from eastern Montana, and having been a representative of citizens near the Otter Creek area, she stated that this is in the top two of the most difficult decisions she has had to make. She appreciates both sides of this issue, and has come to learn that nothing is ever black and white. Ms. Lindeen stated that she knows that even after voting is concluded, there will still be a long process to follow, with many more public meetings and a lot more discussion about what should and should not occur.

Governor Schweitzer expressed his appreciation for all the people who have travelled, shared information, have been part of the body of evidence in this process. He stated that this specific vote will not subsidize a railroad to be built in Montana. His intention is not to subsidize a private energy company to get into the energy business cheaply. There are 120 billion tons of recoverable in Montana, and it is irrational to say that unless the Land Board moves rapidly to lease these tracts, then clearly it is not supportive of energy development in Montana. Some have said said that the Otter Creek coal is the only coal that can or should be developed in Montana, but these are people who believe only in the public option. Energy is a business that ought to be in the hands of private companies and individuals who take a risk and get the reward. He said those companies should not—and will not—be subsidized by the Land Board.

Governor Schweitzer said he shares the growing concern of global warming. He related his experience at a meeting of Western Governors, where Felix Comacho, the Governor of Guam, talked about the atolls that are disappearing due to saltwater encroachment. The encroachment has resulted in the loss of farmland. The Western Governors also discussed the potential of the corn and wheat belts moving north; that trees will move to higher elevations; that range will move to replace them; some species will move to a higher elevation, or further north; that snow will arrive later and melt sooner; and many trout streams will disappear entirely. Governor Schweitzer acknowledged the enormity of those consequences, and stated that climate change is real in his mind.

However, people have stated that coal mining must be stopped in Montana. Governor Schweitzer drew an analogy to the growing evidence that the human diet has markedly changed, which has a negative impact on our children. By the line of reasoning given regarding coal, the Governor said that perhaps Montanans should lead the way by ceasing production of wheat (which is made into processed food), sugar beets (high sugar diets), or beef (too much red meat).

Governor Schweitzer reminded the attendees that the Land Board has a fiduciary responsibility: leasing for oil and gas, cutting timber, and determining the highest and best use of the land. Ultimately there is a responsibility to the people of Montana, as well as their children and grandchildren.

Motion to put out the lease proposal for bidding as motioned by Ms. McCulloch carried 4-1 (Ms. Juneau dissenting).

1209-11 HISTORICAL SOCIETY: PROPOSED LAND DONATION[2]

[2] Item 1209-11 was taken following 1209-4.

RELATED MATERIALS
ATTACHMENT 3

To: Montana State Land Board

Comments of Montana Conservation Voters regarding the Otter Creek tracts
Presented by Bob Adams
December 21, 2009

Dear Governor Schweitzer and Members of the Montana State Land Board:

I am Bob Adams of Helena, speaking in behalf of Montana Conservation Voters. We are a statewide, non-partisan membership organization that works to protect air, land and water by engaging people in the democratic decision making process. We also inform Montana voters of the votes and decisions of elected officials regarding Montana's environment.

The Otter Creek tracts leasing decision now before you is likely the most important decision affecting Montana's environment that you will make during your tenure on this Board.

And on this issue, Montana Conservation Voters urges you to **vote "NO"**...do not lease these tracts. And if you are considering, at this moment, that they might be leased, then we call on you to require an environmental impact statement prepared under the Montana Environmental Policy Act, MEPA, BEFORE YOU MAKE YOUR DECISION.

It's not just a preponderance of the evidence, but "clear and convincing evidence" before you which mandates a "NO" vote on whether to lease the Otter Creek tracts. For months, now, and this morning, you've heard and read the articulate comments of experts noting the impending and irretrievable damage to water, land, air and human communities that would follow the development of the coal in the Otter Creek tracts. You've heard, too, from the ranchers whose livelihood has been tied to that land for generations.

Montana Conservation Voters would like to add our perspective to the issue.

First, let me observe that all of you, over the last few years, have offered your sincere viewpoints on the importance of environmental considerations in your decision-making process for this Board. A common theme of your public statements, some of which were shared in meetings and in conversations with Montana Conservation Voters' leaders, has emphasized your intent to honor environmental considerations as part of your decision-making balance. Let me note some particulars:

GENERALLY (On the most pressing issues facing the Board):

It's critical to elect stewards as much as fiduciaries.

LOOKING TOWARD LONG-TERM OBLIGATIONS:

Maintaining and defending conservation values are as important, and often more important, than the responsibility to provide immediate income.

P.O. Box 63
Billings, MT 59103
406.254.1593 p
406.254.1609 f

P.O. Box 1215
Bozeman, MT 59771
406.586.0109 p/f

P.O. Box 9335
Missoula, MT 59807
406.542.1055 p/f

www.mtvoters.org
mcv@mtvoters.org

ON MEPA:

All significant decisions regarding State lands need to be made through an open public process...MEPA is an important tool toward that end.

ON OTTER CREEK:

Only after a thorough and public government review...

IN CONCLUSION, Montana Conservation Voters requests:

In light of your positive conservation and environmentally-minded thoughts, we respectfully submit that you, the Board, should vote "no" on the Otter Creek lease...for present and future generations of Montanans, and for the land.

Thank you, from Montana Conservation Voters.

Submitted by
Bob Adams
1029 State Street
Helena, Montana 59601
For Montana Conservation Voters

Testimony before the Montana [illegible]
Potential Release of Bid Package for the Otter Creek Coal Tracts
by Beth Kaeding, Northern Plains Resource Council
December 21, 2009

Governor Schweitzer and members of the Land Board: My name is Beth Kaeding, and I am a member of Northern Plains Resource Council. Thank you for this opportunity to speak today.

Throughout the entire process the Land Board has used to address Otter Creek, the public has never been allowed to comment on whether leasing these coal tracts is in the best interest of the State. I have attended and testified at every hearing you have held since May 2008, and at each hearing we were instructed to ONLY comment on whether the State should get an appraisal of the property, whether the appraisal should be accepted, whether the State should prepare a lease package for bid, and now whether the lease language should be accepted.

The process is flawed. There has been NO overarching public process that includes a discussion of the environmental, economic, and social aspects and costs associated with leasing this coal. Until there is an environmental analysis of the impacts to the land, air, wildlife, surface and underground water resources, the social and cultural resources of the area, and the area's rural agricultural economy, the idea that leasing Otter Creek coal is beneficial to the State is false, misleading, and, frankly, wrong.

A project of this magnitude has not been contemplated by the State for many years – if permitted, Otter Creek would be larger than any coal strip mine – ever – in our State. Northern Plains believes that our State Constitution and the Montana Environmental Policy Act direct the State to fully study the ramifications of its actions before making a decision on Otter Creek. Previous Montana Supreme Court decisions support our contention that **leasing is a major State action that requires full environmental analysis prior to the Land Board making an irrevocable and irretrievable commitment of State resources.**

Some are saying that global climate change is "rhetoric." Nothing could be further from the truth. Politicians can debate or deny it all they want, but the scientific fact is that climate change is real – and the burning of coal is a significant contributor to that change. Destroying the Otter Creek valley – its productive agricultural land, its aquifers, its soils, its air quality, its cultural resources, and its wildlife populations to get that coal, even if it is sent somewhere else to be burned – does not protect Montana. Global climate change has already come to Montana – our average summer and winter temperatures have already risen and our average mountain snowpack is already declining. These changes affect every Montanan. There is less precipitation and snowmelt runoff to replenish our aquifers, fill our reservoirs, irrigate our crops, and keep our streams flowing in late summer. The lack of severe cold temperatures has allowed pests like the pine bark beetle to flourish and to ravage our forests, which will eventually result in devastating forest fires. The fire season is already lasting longer, and fires are larger and more intense. Grasslands are less productive for lack of moisture, impacting grazing cattle and wildlife.

Otter Creek coal is best left where it is – in the ground. There it continues to function as an aquifer and the land will remain a productive part of Montana's agricultural economy. The entire

world is focused on transitioning from a carbon-based energy system. Montana should be leading the way with alternative-energy solutions and doing all that we can to protect and preserve our functional, intact, rural, prairie landscapes that are economically and biologically productive – and which bring many here longing for what we have – the last best place.

I do not believe that you are obligated to lease this coal simply because the state owns it. As you have said yourselves in previous hearings on this issue, the money that goes into the Common Schools Trust fund does NOT automatically go to the schools. Only the legislature can appropriate money for the schools and, historically, if there is extra money in the Common Schools Trust fund, the legislature simply reduces the amount of state revenues that go to the schools and so, in the end, school funding is not increased.

You cannot ignore the fact that approving Otter Creek means the construction of the Tongue River Railroad – and that that railroad will devastate another productive rural valley. The state should play NO part in any way of financing that rail line. You know that the Tongue River Railroad is a competitive threat to existing Montana coal producers as it would provide shorter access for higher-value Gillette, Wyoming, coal to get to markets currently served by Montana coal. Thus, rather than opening up new markets for Montana coal, the Otter Creek coal tracts, through construction of the Tongue River Railroad, would reduce coal production in Montana as Wyoming coal would be able to compete successfully in the northern-tier market area where Montana currently has a transportation cost advantage.

I believe that your job as the State's top leaders is to guide our State into the 21st Century and to protect the renewable natural resources that are the heart, soul, and fabric of what is Montana. Montana has been plundered for decades so that some individuals or corporations can get rich while the rest of us live with the consequences. Leasing Otter Creek coal promises nothing more than that same old history. Turning productive soils, native vegetation, and functioning aquifers upside down to develop a polluting, unsustainable coal industry that will ultimately collapse leaving scarred, depleted lands while also contributing to the degradation of our global climate is not what leaders with vision should be contemplating.

As Leland Turner of Gillette, Wyoming, who has lived with coal stripmining for 40 years said last week in a wonderful, yet tragic letter to the editor of the *Miles City Star*: "The mining industry uses the magic word: jobs. They promote the money mining *might* bring. Do not forget what they are taking! In Wyoming, they are polluting our air, destroying our land, and stealing our water. What is it worth? What will they leave for future generations?"

I ask the same of you, members of the Land Board. What is Otter Creek worth? What will YOU leave for future generations of Montanans? What will your legacy be?

I urge you to vote NO on leasing Otter Creek.

We need your help to stop the construction of one of the power plants in the western U.S. **Please make a special gift today.**

EARTHJUSTICE
Because the earth needs a good lawyer

Fight Global Warming!

Dear Gary,

If it's built, Nevada's White Pine coal-fired power plant would spew 13 million tons of new greenhouse gases into the atmosphere each year—speeding up global warming and air pollution.

We need your help to make sure this never happens.

Please make a special gift today to halt Nevada's White Pine coal plant and support a clean, sustainable energy future.

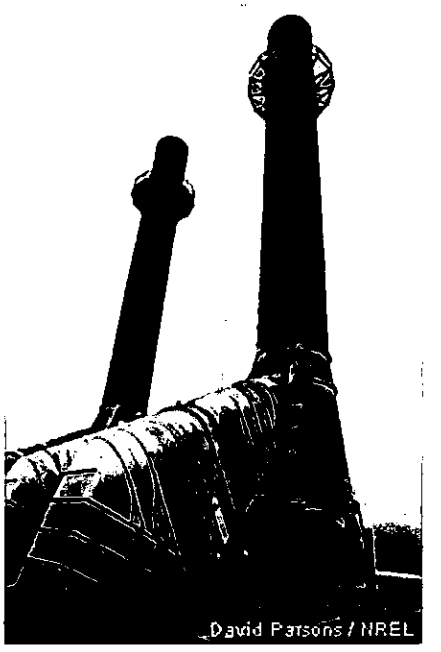
Just weeks ago, Earthjustice attorneys filed a lawsuit to halt the White Pine coal plant. If the White Pine facility is built, it would be **one of the largest and most heavily polluting power plants in the western United States**.

We've had some successes and we have coal on the run, but we can't stop now.

White Pine is just one of the many power plants we're challenging to curb global warming emissions, reduce toxic pollution, and set our country on the right energy path.

Please make a special gift to support a clean, sustainable energy future.

Fight Global Warming and Pollution: Prevent new coal-fired power plants!


David Parsons / NREL

DONATE TODAY!

Just last week, as a direct result of Earthjustice's two-year court battle, the backers of Montana's Highwood coal-fired power plant dropped plans to build the coal plant.

But we couldn't have stopped this plant—which would have generated 2 million tons of greenhouse gases each year—without the financial support of folks just like you ... and we are counting on you to help us continue clearing the way for a clean, sustainable energy

By giving to Earthjustice, you will help fund our work to curb greenhouse gases from coal-fired plants, including:

- Overturning Wyoming's approval of the Dry Fork coal-fired power plant, which would emit nearly 4 million tons of greenhouse gases every year ... and spew destructive gases like sulfur dioxide into the air of nearby areas.
- Opposing the expansion of the Seminole coal-fired power plant in Florida, which would generate 6.5 million tons of greenhouse gases each year.
- Halting the construction of the Desert Rock coal-fired plant in New Mexico, which would spew more than 12 million tons of greenhouse gases annually—equivalent to the exhaust from 2 million cars.

Make a special gift today to stop dirty, coal-fired power plants and set us on the right energy path.

Thank you for all that you do.

Sincerely,

Trip Van Noppen

Trip Van Noppen
President, Earthjustice

P.S. With your first contribution of $15 or more, we'll send you a sturdy, roomy Earthjustice tote bag—made from 100% unbleached cotton—so you can reduce waste and show your support for the environment. It's our way of saying thank you for your support.

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RELATED MATERIALS
ATTACHMENT 6

MEIC
MONTANA ENVIRONMENTA

"Protecting Montana's Natural Environment Since 1973"

December 21, 2009

Board of Land Commissioners
PO Box 201601
Helena 59620-1601

Dear Board Members:

The Montana Environmental Information Center urges you to deny leasing the Otter Creek coal tracts. MEIC has helped to bring forward testimony that proves that leasing Otter Creek would be a catastrophic environmental decision, and would have negative economic impacts on the State – including other state school trust lands. In addition, as stated by Chuck Magraw in his memo to Candace West with DNRC on December 7, 2009 (attached), and Jenny Harbine in her testimony to this Board, a decision to lease Otter Creek would also be illegal. MEIC agrees with Mr. Magraw's assessment that the appraisal was fundamentally flawed, and Ms. Harbine's assessment that leasing these tracts would violate both the trust mandate and the public trust.

Dr. Steven Running provided insightful, credible and verified scientific information that leasing these coal tracts will contribute to global warming (Dr. Running's presentation attached). Leasing the State's coal resources will allow the mining and burning of 1.3 billion tons of coal. When this coal is burned it will contribute about 2.5 billion tons of carbon dioxide to the atmosphere. That is approximately 62 times Montana's current carbon dioxide emissions from all sources combined.

There is scientific consensus that global warming will have a severe negative impact on Montana's temperatures and water resources. These water resources are relied upon by the State to assist in the generation of sustainable income for the trust in perpetuity from farming, ranching, recreation, timber production and more. (See attached.) For this reason alone, the State Land Board should refuse to lease these coal tracts.

The Otter Creek drainage is an alluvial valley aquifer. The Surface Mine Control and Reclamation Act (SMCRA) contains very stringent limitations on coal development in alluvial valley aquifers and those areas necessary to the hydrologic function of the alluvial valley. These limitations are so strict that it is often called a prohibition. All scientific research shows that the Otter Creek coal tracts are bisected by an alluvial valley aquifer and that shallow groundwater contained in the coal seams is essential to the hydrologic function of that alluvial valley aquifer both in the proposed mine area as well as downgradient. (See attached studies by the Environmental Protection Agency, 1981; Office of Surface Mining and Reclamation and Enforcement, United States Department of Interior,

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printed on recycled paper

1985; United State Geological Survey report and maps, 1985; United States Bureau of Land Management, 1982, 1984.)

These studies and associated maps indicate that this area is an alluvial valley aquifer that was considered unminable under SMCRA. The1981 EPA analysis found "Water Quality impacts from coal strip mining would last for hundreds of years."

Such severe impacts on water quality and quantity in an area dependent upon water availability for agriculture, is a poor idea legally, economically and environmentally. Considering the severe limitations to mining the area, the only likely outcome from approving a lease, would be to allow the development of the Tongue River Railroad. As stated repeatedly by Dr. Thomas Michael Power, whose previous comments are hereby incorporated into these comments, the development of this coal as well as the building of the Tongue River Railroad, would be a disaster for Montana's economy and agricultural producers in the area.

We urge the Land Board to vote against issuing a lease that would allow strip mining in the Otter Creek Valley. But if the Board chooses to move forward, against the economic and environmental best interest of this State, the Board should set the bid rate extremely high because it is the only money the State is likely to receive from this project because mining in the area is prohibited under State and Federal law and royalty income will not be realized.

Sincerely,

Anne Hedges
Program Director

RELATED MATERIALS
ATTACHMENT 7

Ecosystem Impacts to Changing Climate in the Northern Rockies

Steven W. Running
Numerical Terradynamic Simulation Group
College of Forestry and Conservation
University of Montana

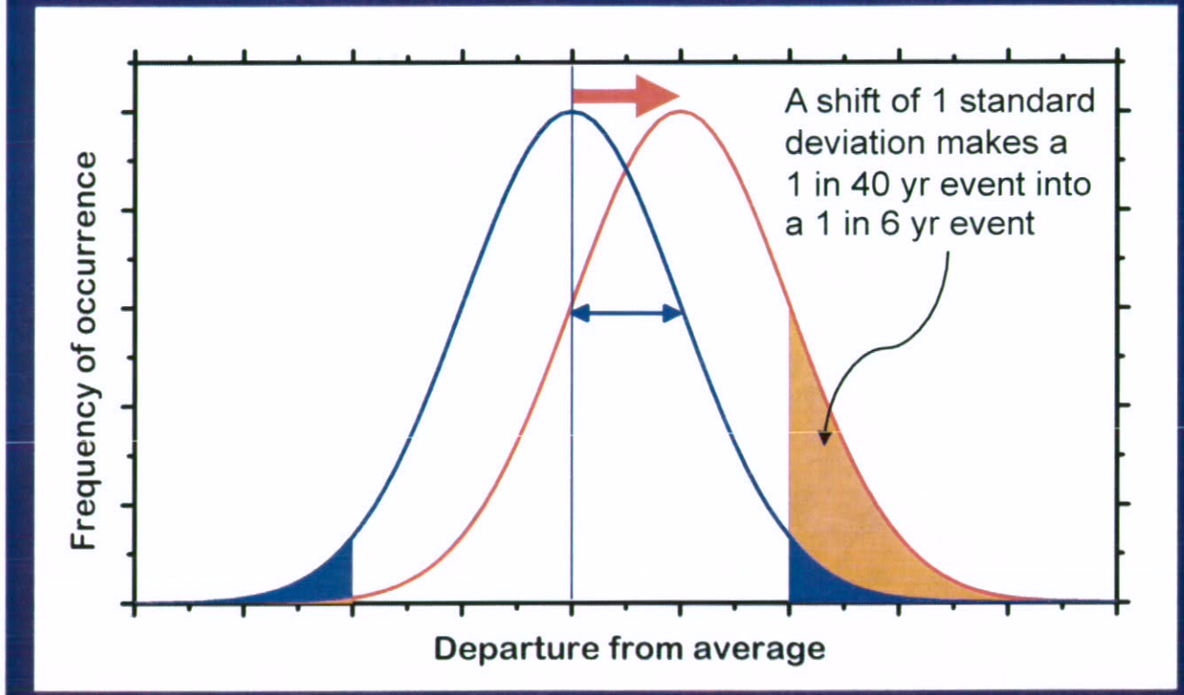
MT Land Board Briefing

December 8, 2009

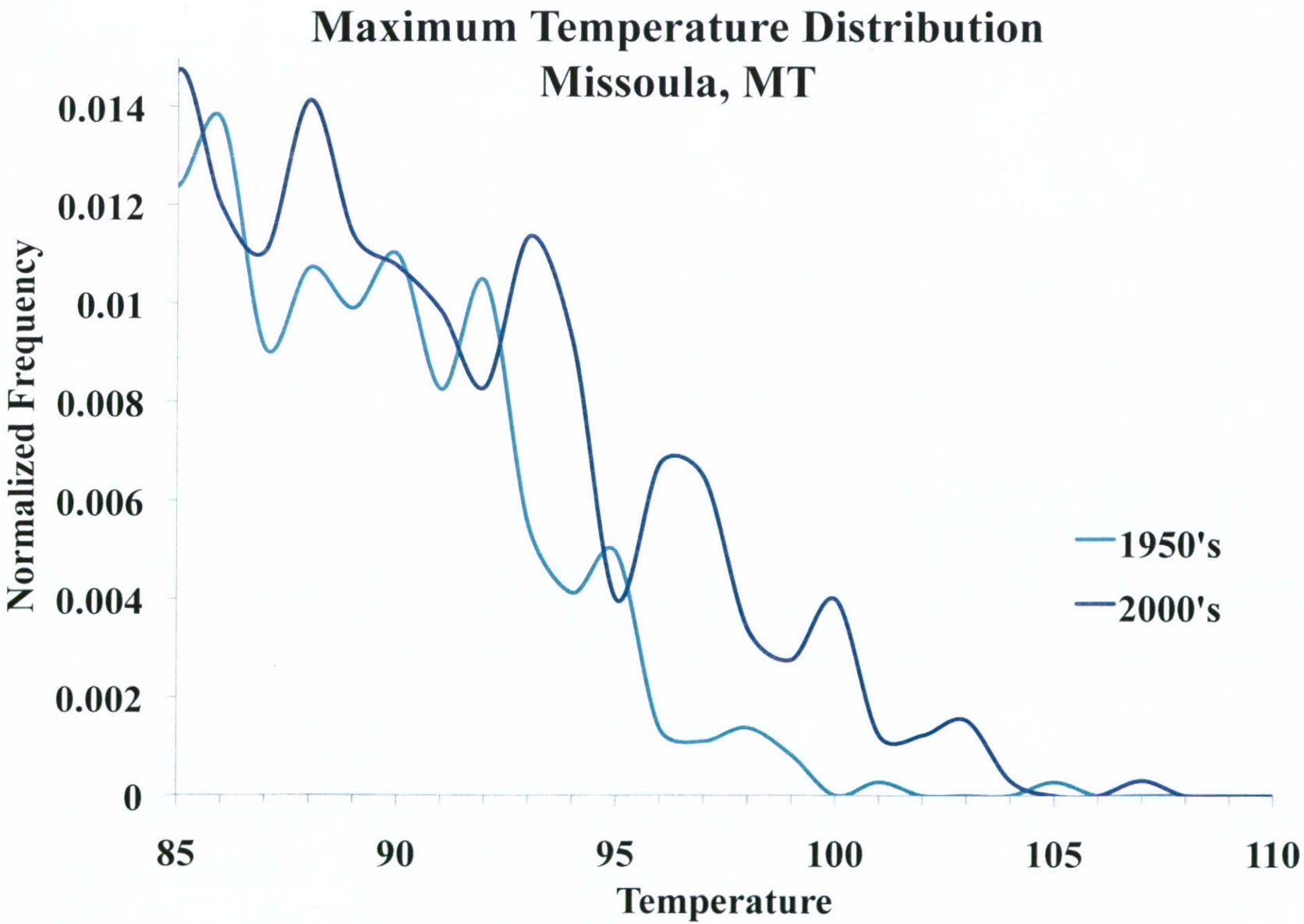
Calculus of extremes

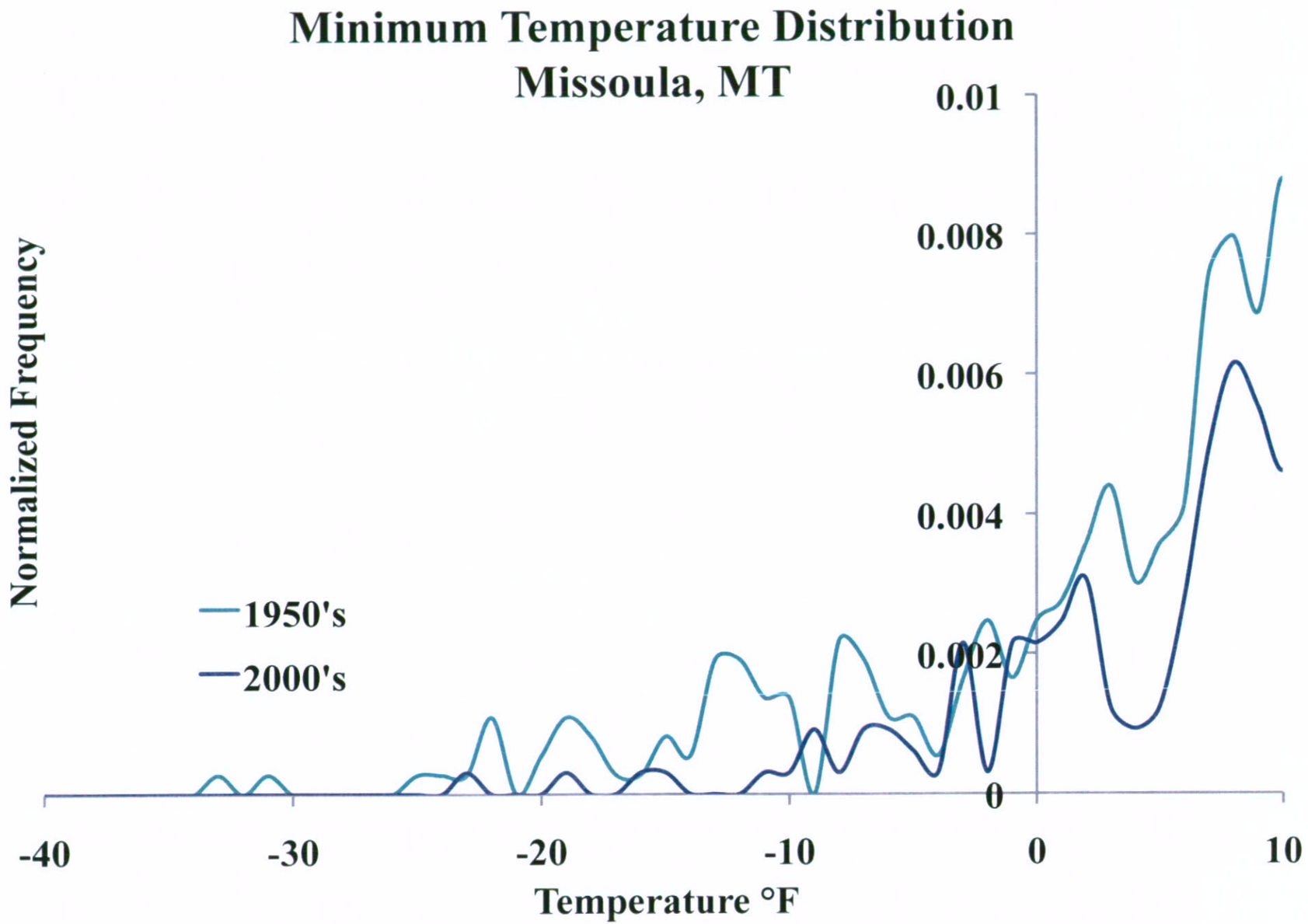
The distribution of weather events around the climatic average often follows a 'bell-shaped' curve.

Climate change can involve change in the average, or the spread around the average (standard deviation), or both.



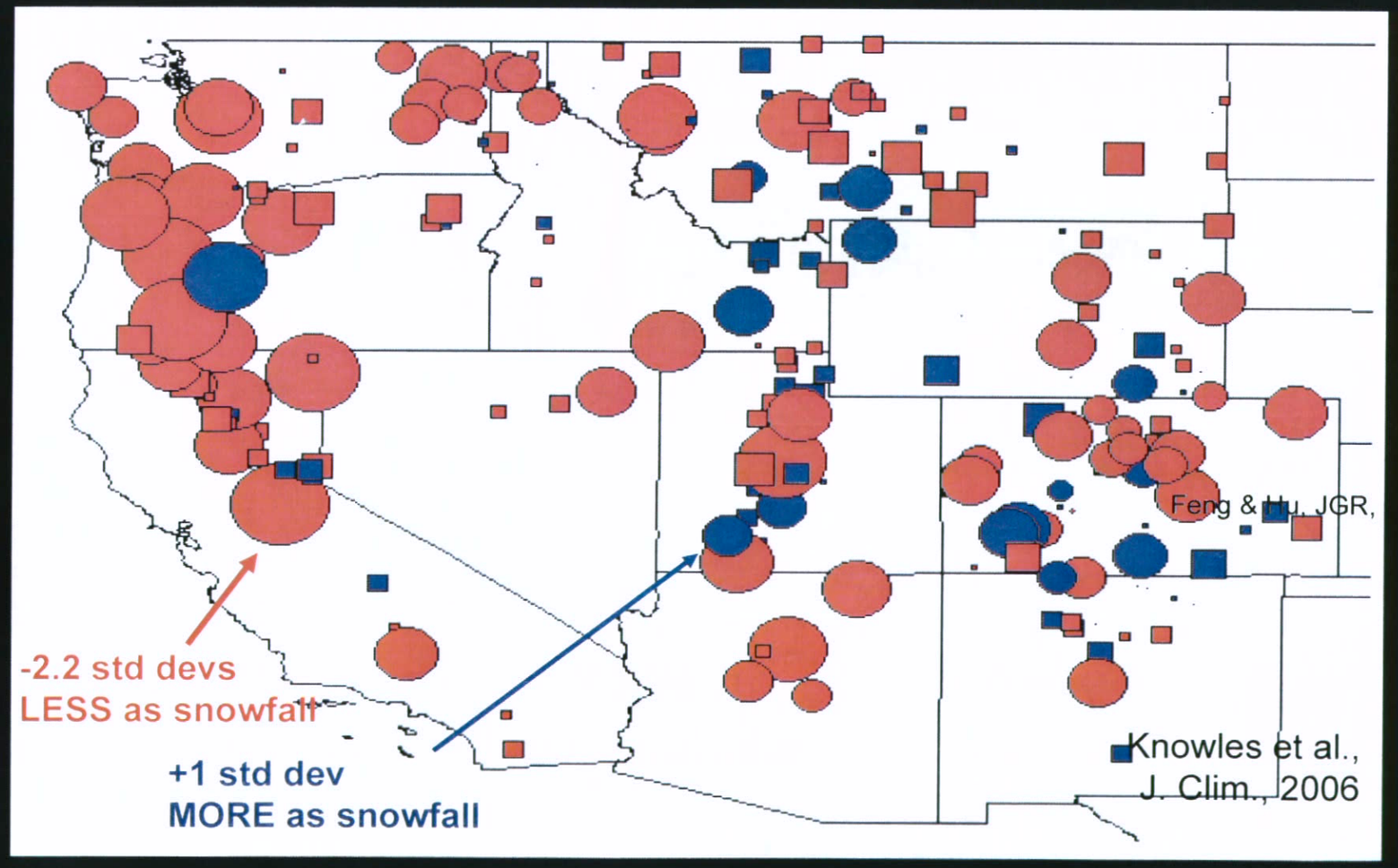
A shift in the distribution of temperatures has a much larger relative effect at the extremes than near the mean.

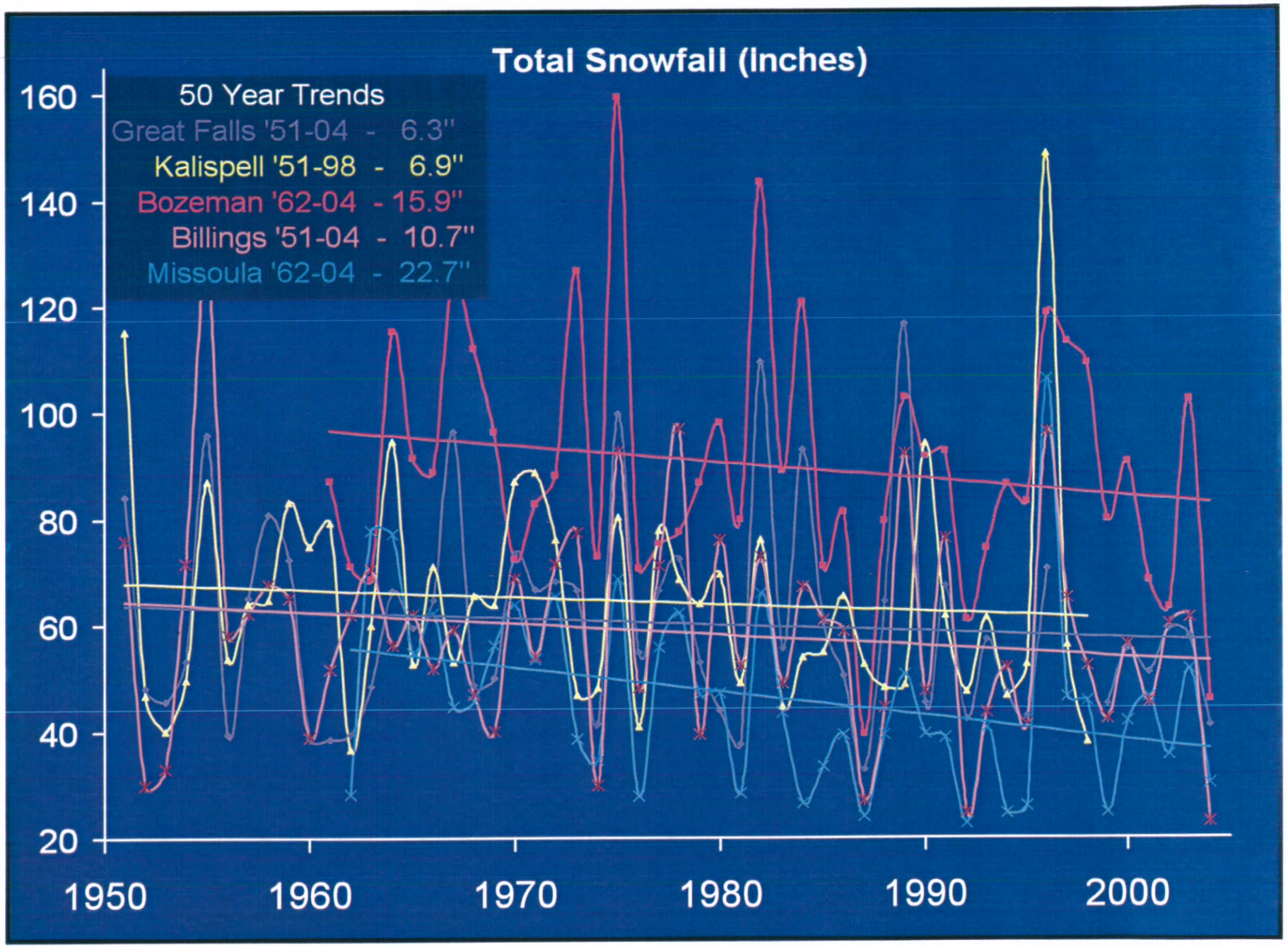

Maximum Temperature Distribution
Missoula, MT
Normalized Frequency
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
85
90
95
100
105
110
Temperature
1950's
2000's

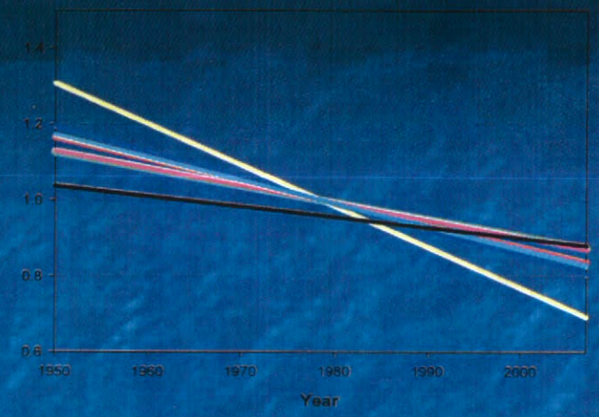

Minimum Temperature Distribution
Missoula, MT
Normalized Frequency
0.01
0.008
0.006
0.004
0.002
0
1950's
2000's
-40
-30
-20
-10
0
10
Temperature °F

This recent warming already has driven significant hydroclimatic changes.

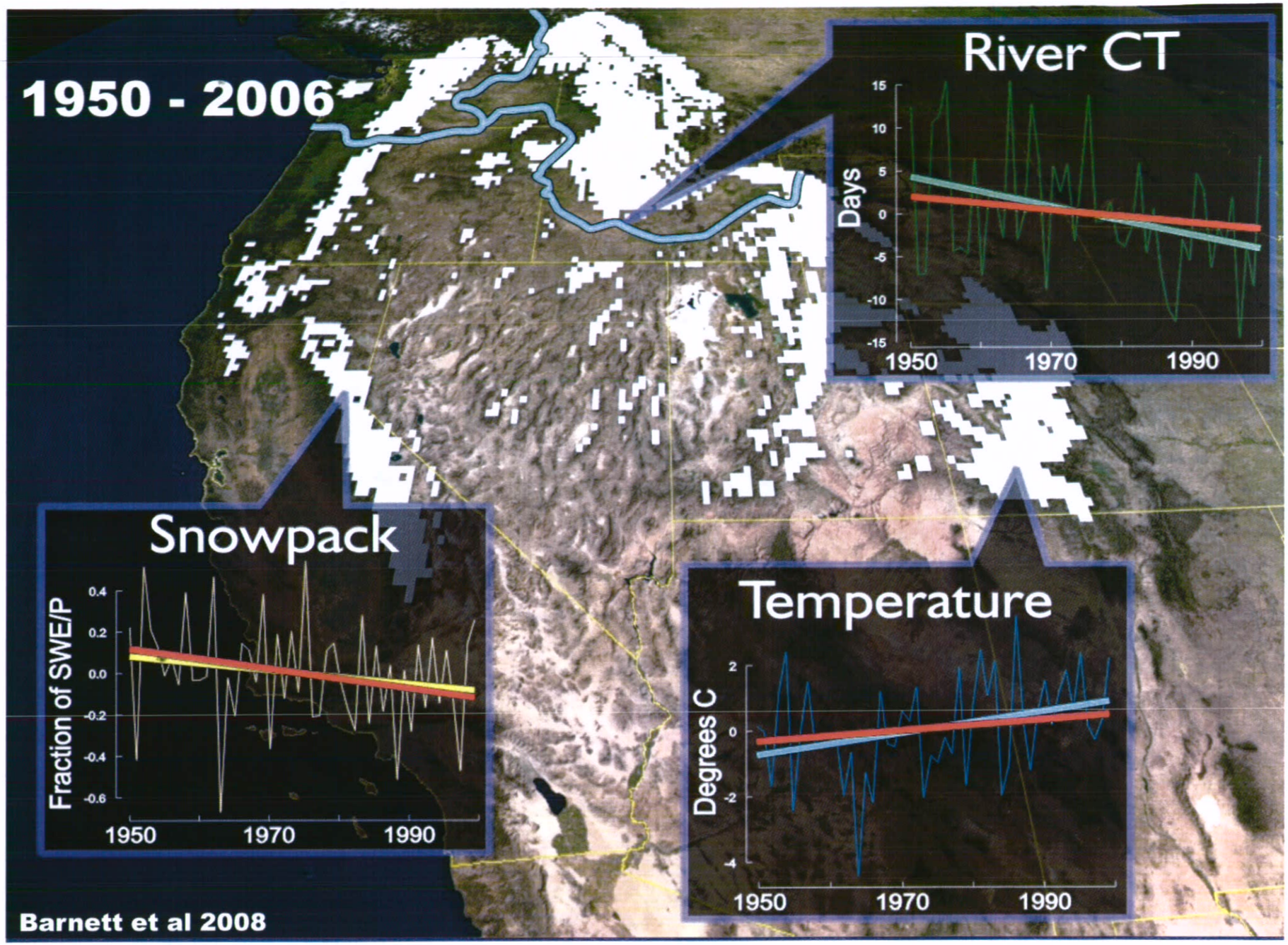
--> Less snow/more rain

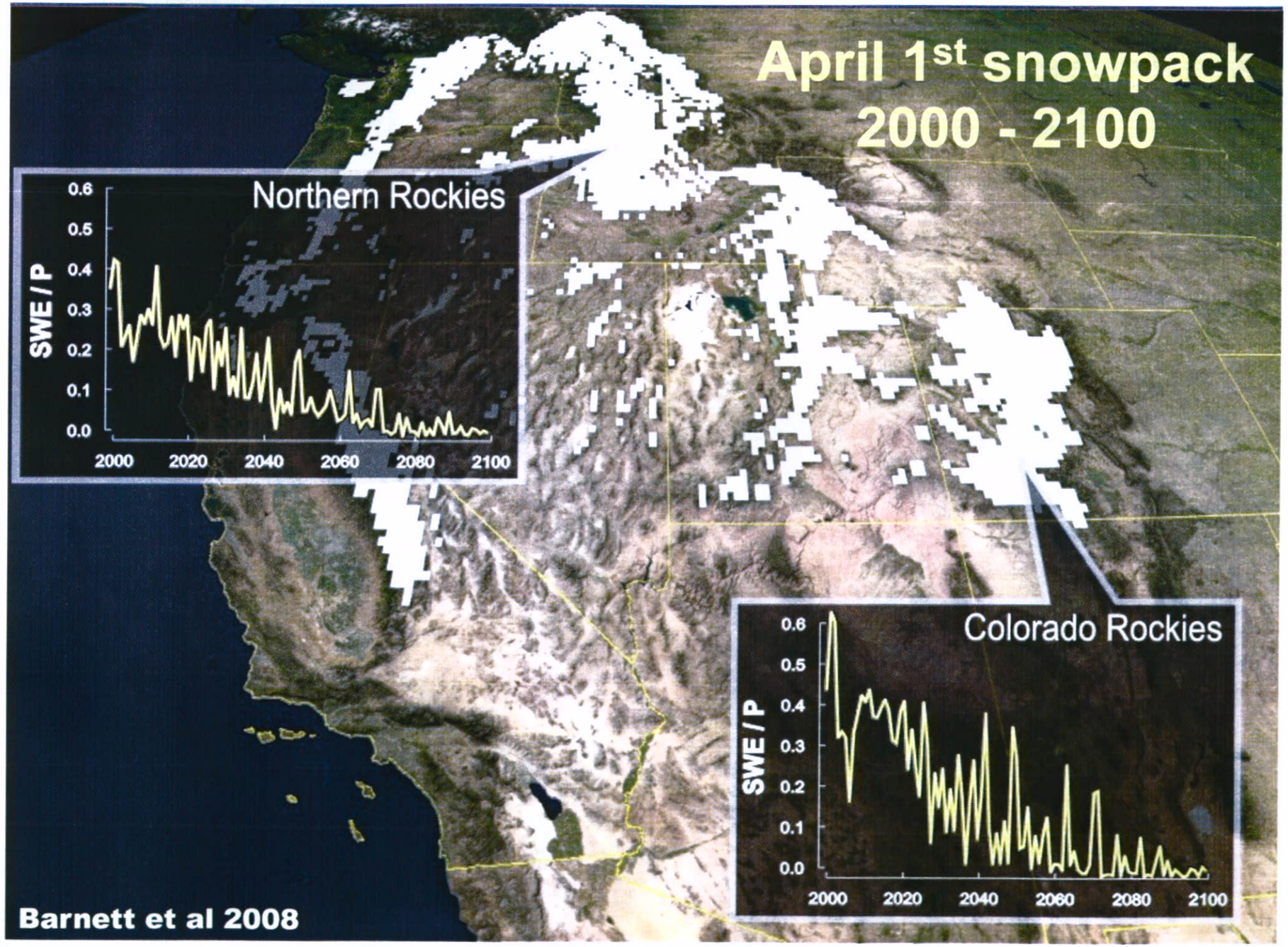


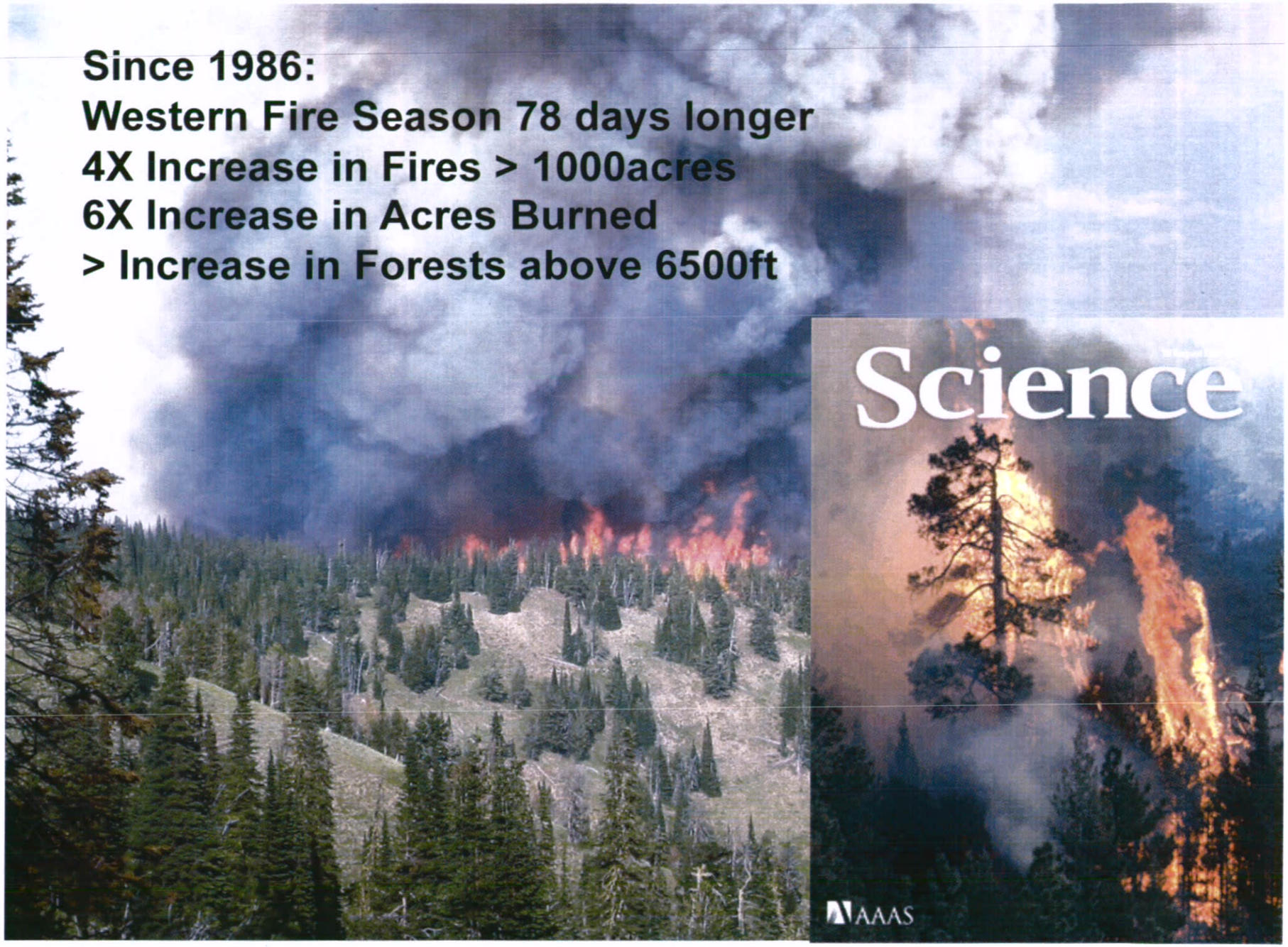

Total Snowfall (Inches)
50 Year Trends
Great Falls '51-04 - 6.3"
Kalispell '51-98 - 6.9"
Bozeman '62-04 - 15.9"
Billings '51-04 - 10.7"
Missoula '62-04 - 22.7"
160
140
120
100
80
60
40
20
1950
1960
1970
1980
1990
2000



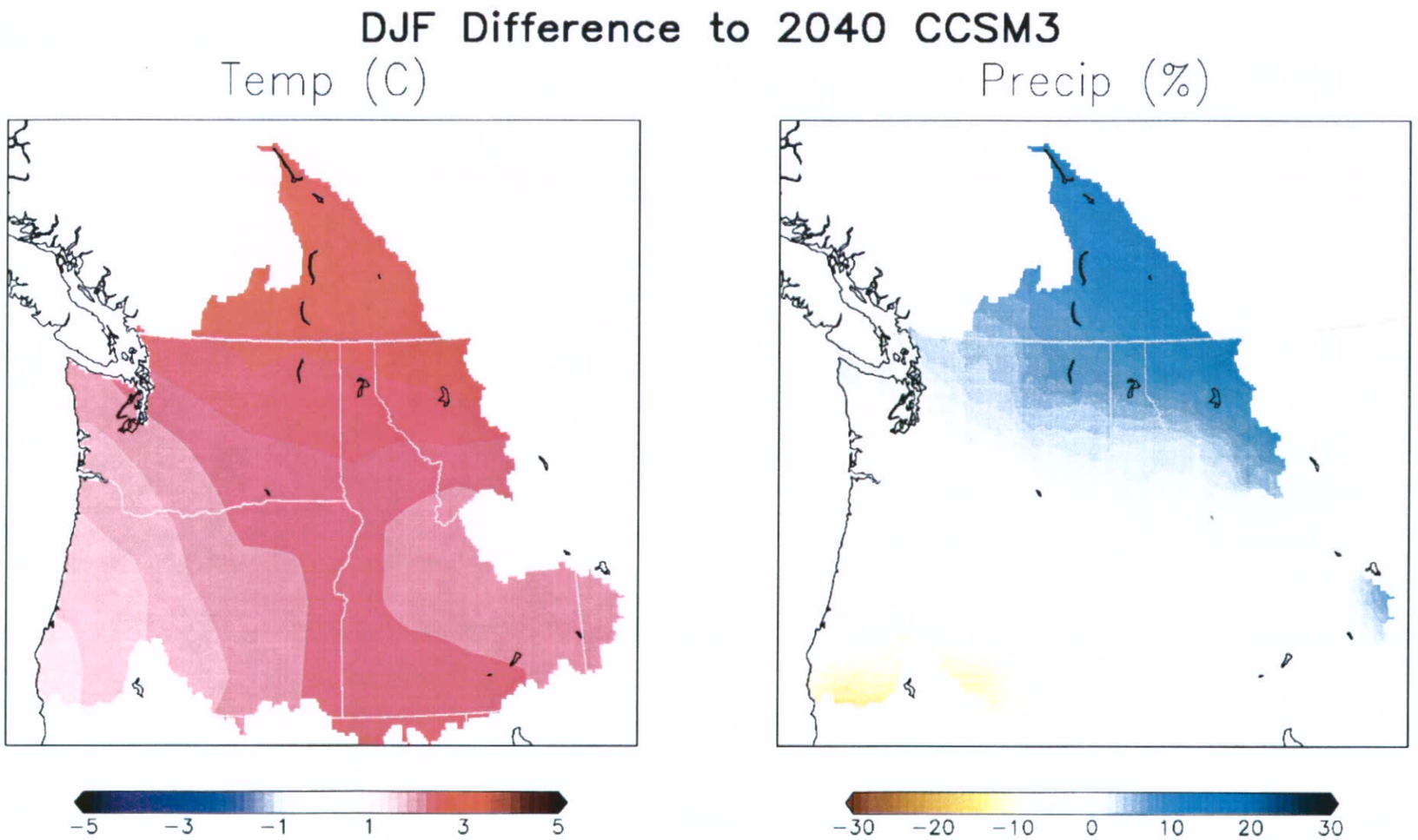
Yellowstone River
North Fork of Flathead River
Clark's Fork of the Yellowstone River
Clark Fork
Middle Fork of Rock Creek
Boulder Creek
Gallatin River


1950 - 2006
River CT
Days
15
10
5
0
-5
-10
-15
1950
1970
1990
Snowpack
Fraction of SWE/P
0.4
0.2
0.0
-0.2
-0.4
-0.6
1950
1970
1990
Temperature
Degrees C
2
0
-2
-4
1950
1970
1990
Barnett et al 2008

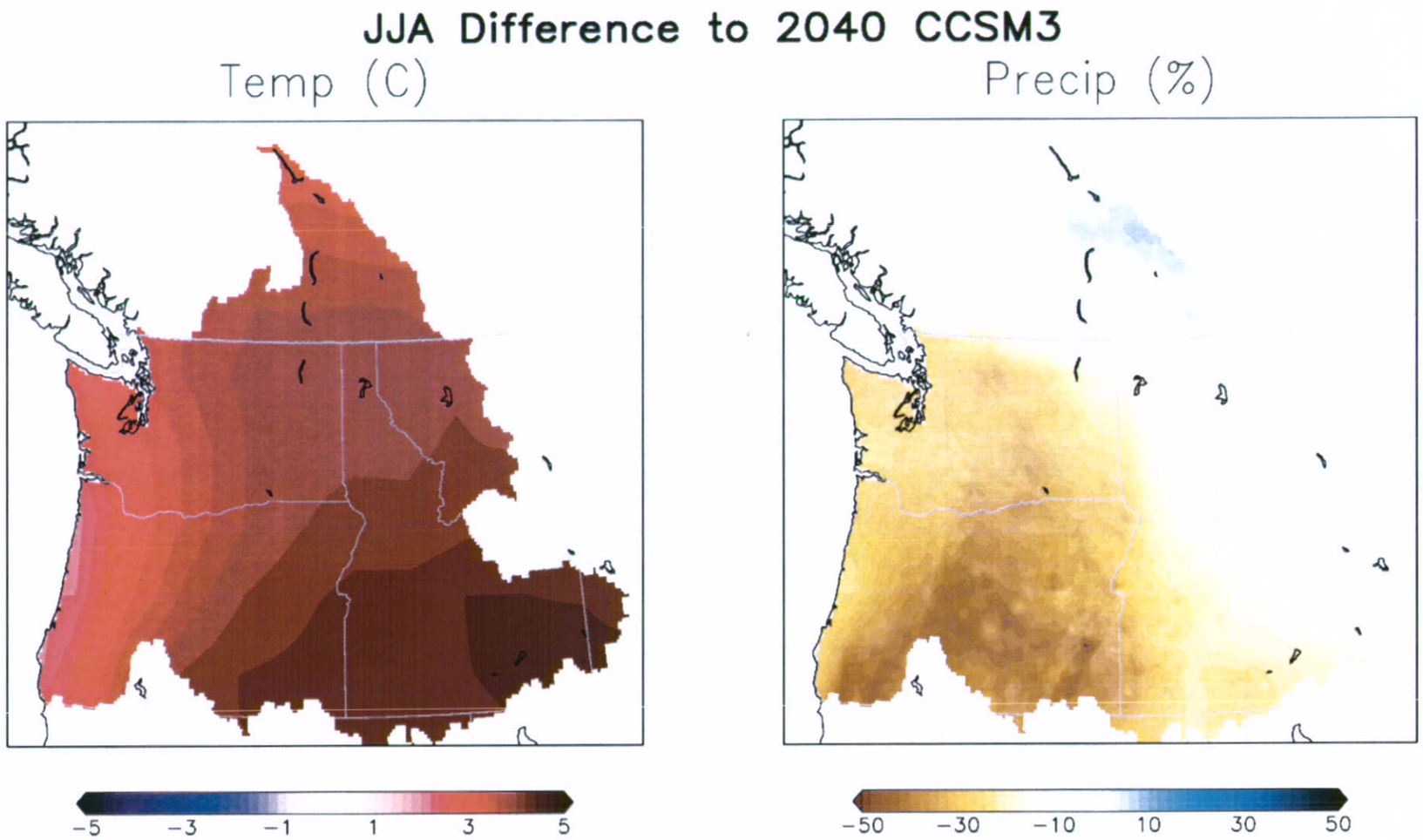

April 1st snowpack
2000 - 2100
Northern Rockies
SWE / P
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2020
2040
2060
2080
2100
Colorado Rockies
SWE / P
0.6
0.5
0.4
0.3
0.2
0.1
0.0
2000
2020
2040
2060
2080
2100
Barnett et al 2008


Since 1986:
Western Fire Season 78 days longer
4X Increase in Fires > 1000acres
6X Increase in Acres Burned
> Increase in Forests above 6500ft
Science
AAAS

Downscaling -- Winter



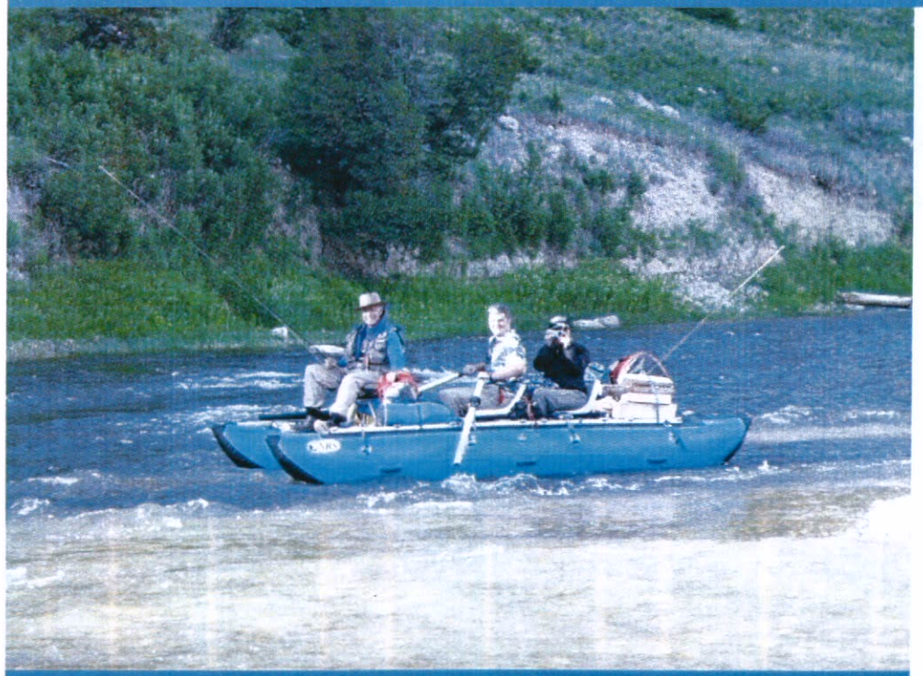
Downscaling -- Summer



By 2050 Global Climate Models project Montana to be 5deg F. warmer in summer, but receive 10% less rainfall

Water Management

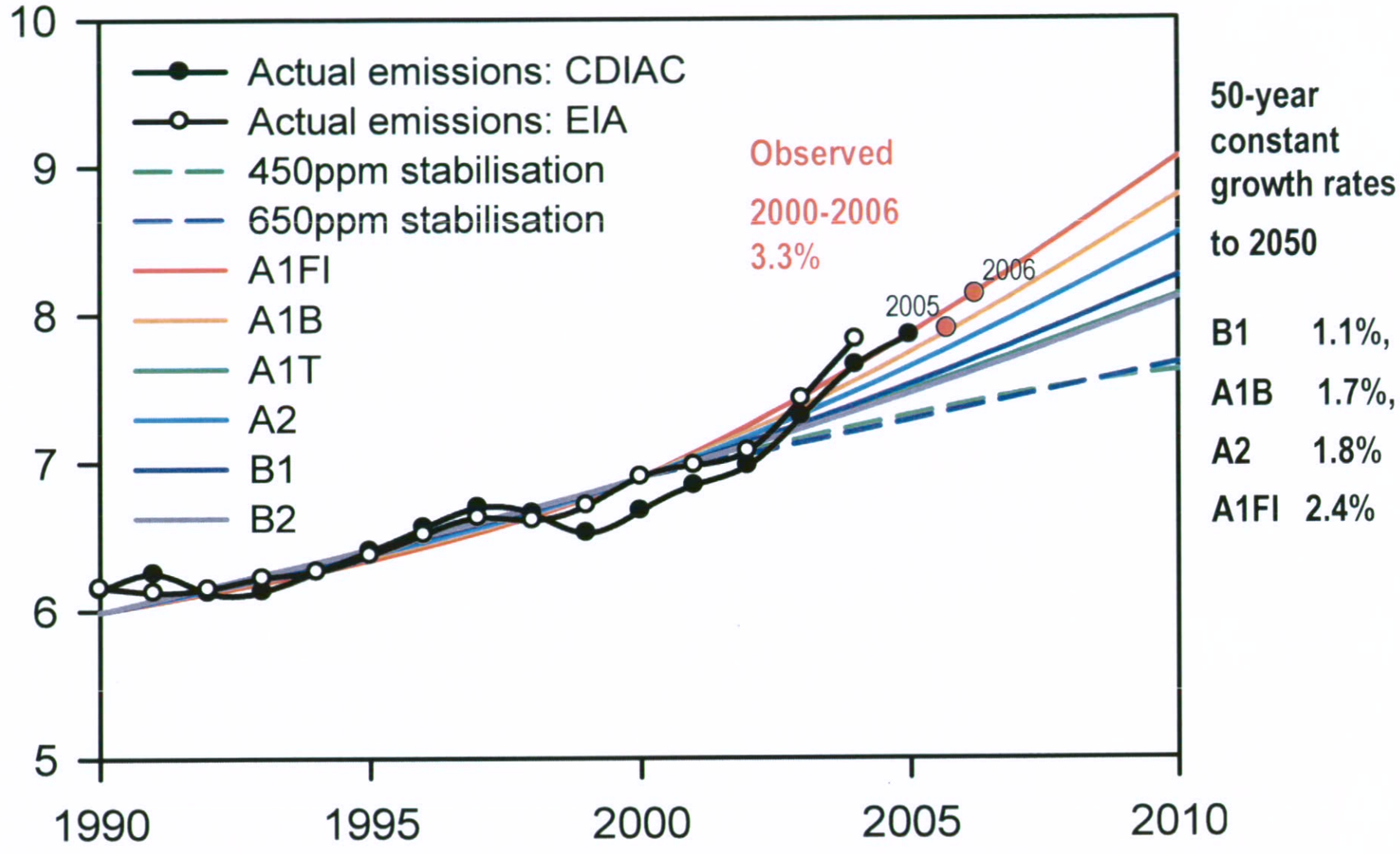
Recreation versus Agriculture



The MonDak Region has an enormous amount of potential for irrigation development.

MT Will need +1cm/decade precip increase

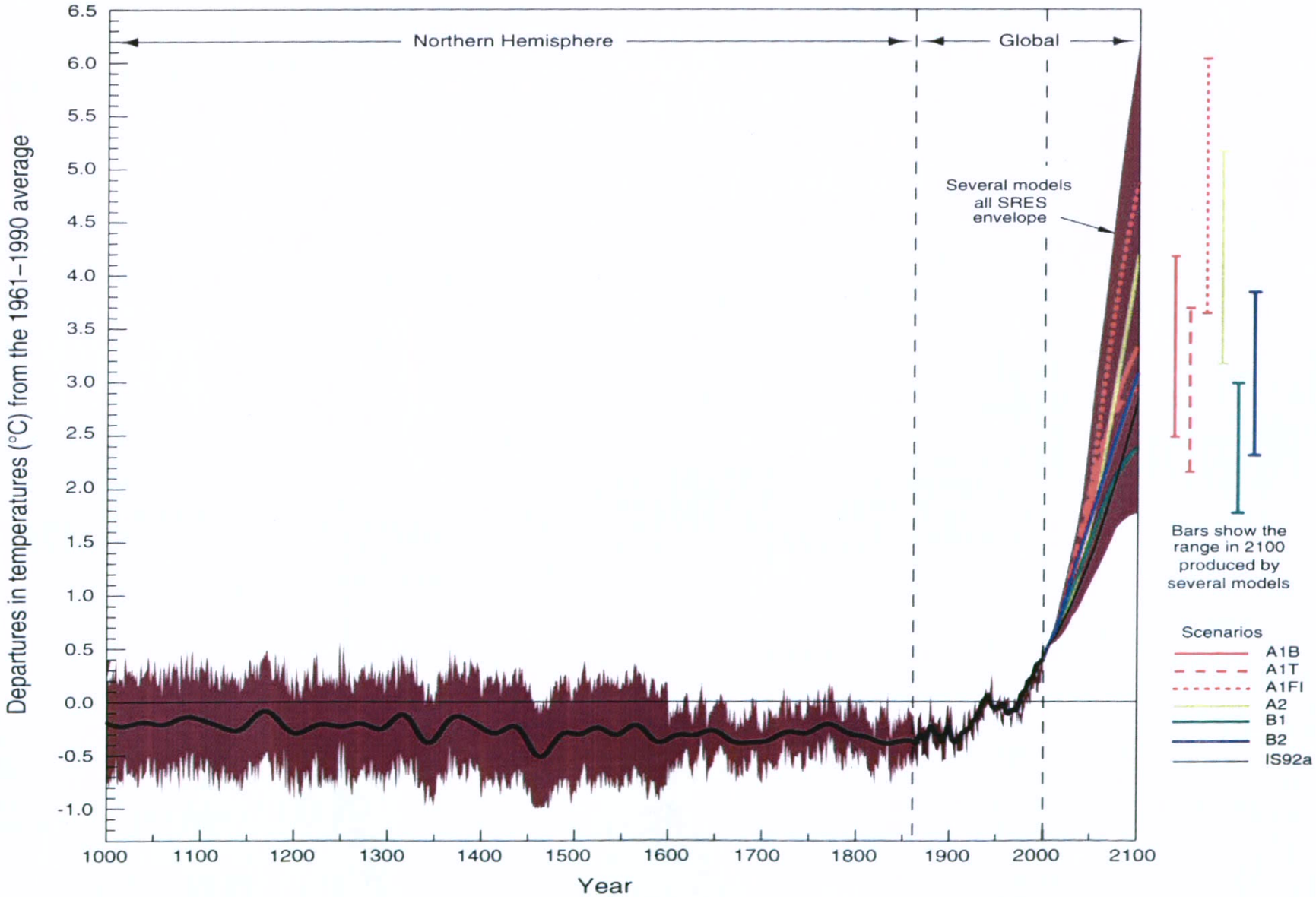
Trajectory of Global Fossil Fuel Emissions



Raupach et al. 2007, PNAS

Variations of the Earth's surface temperature; 1000 to 2100

1000 to 1861, N.Hemisphere, proxy data; 1861 to 2000 Global, instrumental; 2000 to 2100, SRES projections



LAW OFFICE
CHARLES E. MAGRAW
501 8TH AVE
HELENA, MT 59601

406/449-3375
406/461-3696 (mobile)
C.MAGRAW@BRESNAN.NET

December 7, 2009

RE: Otter Creek Coal

Candace West
Chief Legal Counsel
Department of Natural Resources and Conservation
State of Montana

Dear Ms. West:

As you are aware numerous commenters raised specific, substantive objections to the Norwest Otter Creek appraisal. In its response to comments and in testimony before the Land Board the Department dismissed these objections stating that the appraisal provided a basis for the Land Board to proceed. I write to reiterate the Natural Resources Defense Council's position that the appraisal is legally inadequate and that the Land Board cannot issue the proposed bid package until the State obtains an appraisal that sufficiently informs the State as to the property's fair market value and the terms and conditions to be included in any lease.

A recitation of the appraisal's myriad defects identified by commenters and the Department's, mostly unresponsive, arguments seeking to justify the appraisal will not be attempted here. The comments and the Department's responses are preserved in the record.

Instead, I want to speak more generally about the requirement for the State to ascertain fair market value before disposing of state lands and the failure of the Norwest appraisal to accomplish this task.

The requirement that the State must determine the value of the land it desires to sell or lease is well-settled. Section 11 of the Enabling Act (as amended by the Act of May 7, 1932, ch. 172, 47 Stat. 150 (1932)) provides, with respect to those lands granted to the State of Montana by the United States that "none of such lands ... shall ever be disposed of ... unless the full market value of the estate or interest disposed of, to be ascertained in such manner as may be provided by law, has been paid or safely secured to the State."

Article X, section 11, paragraph 2 of the Montana Constitution extends this requirement to all state lands. It states: "No such land or any estate or interest therein shall ever be disposed of except in pursuance of general laws providing for such disposition, or until the full market value of the estate or interest disposed of, to be ascertained in such manner as may be provided by law, has been paid or safely secured to the state."

With respect to state land proposed to be leased for coal development, Montana law requires: "[p]rior to issuing a coal mining lease, the board shall evaluate the coal and land proposed to be leased for the purpose of determining the fair market value of any coal reserves located on the land, giving opportunity for and consideration to public comments on such evaluation." 77-3-312 M.C.A. (2009). Additionally, a decision to lease state lands for coal development requires a determination that it is in the "best interests of the state." 77-3-301 M.C.A. (2009).

Understanding the value of a particular piece of land enables the State to determine whether or not it is in the best interests of the State to dispose of the land – since that decision requires a consideration of a number of different, sometimes competing, factors – and, of course, allows the State to identify the compensation it is entitled to (and must receive) upon a sale or lease.

In order to meet its obligations the Department undertook an appraisal of the Otter Creek coal tracts. According to the Department, the Otter Creek "appraisal ... develops an estimate of fair market value of the state's ownership." As the Department further explains, "[s]tate statute requires the preparation and public review of an appraisal for the Land Board's consideration prior to offering school trust coal properties out for competitive leasing. A coal appraisal serves a specific purpose – it provides the financial terms (bonus bid, rental and royalties) which together represent the full, fair market value of the property that may be offered for lease." DNRC Request for Comments, April 28, 2009 at 1.

The obligation to ascertain fair market value is thus clearly not satisfied by undertaking an appraisal and simply calling it good, without regard to whether the appraisal is valid. The law requires a meaningful evaluation of value, not a paper exercise, in order to ensure that when the State disposes of its land it is acting in the best interests of its citizens.

The Norwest appraisal simply does not provide the necessary foundation to allow the Land Board to make a decision about whether leasing the Otter Creek tracts is in the best interests of the State.

It could not be otherwise given the appraisal's totally inadequate treatment of future coal markets generally or future markets for high sodium Otter Creek coal.

In its responses to comments and in the proposed bid package, the Department states that "the appraisal is estimating the average price of coal from Otter Creek over the 40-plus

year mine life." DNRC responses at 3 and proposed bid package at 3. Department staff is quoted in the minutes to the September 21, 2009 Land Board meeting (at 14) as saying, "the market being looked at is [*sic*] future market ... how it will be over the next 40 or 50 years."

However, the Department's characterization of what the appraisal looked at is demonstrably incorrect. In actuality the appraisal does not estimate future coal prices or assess future coal markets. One can search the appraisal in vain for any discussion of the present or future national coal supply/demand situation, or the effect on coal demand and what it will mean for the price of coal from carbon regulation, or issues related to the use of high sodium coal. Indeed, the appraisal is clear that the coal prices it uses for its modeling are current prices (as of September 2008) of Powder River Basin coal. Appraisal at 3-10.

Without any analysis the appraisal concludes that there will be a market for all the coal that Otter Creek can produce. ("The potential market for the Otter Creek coal will reach 30 Mtpy by 2011 and 33 Mtpy by 2015," Appraisal at 3-12.) As was pointed out by Power Consulting in its comments, this assertion by Norwest is impossible to reconcile with prior statements by Norwest about the difficult market situation Otter Creek coal finds itself in. Power Consulting comments at pp. 4-7.

More egregiously, and fatally for the State should it choose to rely on the appraisal as a basis for leasing, is that Norwest's conclusion that a market exists for Otter Creek coal purports to be based on an analysis prepared by an entity with a financial stake in the development of Otter Creek coal and which no one (including the State apparently) has been allowed to see. Power Consulting comments (at 8-9) discuss this unfortunate situation as well and will not be belabored here. Suffice it to say that in accepting and relying on an appraisal based on undisclosed material the State fails to meet its obligations and the public is prevented from meaningfully commenting on the appraisal.

Nor is the matter remedied by the Department's additional "analysis" that appears for the first time in a single paragraph in the proposed bid package (at 3). This analysis, which looks at 3 existing coal leases, suffers from the same defects set forth above, namely it does not evaluate what future coal prices or markets will look like.

This is not, it must be noted, an issue of whether the appraisal is too high or too low. To restate: the issue here is whether the appraisal provides the Land Board with sufficient information to assess whether leasing Otter Creek coal is in the State's best interest.

The Department makes much of this distinction, stating to the Land Board that the appraisal was designed to "protect[] against undervaluing [the Otter Creek tracts] development potential." September 21, 2009 Land Board meeting minutes at 6. But the Department's reasoning is flawed. The Department concludes that there is no risk to the State if Otter Creek coal is overvalued; rather the risk will be on the entity that decides to enter into the lease. And, if that entity is unable to perform the State will walk away with

the bonus bid. But, there is a risk to the State under this scenario and that is the risk that development will occur and that future coal prices will be low. In that case, the State will receive less in the way of royalty payments than anticipated.

Given that "[r]oyalties constitute the overwhelming majority of gross revenue generated from a producing coal lease," a loss of anticipated royalty payment might be highly significant and might, if there had been better information in advance of leasing, have resulted in different decisions being made. DNRC Otter Creek Proposal Fact Sheet at 1.

Accordingly, it makes no difference in which direction the appraisal is inaccurate. What is required is an appraisal that is full, fair, and professionally conducted so that the Land Board can determine what is in the best interest of the State of Montana.

Thank you for considering my views on this important matter.

Sincerely,

Chuck Magraw

Cc:
Governor Brian Schweitzer
Attorney General Steve Bullock
Secretary of State Linda McCulloch
State Auditor Monica Lindeen
Superintendent of Public Instruction Denise Juneau

DNRC Director Mary Sexton

IMPACT OF GLOBAL WARMING ON STATE REVENUES GENERATED FROM AGRICULTURE, GRAZING, AND TIMBER RESOURCES

The Land Board oversees mining, grazing, forestry and conservation activities that take place on State school trust lands. Mining and burning the coal at Otter Creek will accelerate the negative economic and environmental impacts of global warming on agriculture, grazing, and timber resources that generate significant revenue for trust beneficiaries.

REVENUE LOSS: AGRICULTURAL LANDS

Current Revenue: *In FY 2008 the State of Montana received $12,790,465 of revenue from agricultural leasing on state lands.*

Wheat is the most abundant crop harvested on state school trust lands. Wheat production levels are nearly nine times that of the next two highest agricultural commodities: hay and barley. Crop harvest levels are important because they impact the market lease rates for agricultural land. (From DNRC 2008 Return on Assets Report)

POTENTIAL IMPACTS TO AGRICULTURAL LANDS FROM GLOBAL WARMING:

1. Higher temperatures have a direct negative affect on wheat crop yields, reducing market lease rates and the revenue generated from agricultural leases on state lands.

Grain (including wheat) soybean and canola crops have relatively low optimal temperatures, and thus will have reduced yields and will increasingly begin to experience failure as warming proceeds.

The optimum temperature at which wheat produces maximum yield is 15C. The temperature at which wheat grain yield falls to zero is 34 C. Any temperature beyond 34C will reduce wheat crop yields. *For every one degree Celsius degree temperature increase wheat yields will be reduced anywhere from 4 to 7 percent!* (Emphasis added).

Sources:
Chowdhury, S.I.C., and I.F. Wardlaw, 1978: The effect of temperature on kernel development in cereals. *Australian Journal Agricultural Research,* 29, 205-233.

The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States: U.S. Department of Agriculture, p. 31.

2. **<u>Invasive plant species thrive at warmer temperatures and drier conditions. The effect of weeds and invasive plants on state trust land revenue is two-fold.</u>**

- **First, weeds outcompete agricultural crops such as wheat to reduce yields.**

Weeds respond more positively to increasing temperatures than most cash crops, especially invasive weeds that reproduce by vegetative means. Agricultural crops are in competition with many types of weeds, such as cheatgrass and leafy spurge—prolific invasive plant species in Montana. To date, for all weed/crop competition studies where the photosynthetic pathway is the same, *weed growth is favored as CO2 increases.*

Sources:

Ziska, L.H., and K. George, 2004: Rising carbon dioxide and invasive, noxious plants: potential threats and consequences. *World Resource Rev*, 16, 427-447.

Ziska, L.H. 2003: Evaluation of the growth response of six invasive species to past, present and future carbon dioxide concentrations. *Journal of Experimental Botany*, 54, 395-404.

Ziska, L.H., G.B. Runion. 2006. Future weed, pest and disease problems for plants. In: Newton P., A. Carman, G. Edwards, P. Niklaus (eds.) Agroecosystems in a Changing Climate. CRC. New York. Chapter 11, pp. 262-287.

- **Second, as weeds increase on state agricultural lands, more money will have to be spent controlling them.**

Each year the State and its lessees spend resources on controlling weeds on state agricultural/grazing lands. This will only increase as existing weed management chemicals become less effective, and new species of weeds migrate northward.

Recent research suggests that glyphosate, the most widely used herbicide in the United States, loses its efficacy on weeds grown at higher CO2 levels. Therefore, not only will there be more weeds, but more money will have to spent on buying herbicides and other chemical management products to control the spread of these weeds.

In addition, as temperatures increase, weeds will spread northward moving onto agricultural land in Northern Great Plains states like Montana. New species of weeds will begin to inhabit the region, requiring more state dollars spent on new methods and chemicals to control their numbers.

Sources:

Patterson, D.T., J.K. Westbrook, R.J.C. Joyce, P.D. Lingren, and J. Rogasik, 1999: Weeds, insects and diseases. *Climatic Change*, 43, 711-727.

Ziska, L.H., J.R. Teasdale, and J.A. Bunce, 1999: Future atmospheric carbon dioxide may increase tolerance to glyphosate. *Weed Sci*, 47, 608-615.

REVENUE LOSS: RANGELANDS/GRAZING LEASES

Current Revenue on Grazing lands: In FY 2008, grazing leases on 4.3 million acres of state lands generated $7,098,951.

Yield of grazing lands is directly tied to commodity prices for domestic livestock food products, which is directly related to lease rates and revenues generated from grazing lands. (From DNRC 2008 Return on Assets Report)

As temperatures rise, and CO2 levels increase, grasslands that provide animals with forage will be less productive due to plant species shifts and reduced forage quality. Temperature increases will also cause significant stress to domestic livestock, especially cattle. Less cattle means less grazing leases and less revenue generated from rangelands for trust beneficiaries.

POTENTIAL IMPACTS TO GRAZING LANDS FROM GLOBAL WARMING:

As a result of climate change, the forage quality and quantity of plants on grazing lands will decline. These impacts combined with direct impacts on livestock mortality will reduce the commodity prices and lease rates, and revenue generated from grazing leases on state-owned rangelands.

1. High quality forage plants will be displaced by low quality woody species.

The worldwide encroachment of woody plants into grasslands remains one of the best examples of the combined effects of climate change and management driving a species change that has a tremendous negative impact on livestock production and commodity prices for domestic beef.

Sources:

Briggs, J.M., A.K. Knapp, J.M. Blair, J.L. Heisler, G.A. Hoch, M.S. Lett, and J.K. McCarron, 2005: An ecosystem in transition: Causes and consequences of the conversion of mesic grassland to shrubland. BioScience 55, 243-254.

Morgan, J.A. 2005. Rising atmospheric CO2 and global climate change: Management implications for grazing lands. pp. 245-272 in: S.G. Reynolds and J. Frame (eds) *Grasslands: Developments Opportunities Perspectives.* FAO and Science Pub. Inc.

Polley, H.W., W.A. Dugas, P.C. Mielnick, and H.B., Johnson, 2007: C3-C4 composition and prior carbon dioxide treatment regulate the response of grassland carbon and water fluxes to carbon dioxide. *Functional Ecology*, 21, 11-18.

2. Forage quality will be reduced because of lack of water and temperature increases caused by climate change.

Plant nitrogen and crude protein concentrations decline in a CO_2 rich environment. Such reductions in forage quality could have pronounced negative effects on animal growth, reproduction, and mortality, as well as reducing digestibility of forage by 10 to 14 percent.

Sources:
Milchunas, D.G., A.R. Mosier, J.A. Morgan, D.R. LeCain, J.Y. King, and J.A. Nelson, 2005: Elevated CO2 and defoliation effects on a shortgrass steppe: forage quality versus quantity for ruminants. *Agriculture, Ecosystems and Environment*, 111, 166-184.

Owensby, C.E., R.C. Cochran, and L.M. Auen, 1996: Effects of elevated carbon dioxide on forage quality for ruminants. In: Körner, Ch. and F.A. Bazzaz (eds.) *Carbon Dioxide, Populations and Communities*. Academic Press, San Diego, pp. 363-371.

3. Warmer temperatures could have a profound effect on the economic viability of livestock production in Montana

The heat waves of 1995 and 1999 caused documented cattle losses in several states close to 5,000 head each year.

Sources:
Hahn, G.L. and T.L. Mader, 1997: Heat waves in relation to thermoregulation, feeding behavior and mortality of feedlot cattle. *Proceedings 5th International Livestock Environment Symposium*, American Society of Agricultural Engineers, St. Joseph, MI: 563-571.

REVENUE LOSS: TIMBER RESOURCES

Current Revenue: *In FY2008 the Forest Management Bureau of the TLMD reported a net revenue of $5,549, 816. State trust lands timber harvests fluctuate from year to year depending on current price, expected future price, and episodic events such as wildfire and insect outbreaks.* (From DNRC 2008 Return on Assets Report)

Impacts of climate change on forest resources such as insect outbreaks and wildfires will cause a decline in timber production on state forestlands, affecting sustained yield and reducing a large revenue source for trust beneficiaries.

POTENTIAL IMPACTS TO TIMBER RESOURCES FROM GLOBAL WARMING:

1. Insect outbreaks will reduce the quality and quantity of timber resources.

Insect outbreaks including the spread of mountain pine beetle in forest ecosystems cost the United States $1.5 billion annually. Mountain pine beetle that thrives due to higher winter temperatures is attacking ecologically and

economically important tree species. For example, the mountain pine beetle in British Columbia has destroyed over 10 million hectares of pine forests. In the United States, over 17 percent of the whitebark pine forests in the Greater Yellowstone Ecosystem have been destroyed by pine beetle infestations.

Sources:
Logan, J.A., and J.A. Powell, 2001. Ghost forests, global warming and the mountain pine beetle (Coleoptera: Scolytidae). American Entomologist, 47, 160-173.

Taylor, S.W., A.L. Carroll, R.I. Alfaro, and L. Safranyik, 2006. Forest, climate, and mountain pine beetle outbreak dynamics in western Canada. Pages 67-94 In: L. Safranyik and W.R. Wilson, (eds),. The mountain pine beetle: a synthesis of biology, management, and impacts on lodgepole pine. Natural Resources Canada, Canadian Forest Service, Pacific Forestry Centre, Victoria, British Columbia.

Dale, V.H., L.A. Joyce, S. McNulty, R.P. Neilson, M.P. Ayres, M.D. Flannigan, P.J. Hanson, L.C. Irland, A.E. Lugo, C.J. Peterson, D. Simberloff, F.J. Swanson, B.J. Stocks, and B.M. Wotton, 2001. Climate change and forest disturbances. BioScience, 51, 723-734.

2. Frequency and intensity of wildfires will reduce timber yields due and will increase costs of fire suppression on state lands.

Since 1985, there has been an increase in the number of large wildfires and the length of the wildfire season in the United States. These increases were directly related to temperature shifts and changes in the spring and summer. More fires shift forest composition to understory-dominant species. A decline in large trees reduces timber yields on state lands.

Moreover, as wildfires become more frequent and intense, state costs to suppress these fires will increase substantially.

Sources:
Calkin, D.E., K.M. Gebert, J.G. Jones, and R.P. Neilson, 2005. Forest service large fire area burned and suppression expression trends, 1970-2002. *Journal of Forestry,* 103, 179-183.

Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam, 2006. Warming and earlier spring increase western U.S. forest wildfire activity. *Science*, 313, 940-943.

This Project Summary was developed by EPA's Industrial Environmental Research Laboratory, Cincinnati, OH to announce key findings of the research project which is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

This is a summary of the results of an investigation designed to address the questions of the Northern Cheyenne Indian Tribe concerning the potential hydrological impacts of coal strip mining on their Reservation in southeastern Montana.

At the initiation of this research effort in 1975, all available data describing the natural geologic, meteorologic, groundwater and surface water systems operating in the Reservation area were collected and reviewed. It was concluded that existing basic data were inadequate for developing a meaningful mining impact analyses. In an attempt to obtain necessary baseline information, meteorologic and hydrologic data collection networks were designed and implemented. Geologic mapping and field programs were initiated. Many of these programs still continue for it is realized that initial programs have only provided sufficient information to establish system trends and further data needs. A long period of record is necessary to characterize more completely the natural systems of the Reservation which are believed typical of the western coal region.

Once adequate data were collected, interpretation and analyses of the information base were started. The types and extent of geologic formations found in the area were delineated. The coal stratigraphy and geomorphology of three areas with the potential for economical coal mining were described. Analyses of precipitation and evaporation records yielded a correlation with topography and a base for groundwater recharge evaluation and surface water system definition. Rock units which form the complex groundwater system operating within the Reservation were identified and hydrogeologic properties of coal, clinker, sandstone and alluvial material were described. Precipitation and surface water discharge records were correlated to define the surface water systems. Seepage run data were used to identify the contribution of groundwater to the surface water systems. Most of the project period was used to identify the existing natural system, since it is firmly believed that without careful delineation of the natural undisturbed or pre-mining systems, prediction of the coal strip mining impacts to the water resources would not be meaningful.

Intensive analyses of the potential impacts coal strip mining could have on the water resources of the Reservation was initiated in the last year of the project. After evaluation of geologic and hydrologic data, general mine sites were selected in three areas. Pre-mining input/output models of the hydrologic system in the area were developed at each site. The emphasis of the mining impact section is on an evaluation of the post-mining water quality and quantity changes. Aquifer dewatering during mining and mine effluent quality impacts were recognized, but the absence of detailed mining plans and hydrogeologic data precluded detailed analyses. Post-mining impact analyses included laboratory saturation extract testing of drill cuttings, and leaching tests of representative samples for each mine. Inputs to spoil hydrology modeling were obtained from available literature. Impact analysis techniques were evaluated and the use of these methods for regional, large-scale coal development impact prediction was discussed. A brief discussion of management possibilities of the Tribe's water resources in light of potential impacts from mining on the Reservation and from regional mining was prepared.

Conclusions and Recommendations

Conclusions

Geology

Approximately 90 percent of the Reservation surface lies in the coal bearing Tongue River Member of the Paleocene Fort Union Formation. The Member, where complete, is about 500 m (1640 ft) thick.

Fine-grained clastics and coals dominate the Tongue River Member. Nearly all sediment is medium to fine grained sandstone, siltstone, or shale. Shale is often found near the tops and bases of coal seams. Channel sands are common. Thin limy zones are often present.

Eleven major coal bed systems have been identified on the Reservation. From highest to lowest stratigraphic level, they are the Roland, Smith, Ander son, Canyon, Cook, Wall, Pawnee Sawyer-Knobloch-Lee-Nance, Rosebud McKay, Flowers-Goodale, and Robinson

Alluvium up to 37 m (120 ft) thick ir places fills the valleys of Rosebud Creek Tongue River, and their tributaries.

Clinker beds, formed by the burning o major coal seams, cover about one-thir of the Reservation surface and reacl thicknesses of up to 70 m (230 ft). Th most extensive clinker beds are thos related to the Anderson and Knobloc coal seams.

Individual coal seams are continuou over much of the Reservation, but ma split, pinch out, or merge with othe seams. Interburden units of shale, silt stone and sandstone are, for the mos part, fairly discontinuous.

The Eocene Wasatch Formation cap highland areas in the south-central par of the Reservation.

Strata are nearly flat lying with general dip of less than one degree t the southeast.

Minor northwest-southeast anc northeast-southwest trending fault and joints occur. Measured vertica displacement so far has been limited t 50 m (160 ft) or less.

Present-day Reservation topograph has been formed by rivers dissecting ar ancient plateau surface.

Groundwater

Alluvium, clinker, sandstone and coa are the major near-surface aquife lithologies on the Reservation.

Four hydrogeologic units, the Uncon solidated, Anderson, Knobloch, an Lower Tongue River, have been identi fied. These units store and transmi groundwater in the near surface hydro geologic system.

Clinker deposits are major compo nents of the identified flow systems. Th fractured nature of these deposits resul in a range of hydraulic conductivitie and recharge potentials.

The hydraulic properties of clinker ar dependent on the thickness of the coa burned and on the quantity of coa clinker produced.

In the water years 1975 and 1976 recharge was greatest to the uncon solidated deposits in the major strean valleys and clinker deposits. Recharg to the confined system was negligible

Hydraulic conductivities estimated fo coal aquifers fall within the range o those reported in the literature.

Groundwater quality relationship

United States
Environmental Protection
Agency

Industrial Environmental Research
Laboratory
Cincinnati OH 45268

Research and Development

EPA-600/S7-81-004 Mar. 1981

EPA

Project Summary

Hydrologic Impacts From Potential Coal Strip Mining — Northern Cheyenne Reservation

William W. Woessner, Thomas J. Osborne, Edward L. Heffern, Charles Andrews, Jason Whiteman, Wesley Spotted Elk, and Daniel Morales-Brink

This research project was initiated with the overall objective of assessing the possible impacts of coal strip mining to the groundwater and surface water resources of the Northern Cheyenne Indian Reservation.

Meteorological, groundwater and surface water monitoring networks were established to evaluate the occurrence, quantity, movement and quality of the region's water resources. Available geologic data were gathered, and field mapping and drilling programs were undertaken to delineate the near surface stratigraphy of the coal bearing Fort Union Formation. Three priority study sites containing strippable coal and representing varied hydrogeologic settings were selected for more detailed study.

Results of this project show the presence on the Reservation of a complete section of the Tongue River Member of the Fort Union Formation which contains 11 major coal seams. A stacked groundwater flow system exists in which extensive clinker deposits, thick coal seams, channel sandstones and unconsolidated alluvium in the major valleys store and transmit the major portion of groundwater. Water quality is variable and is principally the result of the aquifer mineralogy and the presence or absence of sulfur reducing bacteria. Hydrologic and salt balance calculations indicate that in the Tongue River along the Reservation, mean discharge increased by eight percent and dissolved solids load increased by six percent. In that part of Rosebud Creek located within the Reservation, mean discharge increased by 150 percent and the dissolved solids load increased by 39 percent. Postulated coal strip mining at three priority study sites in the Tongue River Valley, high central divide region and Rosebud Creek Valley would have impacts on the local surface water and groundwater resources. Water quality degradation from the leaching of spoils would affect the quality of the major streams. A large percentage of the leachable constituents in mine spoils would be removed by the first pore volume of spoil recharge and groundwater which passes through the spoil. Mining all strippable reserves of the Knoblock coal seam system along both sides of the Tongue River Valley from Birney Day Village to a point eight kilometers north of the town of Ashland would have a major impact on the regional groundwater quality and a significant impact on the quality of the Tongue River. Water quality impacts from coal strip mining would last for hundreds of years.

are influenced by sulfur reducing bacteria in deeper flow systems and by ion exchange.

The principal constituents of the groundwater are sulfate, calcium, and bicarbonate ions. The presence of calcium and magnesium usually is interpreted to indicate recharge is entering the system.

The Tongue River receives groundwater discharge from bedrock and alluvial aquifers along the reach of the Reservation.

Rosebud Creek receives groundwater discharge along the reach within the Reservation, although rates are small.

Surface Water

The Tongue River derives its principal hydrologic and water quality characteristics in the upper reaches above the Tongue River Dam. Snowmelt from the Big Horn Mountains, irrigation in Wyoming, and streamflow regulation by the Tongue River Reservoir are dominating influences on the annual hydrograph and salinity trends of the Tongue River in Montana.

Groundwater discharge is a small component of the total discharge of the Tongue River below the Tongue River Dam, comprising about 16 percent of the streamflow at the northern boundary during baseflow periods. The mean groundwater seepage rate to the Tongue River along the Reservation was found to be 0.01 cubic meters per second per river kilometer (0.55 ft^3/sec/r mi) during the fall and winter base flow periods measured.

The mean discharge between Tongue River gaging stations at either Reservation boundary increased by 1.13 m^3/sec (39.9 ft^3/sec), or about eight percent during the study period. The river was found to gain an average of 0.798 m^3/sec (28.2 ft^3/sec) from surface water discharges. Consumptive uses from irrigation caused an average annual rate of depletion of 0.095 m^3/sec (3.36 ft^3/sec). Evaporation losses were calculated to occur at a mean annual rate of 0.071 m^3/sec (2.51 ft^3/sec).

Rosebud Creek is a prairie stream that derives its principal characteristics from seasonal climatic patterns, topographic controls and geologic deposits bordering the creek or its tributaries. Rosebud Creek was found to gain flow throughout its upper half, and lose flow throughout its lower half, on an annual basis.

Groundwater discharge to Rosebud Creek comprises about 23 percent of the total discharge at the northern Reservation boundary during baseflow periods. The mean groundwater seepage rate to Rosebud Creek on the Reservation was found to be 0.001 m^3./sec.r/km (0.08 ft^3/sec/r/mi) during the fall-winter baseflow periods measured.

The mean discharge between Rosebud Creek gaging stations at either Reservation boundary increased by 0.653 m^3/sec (23.1 ft^3/sec) or about 150 percent during the study period. The creek gained an average of 0.137 m^3/sec (4.84 ft^3/sec) from groundwater discharge and 0.414 m^3/sec (14.6 ft^3/sec) from surface tributary discharge. Evaporation losses were calculated to occur at a mean annual rate of 0.033 m^3/sec (1.17 ft^3/sec).

The Tongue River at the state line has already picked up 81 percent of the average dissolved solids concentration measured at Miles City, Montana, primarily due to the effects of irrigation return flows in Wyoming. The average dissolved solids concentration increased by 38 mg/1 or eight percent between the two NCRP sampling stations at the Reservation boundaries.

Most surface waters on the Reservation are a calcium-magnesium-bicarbonate type normally associated with streams receiving most of their water from lower-salinity sources such as snowmelt, storm runoff or clinker-alluvial aquifers. Cook Creek and Muddy Creek have a calcium-magnesium sulfate-bicarbonate water type higher in salinity due to pronounced effects of groundwater and spring flow from coal and sandstone aquifers in the upper part of the drainages above the clinker zones.

Total dissolved solids at NCRP sampling stations on the Tongue River cycled between lows of 200 mg/1 to highs of 700 mg/1 during water years 1976 and 1977.

Rosebud Creek at the northern Reservation boundary has already picked up 85 percent of the average dissolved solids concentration measured at the mouth of Rosebud Creek. The average dissolved solids concentration increased by 203 mg/1 or 37 percent between the two NCRP sampling stations at the Reservation boundaries.

Dissolved solids concentrations in Rosebud Creek were usually higher but less variable at either sampling station than in the Tongue River. The sampled range at RBC #2 was from 400 to 650 mg/1 and was 550 to 900 mg/1 at RBC #1. The principal reason for the lack of salinity variation is due to the dominance of discharge from clinker and alluvial aquifers directly to the creek and its tributaries, and lack of irrigation.

A hydrologic balance equation was applied to NCRP Tongue River and Rosebud Creek data. The calculated downstream discharge at TR #1 was 0.7 percent less than the measured value. The calculated discharge at RBC #1 was 9.2 percent less than the measured discharge.

A salt balance equation was applied to NCRP water quality data once the hydrologic system was balanced. The calculated dissolved solids concentration at TR #1 was nine percent higher than the measured value and the calculated value at RBC #1 was two percent lower than the measured value.

Impacts

Pre-mining exploration and mine plan drilling may impact the natural groundwater systems.

During mining, reduction of water levels in wells, destruction of wells, and the reduction or disappearance of spring flow are the major impacts. Water quality impacts from a nitrate rich mine effluent can occur.

Post-mining spoil water is higher in total dissolved solids than the natural pre-mining groundwater.

Quantification of recharge rates of the spoil, and the quantity and quality of resulting leachate entering the groundwater flow system, is necessary to predict post-mining impacts to the water resources.

Single 4.9 to 9.8 million metric tons per year (5 to 10 million short tons per year) mines have a local impact on the quantity and quality of the adjacent surface water and groundwater system. Salinity impacts to the Tongue River and Rosebud Creek are expected to be minimal.

Extensive mining of the Tongue River Valley will impact the groundwater and surface water systems operating in the region. Groundwater with higher TDS, and chemical constitutent concentrations, will be unusable for irrigation and mine site vegetation use. Downgradient from the mine site, water quality will gradually improve; however, high sodium adsorption ratio (SAR) and TDS values may limit the use of the water. Total dissolved solids in the Tongue River would increase from 16 mg/1 during mean flows to over 500 mg/1 during

very low flow periods depending on the rate of recharge to the spoils.

The majority of leachable material is removed from the overburden samples by the time one pore volume of water passes through the samples.

Both groundwater and spoil water will leach constituents from mine spoils. Local groundwater used in tests leached chemical constituents from the overburden sample.

The time required to pass one pore volume of water through spoil material at the three postulated mine sites ranged from a low of 100 years at the Indian Coulee mine site to a high of 1,500 years at the Buffalo Jump mine site.

The length of time mining impacts could affect the regional water resources is measured in hundreds of years.

Recommendations for Future Research

Geology

The structure of coal clinker beds needs more intensive study in order to determine which zones within the clinker are the main transmitters of water.

An extensive drilling and geophysical logging program on the unexplored portions of the Reservation is needed in order to define stratigraphic correlations between coal seams and to define possible additional reserves of strippable coal.

Major massive sandstone bodies on the Reservation need more thorough surface mapping and subsurface confirmation with drill logs, in order to determine their configuration.

Hydrology

Additional studies of the flow systems operating on the Reservation, especially the identification of recharge areas of the deeper flow systems operating in the Tongue River Member are needed. A series of deep wells should be drilled in the suspected highland recharge area and its flanks, to measure head differences, recharge rates, and water quality changes with depth.

Detailed pump testing of representative wells in the coal, clinker sandstone and alluvial aquifers is needed to refine hydraulic conductivity calculations. Special attention should be given to documenting the hydraulic conductivities of clinker, as this is an important hydrogeologic unit, adjacent and downgradient from most proposed mining operations in the region.

An array of two or more wells finished in alluvium, clinker, and bedrock material, ideally located adjacent to existing stream gaging stations, should be instrumented with continuous water level recorders for one or more years. Comparisons of stream stage hydrographs with well hydrographs would indicate trends in groundwater recharge, discharge, and storage in relation to fluctuations in river stage and discharge. Such data would greatly assist interpretation of seepage run results and groundwater discharge rates to the Tongue River and Rosebud Creek.

Water occurrence, water storage, and use by plants in the unsaturated zone, is a significant component of the hydrologic balance. Field studies using lysimeters or other soil moisture indicators should be conducted in conjunction with concurrent precipitation and well measuring programs.

Impacts

Monitoring of groundwater levels should continue to refine estimates of recharge to the various aquifers. Accurate data on the rates of recharge for clinker are critical for determining the impact post-mine waters would have on the adjacent water resources.

Additional seepage runs should be conducted on Rosebud Creek and on Tongue River to refine groundwater discharge rates. These rates are very useful for checking the hydraulic conductivities of alluvium and for predicting the influence mining will have on surface water resources.

The impact of pre-mining drilling operations on the natural groundwater system should be studied.

Spoil hydrology research is at an early stage. Accurate predictions of the impacts of a mining operation to the quality and quantity of the associated hydrologic system cannot be performed without representative values of spoil water chemistry, spoil hydraulic properties and recharge rates. Therefore, mining impact research in the immediate future should focus on spoil hydrology.

are influenced by sulfur reducing bacteria in deeper flow systems and by ion exchange.

The principal constituents of the groundwater are sulfate, calcium, and bicarbonate ions. The presence of calcium and magnesium usually is interpreted to indicate recharge is entering the system.

The Tongue River receives groundwater discharge from bedrock and alluvial aquifers along the reach of the Reservation.

Rosebud Creek receives groundwater discharge along the reach within the Reservation, although rates are small.

Surface Water

The Tongue River derives its principal hydrologic and water quality characteristics in the upper reaches above the Tongue River Dam. Snowmelt from the Big Horn Mountains, irrigation in Wyoming, and streamflow regulation by the Tongue River Reservoir are dominating influences on the annual hydrograph and salinity trends of the Tongue River in Montana.

Groundwater discharge is a small component of the total discharge of the Tongue River below the Tongue River Dam, comprising about 16 percent of the streamflow at the northern boundary during baseflow periods. The mean groundwater seepage rate to the Tongue River along the Reservation was found to be 0.01 cubic meters per second per river kilometer (0.55 ft^3/sec/r mi) during the fall and winter base flow periods measured.

The mean discharge between Tongue River gaging stations at either Reservation boundary increased by 1.13 m^3/sec (39.9 ft^3/sec), or about eight percent during the study period. The river was found to gain an average of 0.798 m^3/sec (28.2 ft^3/sec) from surface water discharges. Consumptive uses from irrigation caused an average annual rate of depletion of 0.095 m^3/sec (3.36 ft^3/sec). Evaporation losses were calculated to occur at a mean annual rate of 0.071 m^3/sec (2.51 ft^3/sec).

Rosebud Creek is a prairie stream that derives its principal characteristics from seasonal climatic patterns, topographic controls and geologic deposits bordering the creek or its tributaries. Rosebud Creek was found to gain flow throughout its upper half, and lose flow throughout its lower half, on an annual basis.

Groundwater discharge to Rosebud Creek comprises about 23 percent of the total discharge at the northern Reservation boundary during baseflow periods. The mean groundwater seepage rate to Rosebud Creek on the Reservation was found to be 0.001 m^3./sec.r/km (0.08 ft^3/sec/r/mi) during the fall-winter baseflow periods measured.

The mean discharge between Rosebud Creek gaging stations at either Reservation boundary increased by 0.653 m^3/sec (23.1 ft^3/sec) or about 150 percent during the study period. The creek gained an average of 0.137 m^3/sec (4.84 ft^3/sec) from groundwater discharge and 0.414 m^3/sec (14.6 ft^3/sec) from surface tributary discharge. Evaporation losses were calculated to occur at a mean annual rate of 0.033 m^3/sec (1.17 ft^3/sec).

The Tongue River at the state line has already picked up 81 percent of the average dissolved solids concentration measured at Miles City, Montana, primarily due to the effects of irrigation return flows in Wyoming. The average dissolved solids concentration increased by 38 mg/1 or eight percent between the two NCRP sampling stations at the Reservation boundaries.

Most surface waters on the Reservation are a calcium-magnesium-bicarbonate type normally associated with streams receiving most of their water from lower-salinity sources such as snowmelt, storm runoff or clinker-alluvial aquifers. Cook Creek and Muddy Creek have a calcium-magnesium sulfate-bicarbonate water type higher in salinity due to pronounced effects of groundwater and spring flow from coal and sandstone aquifers in the upper part of the drainages above the clinker zones.

Total dissolved solids at NCRP sampling stations on the Tongue River cycled between lows of 200 mg/1 to highs of 700 mg/1 during water years 1976 and 1977.

Rosebud Creek at the northern Reservation boundary has already picked up 85 percent of the average dissolved solids concentration measured at the mouth of Rosebud Creek. The average dissolved solids concentration increased by 203 mg/1 or 37 percent between the two NCRP sampling stations at the Reservation boundaries.

Dissolved solids concentrations in Rosebud Creek were usually higher but less variable at either sampling station than in the Tongue River. The sampled range at RBC #2 was from 400 to 650 mg/1 and was 550 to 900 mg/1 at RBC #1. The principal reason for the lack of salinity variation is due to the dominance of discharge from clinker and alluvial aquifers directly to the creek and its tributaries, and lack of irrigation.

A hydrologic balance equation was applied to NCRP Tongue River and Rosebud Creek data. The calculated downstream discharge at TR #1 was 0.7 percent less than the measured value. The calculated discharge at RBC #1 was 9.2 percent less than the measured discharge.

A salt balance equation was applied to NCRP water quality data once the hydrologic system was balanced. The calculated dissolved solids concentration at TR #1 was nine percent higher than the measured value and the calculated value at RBC #1 was two percent lower than the measured value.

Impacts

Pre-mining exploration and mine plan drilling may impact the natural groundwater systems.

During mining, reduction of water levels in wells, destruction of wells, and the reduction or disappearance of spring flow are the major impacts. Water quality impacts from a nitrate rich mine effluent can occur.

Post-mining spoil water is higher in total dissolved solids than the natural pre-mining groundwater.

Quantification of recharge rates of the spoil, and the quantity and quality of resulting leachate entering the groundwater flow system, is necessary to predict post-mining impacts to the water resources.

Single 4.9 to 9.8 million metric tons per year (5 to 10 million short tons per year) mines have a local impact on the quantity and quality of the adjacent surface water and groundwater system. Salinity impacts to the Tongue River and Rosebud Creek are expected to be minimal.

Extensive mining of the Tongue River Valley will impact the groundwater and surface water systems operating in the region. Groundwater with higher TDS, and chemical constitutent concentrations, will be unusable for irrigation and mine site vegetation use. Downgradient from the mine site, water quality will gradually improve; however, high sodium adsorption ratio (SAR) and TDS values may limit the use of the water. Total dissolved solids in the Tongue River would increase from 16 mg/1 during mean flows to over 500 mg/1 during

very low flow periods depending on the rate of recharge to the spoils.

The majority of leachable material is removed from the overburden samples by the time one pore volume of water passes through the samples.

Both groundwater and spoil water will leach constituents from mine spoils. Local groundwater used in tests leached chemical constituents from the overburden sample.

The time required to pass one pore volume of water through spoil material at the three postulated mine sites ranged from a low of 100 years at the Indian Coulee mine site to a high of 1,500 years at the Buffalo Jump mine site.

The length of time mining impacts could affect the regional water resources is measured in hundreds of years.

Recommendations for Future Research

Geology

The structure of coal clinker beds needs more intensive study in order to determine which zones within the clinker are the main transmitters of water.

An extensive drilling and geophysical logging program on the unexplored portions of the Reservation is needed in order to define stratigraphic correlations between coal seams and to define possible additional reserves of strippable coal.

Major massive sandstone bodies on the Reservation need more thorough surface mapping and subsurface confirmation with drill logs, in order to determine their configuration.

Hydrology

Additional studies of the flow systems operating on the Reservation, especially the identification of recharge areas of the deeper flow systems operating in the Tongue River Member are needed. A series of deep wells should be drilled in the suspected highland recharge area and its flanks, to measure head differences, recharge rates, and water quality changes with depth.

Detailed pump testing of representative wells in the coal, clinker sandstone and alluvial aquifers is needed to refine hydraulic conductivity calculations. Special attention should be given to documenting the hydraulic conductivities of clinker, as this is an important hydrogeologic unit, adjacent and downgradient from most proposed mining operations in the region.

An array of two or more wells finished in alluvium, clinker, and bedrock material, ideally located adjacent to existing stream gaging stations, should be instrumented with continuous water level recorders for one or more years. Comparisons of stream stage hydrographs with well hydrographs would indicate trends in groundwater recharge, discharge, and storage in relation to fluctuations in river stage and discharge. Such data would greatly assist interpretation of seepage run results and groundwater discharge rates to the Tongue River and Rosebud Creek.

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The impact of pre-mining drilling operations on the natural groundwater system should be studied.

Spoil hydrology research is at an early stage. Accurate predictions of the impacts of a mining operation to the quality and quantity of the associated hydrologic system cannot be performed without representative values of spoil water chemistry, spoil hydraulic properties and recharge rates. Therefore, mining impact research in the immediate future should focus on spoil hydrology.

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The complete report, entitled "Hydrologic Impacts From Potential Coal Strip Mining—Northern Cheyenne Reservation," (Order No. PB 81-155 061; Cost: $23.00, subject to change) will be available only from:
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5285 Port Royal Road
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The EPA Project Officer can be contacted at:
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DRAFT

RECONNAISSANCE MAPS TO ASSIST IN IDENTIFYING ALLUVIAL VALLEY FLOORS, POWDER RIVER BASIN, MONTANA AND WYOMING

Office of Surface Mining Reclamation and Enforcement
UNITED STATES DEPARTMENT OF THE INTERIOR

June 1985

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INTRODUCTION

Alluvial valley floors are defined by the Surface Mining Control and Reclamation Act of 1977 as:

> ...the unconsolidated streamlaid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation and windblown deposits [Section 701(1), Public Law 95-87].

With the passage of this act, Congress provided for the preservation of alluvial valleys in the semiarid West. Generally, alluvial valley floors are areas in the Western United States which (1) are located in topographic valleys having an associated stream channel, (2) are underlain by unconsolidated deposits whose surface usually has a landform appearance of flood plains or terraces, and (3) have an agricultural importance derived from water availability. Environmental characteristics, agricultural uses, and irrigation practices within stream valleys vary in the different coal regions of the West. Therefore, the specific rationale used for identifying the role and character of alluvial valley floors may vary from one area to another.

The objective of this study was to identify surface irrigated and subirrigated sites in the West to develop an understanding, from a regional perspective, of the types of stream valleys that may be studied further for consideration as alluvial valley floors. Further, potentially surface irrigable sites which also meet the geomorphic criteria were also identified on the basis of regional agricultural practices. This information was compiled onto 1:100,000-scale maps for all or part of four coal regions in the Western United States. Areas studied include the Fort Union coal region in west-central North Dakota, the Powder River Basin coal region of southeastern Montana and northeastern Wyoming, the Yampa and Danforth Hills coal fields of northwestern Colorado, the Book Cliffs, Grand Mesa, and Somerset coal fields of west-central Colorado, and the Book Cliffs and Wasatch Plateau coal fields of central Utah.

These maps represent only a reconnaissance-level effort in identification of areas which are <u>likely</u> to meet this definition, and these areas, therefore, are called <u>potential</u> alluvial valley floors. The intent of this mapping effort is to identify areas which might, at a future date, be designated as alluvial valley floors. Because reconnaissance-level data have been used in this study, it is recognized that detailed data collected for any specific area may more conclusively prove or disprove the alluvial valley floor findings made in this report. The following text outlines the basis for the alluvial valley floor mapping. If further site-specific study is necessary, information

contained in this report can help identify those issues requiring additional study.

Mapping was conducted consistent with the method described in chapter II of the "Alluvial Valley Floor Identification and Study Guidelines" (U.S. Office of Surface Mining, 1983). The data on which these maps are based were obtained primarily by field investigation and supplemented with information from regulatory and land management agencies, from published reports, and from aerial photographs and Landsat imagery.

This part of the study encompasses the Powder River Basin coal region of southeastern Montana and northeastern Wyoming. Parts of Treasure, Big Horn, Rosebud, Custer, and Powder River Counties in Montana and Sheridan, Johnson, Campbell, and Converse Counties in Wyoming are included within the area. The study area includes the entire Northern Cheyenne and the eastern part of the Crow Indian Reservations. Figures 1 and 2 respectively, show the location of the study area and the location of the individual maps (pls. 1-10) of potential alluvial valley floors which accompany this text.

PHYSIOGRAPHY AND CLIMATE

The study area is in the unglaciated part of the Great Plains physiographic province. The landscape is variable and includes gently rolling terrain, eroded bluffs and buttes, and small mountains or hills. Arable land is limited to narrow stream valleys, plateaus, and some gently sloping uplands. The major drainages flow in valleys that are characterized by narrow flood plains and terraces which generally merge into rough, broken, eroded lands often leading up to higher plateaus. The steeper and higher parts of the area are covered with open stands of ponderosa pine. Smaller tributaries are ephemeral and have channels ranging from broad and grassy to steeply walled and susceptible to erosion.

In the northern and central Powder River Basin, elevations vary from 2,600 feet (800 m) where the Tongue River leaves the study area to 5,400 feet (1,650 m) in the Wolf Mountains west of Decker, Montana. This northern area has several high plateaus rising in elevation to 4,300 feet (1,300 m) in the Northern Cheyenne Indian Reservation, Custer National Forest, and the headwaters area of Hanging Woman Creek. All drainage is northward to the Yellowstone River, which is north of the study area.

The southern Powder River Basin is crossed in a west-to-east direction by several major tributaries to the Little Missouri and Cheyenne Rivers. This southern area is dominated by an extensive upland surface at an elevation of about 5,000 feet (1,525 m) extending from Gillette south to Antelope Creek. The extreme southern part of the study area is primarily gently rolling country between 4,900 and 5,600 feet (1,500 to 1,700 m) in elevation.

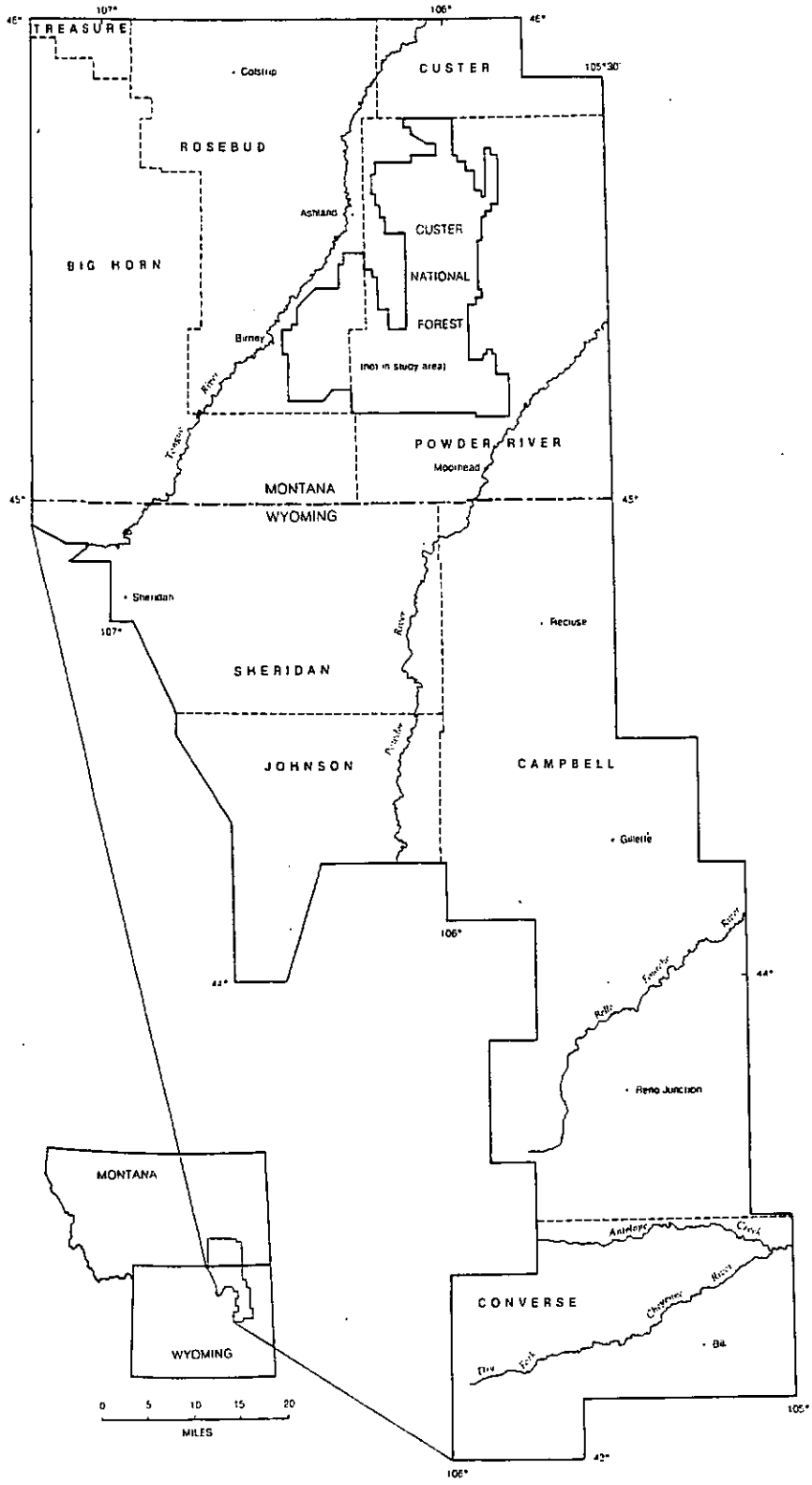

Figure 1. Map showing location of the Powder River Basin coal region study area.

The Fort Union Formation of Paleocene age and the overlying Wasatch Formation of Eocene age are the two rock units exposed in the study area. The Tongue River Member is the uppermost part of the Fort Union Formation and contains the numerous coal beds which form the great reserves of the Powder River Basin coal region. Both the Wasatch Formation and the Tongue River Member are composed primarily of sandstone, which is abundantly displayed in the small cliffs bordering many stream valleys. Red zones of clinker occur where many exposed coal seams have burned.

The climate of the study area is semiarid and mean annual precipitation ranges from 9 to 20 inches. Topography appears to be the major factor affecting the distribution of rainfall. Part of the area is in the lee of the Big Horn Mountains and receives somewhat less precipitation. Except in the highest parts of the study area, most precipitation falls during the growing season, primarily in May and June. Temperatures are high in the summer and below freezing in the winter. The growing season varies in length from 90 to 125 days (Toy and Munson, 1978).

DATA COLLECTED

Detailed information regarding the areas included in this study was compiled through field investigation and an intensive review of published reports, interpretation of aerial photography and Landsat imagery, review of geologic and soils data, and evaluation of irrigation and agricultural practices for each region. Potential alluvial valley floors were classified and delineated on maps at a scale of 1:24,000, and the information was transferred to the 1:100,000-scale maps that accompany this text. Essentially, the areas mapped are the parts of valleys underlain by unconsolidated deposits, where: (1) surface-water irrigation is practiced or could be practiced; (2) natural flood irrigation occurs, or (3) ground water occurs at sufficiently shallow depths that vegetation can tap this available supply. Reconnaissance-level data have been collected on each of these topics.

Identification of unconsolidated deposits found in valleys was based on interpretation of aerial photography, topographic maps, soil surveys, bedrock and surficial geologic maps, and field observations. Bureau of Land Management color-infrared aerial photography for Montana (scale 1:24,000 and 1:31,680; flown in June to August 1978 and 1979) and Wyoming (scale 1:31,680; flown in May through July, 1976) was utilized. U.S. Office of Surface Mining color-infrared photographs (scale 1:24,000) of an area between Sheridan, Wyoming, and Decker, Montana, flown in September 1982 were also used. Geologic information was obtained from maps at various scales (Lewis and Roberts, 1978; Keefer, 1974; Love, Weitz, and Hose, 1955; Reheis and Coates, 1982; Reheis and Williams, 1979; Reheis, 1982). Numerous 1:24,000-scale quadrangle maps of surficial geology for Campbell County, Wyoming, were also used. (See index in Reheis, 1982, and Reheis and Coates, 1982.)

Soil survey data was available for parts of the study area (U.S. Soil Conservation Service, 1977 [Big Horn County, Montana], 1975 [Johnson County, Wyoming, southern part], 1971 [Powder River County, Montana], and 1967 [Treasure County, Montana]). Collectively, these data permitted identification of flood plains, terraces, sheetwash alluvium, and gently sloping areas where colluvium is interpreted to overlie alluvium.

Interviews with local farmers and ranchers as well as resource professionals played a key role in our collection of agricultural data. Data were collected concerning the location and use of irrigated fields, agricultural practices, the importance of stream valleys to farms and ranches, and general perceptions of local agriculture and economics. Attempts were made to talk to as many farmers and ranchers in the study area as possible. During this study, 425 interviews were conducted in the entire study area.

Data on surface-water irrigation were collected from various sources. In Montana, water resource surveys published by the Montana State Engineer's Office for Big Horn (1947), Rosebud (1948), Treasure (1951) and Powder River Counties (1961) were used, as well as adjudicated water rights data as of September 1982 for the Powder River drainage (Montana Department of Natural Resources and Conservation, unpublished). Irrigation surveys by the Wyoming State Engineer's Office were also available for the Powder River drainage basin (1963-1971) and the Tongue River drainage basin (1979). Other regional compilations were also used (Wyoming State Engineer's Office, 1971, and Wyoming Water Development Commission, 1981). Interpretation of aerial photographs and extensive field checks further refined and updated the assembled data. To the authors' knowledge, these compiled data represent the most complete surface-water irrigation assessment available for the Powder River Basin coal region.

These reconnaissance maps of potential alluvial valley floors distinguish between surface irrigated sites which have either dependable or undependable water supplies. Surface irrigated sites with dependable water are those where water is diverted from a perennial or large intermittent stream by diversion, dam, or pumping. Surface irrigated sites with undependable water supply are fields irrigated by: (1) overflow caused by dikes built across the channel (French, 1978; Branson, 1952); (2) border dikes which impound overbank floodflows or tributary floodwaters, or (3) border dikes which spread water pumped from a stream during a runoff event. The water supply in these streams cannot be relied on every year to provide consistent quantities of irrigation water. Some small-scale diversion and ditch systems located on ephemeral and intermittent streams were also included in this category because the frequency and reliability of runoff for irrigation was similar to that for spreader dike sites. Further, an occasional diversion ditch is used as a delivery system for spreader dike irrigation.

Field surveys conducted for this project in 1982 and 1983 showed that many systems have been abandoned. In our assessment of regional surface-water development practices, an attempt has been made to distinguish between abandonment of systems due to changes in management style and abandonment due to water quality or quantity problems, or other resource-based problems. Our assessment of the success of systems was largely based on interviews with area residents. Systems which were abandoned solely due to management considerations, but which otherwise were reported to have operated successfully, have been mapped as successful systems. In several areas, interviews indicated that specific spreader dike systems were established, not for enhancing hay production, but as an erosion-control measure. These spreader dike systems as well as other irrigation systems abandoned for resource-based reasons were not mapped, except in the southern Powder River Basin (pls. 8-10). In this part of the study area more complete data were collected, and, therefore, these erosion-control and abandoned systems are indicated by a separate mapping unit to provide additional data.

Natural flooding occurs along all streams, and areas of subirrigation and normal recurrent flooding may overlap in parts of the study area. The net result of both processes is increased vegetation growth on bottomlands, but distinguishing the relative importance of these two processes at this reconnaissance level has usually not been possible. Based on reports from local residents and resource professionals, regular natural flood overflow is a relatively unimportant process, except in a few drainages in the most arid parts of the study area. Areas of increased productivity are usually due to subirrigation.

Subirrigation was interpreted from Landsat imagery taken during the moisture-stress period of the late growing season in 5 different years (fig. 3). Near-infrared color composites and black-and-white images of Landsat's Band 5 were used because these bands indicate the relative moisture content of vegetation. This approach was necessary because different years vary in moisture regime, which is the major cause of increased vegetation productivity. This effort was directed at mapping areas which consistently reflect subirrigation. Mapped subirrigated areas are, therefore, those valley-bottom areas which indicated vegetation growth during years of evaluated Landsat imagery. Areas which were apparently subirrigated only in the wettest years have not been mapped.

The areal variability of precipitation (table 1) and the different years of Landsat used for different parts of the study area (fig. 3) introduces some inconsistency into the subirrigation analysis. The wettest year analyzed was 1978, in which mean annual precipitation was about 40 percent greater than normal in the northern Powder River Basin. Individual weather stations recorded precipitation as much as 57 percent greater than average. However, south of Reno Junction, no suitable Landsat imagery was available for 1978 (scene D, fig. 3). The wettest years analyzed for the southern Powder River Basin was 1972 when average annual precipitation was only 10 percent above normal.

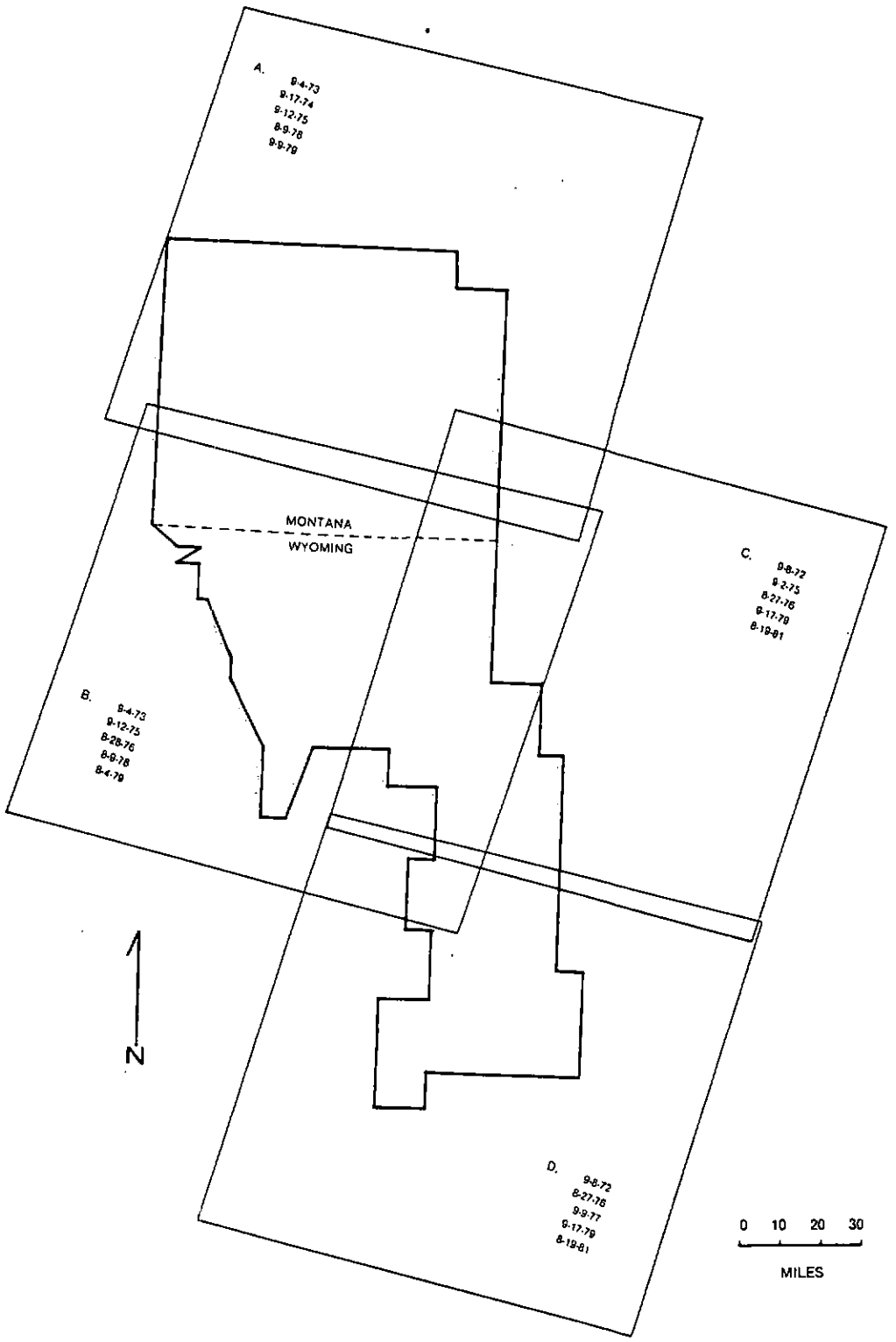

Figure 3. Map showing the study area and the approximate location of Landsat scenes used in the subirrigation analysis. Five images of each of the four scenes were used. Dates on which individual images were taken are indicated.

Table 1. Tabulation of approximate annual precipitation for each Landsat image used in the subirrigation analysis. Data summarized from National Oceanic and Atmospheric Administration climatic data for Wyoming and Montana.

Landsat scene	Geographic area	Year of Landsat imagery	Relative amount of annual precipitation (1)
A	Montana portion, Powder River Basin	1973	wet
		1974	wet
		1975	very wet
		1978	very wet
		1979	very dry
B	Powder and Tongue River drainages, central Powder River Basin	1973	normal
		1975	wet
		1976	normal
		1978	very wet
		1979	dry
C	Gillette area and Belle Fourche River drainage	1972	wet
		1975	normal
		1976	wet
		1979	dry
		1981	normal
D	southern Powder River Basin	1972	wet
		1976	normal
		1977	normal
		1979	dry
		1981	normal

(1)

very dry	25 percent below normal or less
dry	10 percent to 25 percent below normal
normal	10 percent below to 10 percent above normal
wet	10 percent to 25 percent above normal
very wet	25 percent above normal or more

The only dry year analyzed was 1979 and imagery for that year was analyzed for the entire study area. Average annual precipitation in 1979 ranged from about 36 percent below average in the north to just 10 percent below average in the south. In general, precipitation was about normal or above normal for 4 out of the 5 years of Landsat imagery (table 1). Therefore, the mapped extent of subirrigation may be greater than what actually occurs in dry years.

Landsat imagery taken earlier in the growing season (e.g., July), when many plants are under maximum moisture stress, could have been used in the subirrigation analysis. However, it is possible that moisture from early summer rains might still be available to plants, and, therefore, a false impression of subirrigated areas might be given by the Landsat imagery. Further, alluvial water tables do not drop at such a rate that a stream which appears subirrigated on July Landsat imagery would not appear subirrigated on imagery taken a month later. It is possible that a narrower part of the valley would appear subirrigated at the later date. The smallest size area which can be seen on Landsat imagery is limited by the 80- x 80-m size (1.6 acres) of a pixel, or piece of Landsat datum. Areas of subirrigation smaller than this size could not be distinguished and were not mapped. Ground-water-level data obtained from field interviews and observations, coal mine permits, and published reports (e.g., Wells, 1982; Hopkins, 1973) were considered in calibrating the Landsat imagery with areas known to be subirrigated or with known depths to the water table. Generally, subirrigated areas have ground-water depths of 10 feet or less.

AGRICULTURAL LAND USE

In the Powder River Basin agricultural operations are primarily cattle or sheep ranches, although some of these operations also grow grain, usually wheat, commercially. Scattered throughout the region are a few farms whose principal income base is grain. These farms are found principally in the Mizpah and Sand Creeks area and on the high plains around Gillette.

Stream valleys are central to ranching operations (fig. 4). The rough arid uplands provide spring, summer, and fall pasture and cover much more area than the more productive bottomlands. Winters are long and cold, and animals must be fed hay grown during the summer. Irrigated and subirrigated valley bottomlands produce almost all of this hay. Supplemental hay is less important in southern Campbell and Converse Counties, where the winter snow cover is usually minimal, and livestock are able to graze throughout the winter.

Most ranchers in the region feed alfalfa or native hay, often along with protein or mineral supplements. Hay availability is frequently the limiting factor on herd size, and the number of animals a rancher has is usually limited by the land or cash available to obtain winter feed. Although hay can be produced on upland areas, only one cutting is

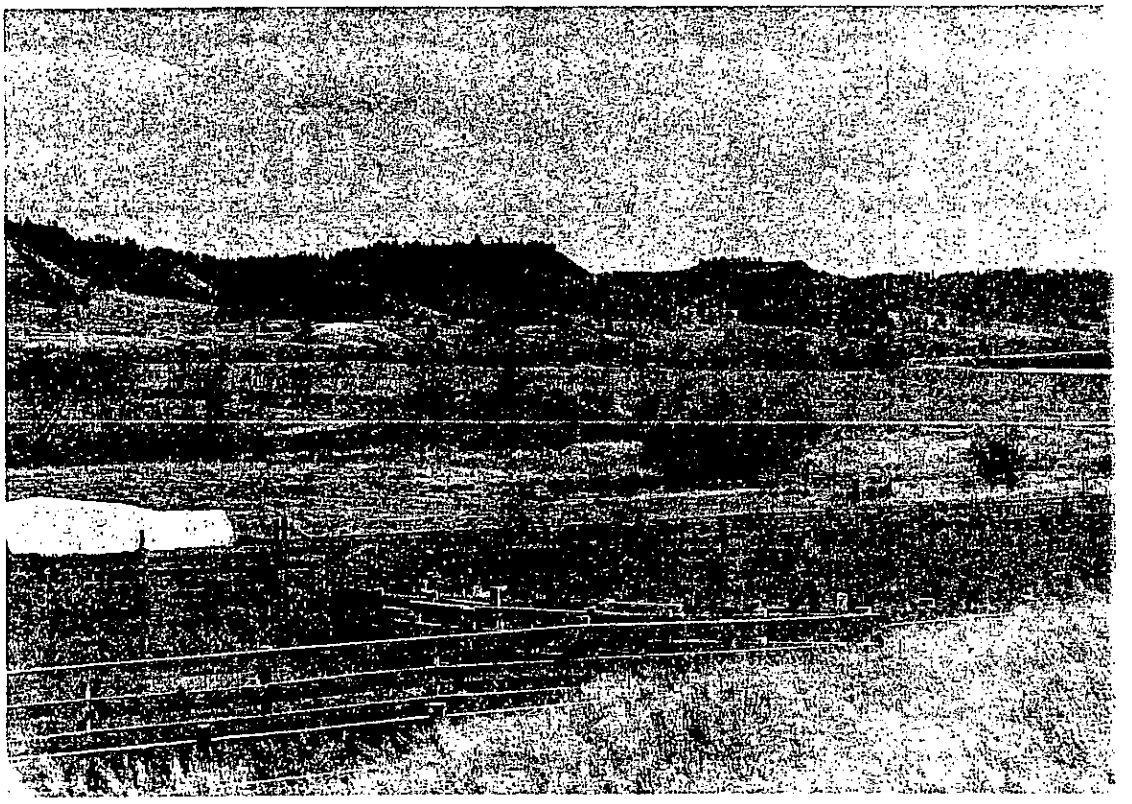

Figure 4. Subirrigated hay meadows adjacent to a ranch headquarters in the Rosebud Creek valley near Kirby, Montana.

produced, yielding an average of 3/4 to 1½ tons per acre. Subirrigated or flood irrigated alfalfa hayfields (fig. 5) dependably produce two cuttings, and in areas of excellent water availability and sufficient growing season, three cuttings are possible. Flood irrigated fields of native grass hay are generally cut only once, but production is still greater by 1 or 2 tons than that from dryland fields. Some ranchers interseed more productive grasses into native hayfields to boost total hay production. Yields of alfalfa and alfalfa-grass hay mixtures can be as much as 6 tons per acre in the best areas. After cutting the hay crop from an irrigated or subirrigated field, the regrowth will often provide additional forage for grazing. Thus, water availability not only increases the number of possible cuttings but also boosts the yield.

Valley bottoms are important to ranching for reasons beyond providing hay. The stock water found in valleys is generally of good quality and can be maintained relatively easily. Shelter from the summer sun and winter winds can be found in valleys, and for this reason, many ranches have their headquarters and calving grounds in these protected areas. Ranchers throughout the coal region consistently identified these valley floor features, as well as irrigated and subirrigated fields, to be critical to the success of their operations. Except where subirrigation was extensive, increased productivity of valley-bottom rangeland was not reported as significant.

The annual cycle of ranching life can be viewed as beginning in late winter (February to April) with calving and lambing. Protection from late-season storms is critical for the survival and healthy growth of the young animals. On many ranches, sheds provide protection for newly born lambs, but calving usually occurs in protected pastures where trees, shrubs, cliffs, or other natural features break the cold winds. The young animals and their mothers are kept in these protected pastures until the brief spring (April to June) brings new grass on the hills. During the summer months the animals are moved between pastures as grass and stock water availability changes. Most rainfall in this region falls between April and July, with the highest monthly rainfall occurring in May or June. Growth of range grasses is consistent with this pattern. The range of eastern Montana and Wyoming is characterized by "cool" and "warm" season grasses, which mature in late spring and early summer, respectively. Grazing strategies utilize pastures according to species abundance of these two types of grasses. Upland grasses are dormant by late July and the hills are brown. Valley bottoms remain green longer, depending on water availability. In this semiarid land, stock water availability is also a major factor in grazing patterns. In areas where springs or streamflow are unavailable or of unacceptable quality, wells must be developed.

Cutting hay for winter feed begins as soon as the hay nears maturity. On subirrigated and irrigated fields, the process of cutting, drying, baling, and storing of hay continues all summer, with the first cutting typically taken before July 4th. The animals stay out on the upland pastures as long as grass availability, weather, and the hunting

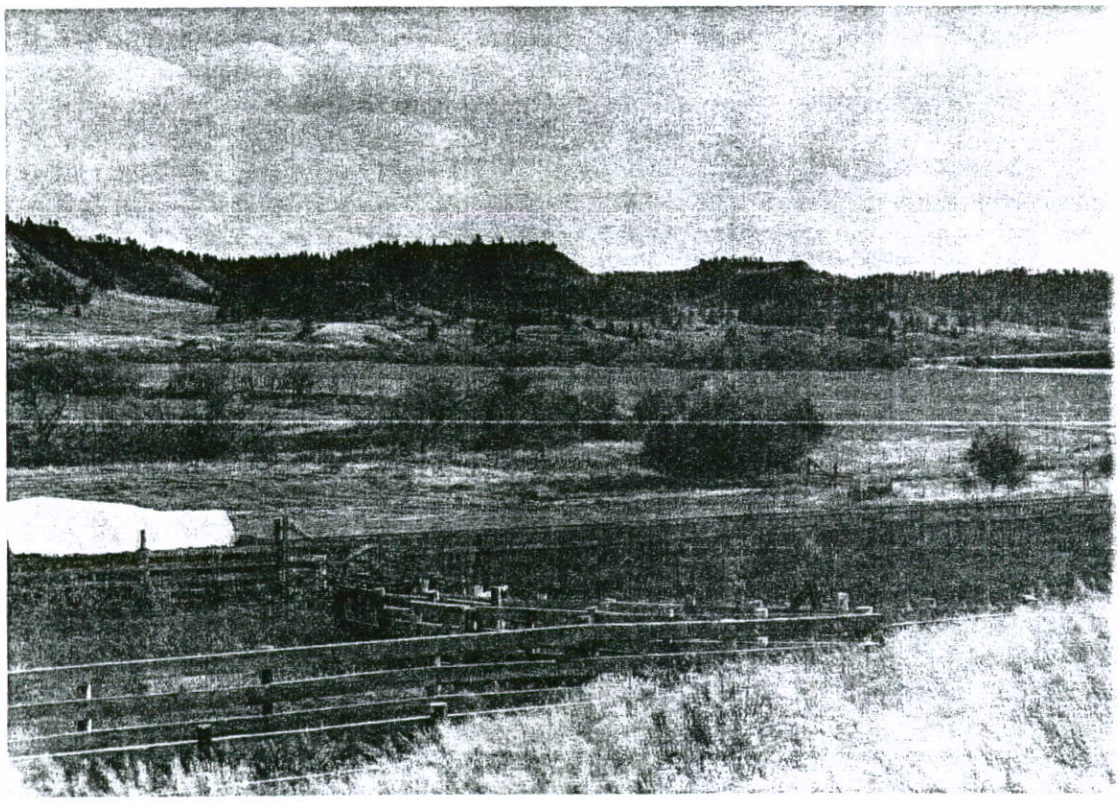

Figure 4. Subirrigated hay meadows adjacent to a ranch headquarters in the Rosebud Creek valley near Kirby, Montana.

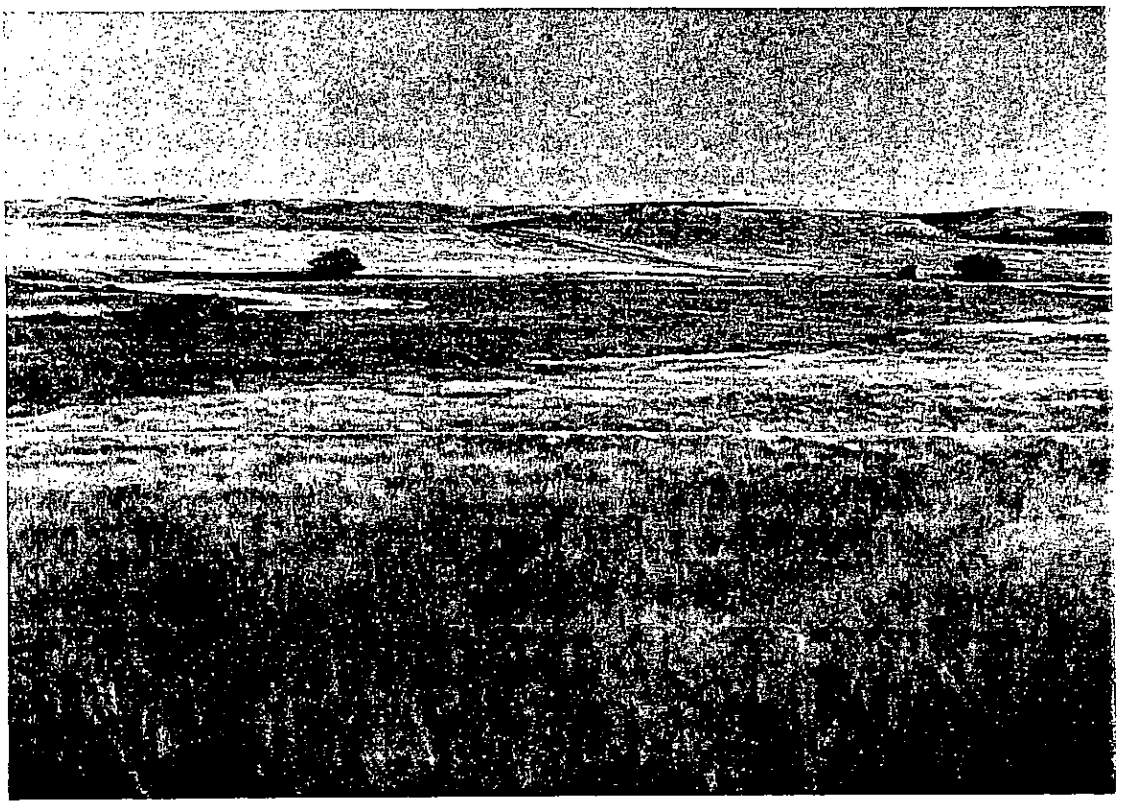

Figure 5. Subirrigated hayfields along Browns Spring valley.

season permit. In parts of the study area ranchers bring their livestock into protected areas to avoid having their animals mistaken for antelope or deer. During the fall and early winter most ranchers sell part of their stock, particularly some of the animals born the previous spring. Many ranchers winter their animals on the valley haylands for protection from winter storms and for ease of feeding and watering. Winter feeding begins with heavy snow--anytime from November to January--and continues until March or April, depending on the location and year.

There are several significant exceptions to this general pattern of agricultural use. For the most part, the southern part of the Powder River Basin experiences light snows and strong winds that keep many upland pastures clear; commonly, animals can graze all winter long and require little supplemental feeding. Throughout much of the area south of Gillette, ranchers do not cut their own hay; instead, they get it from producers near the Big Horn Mountains, such as along Clear Creek, or from producers in the North Platte valley near Douglas. The consensus among ranchers in this area is that so little hay is needed that it does not pay to purchase equipment and spend time producing hay with marginal water sources when better hay-producing areas exist nearby. In the past, when ranches were smaller and transportation more difficult, many of the operators who now buy hay grew their own. According to our interviews, the influx of money from energy development (gas, oil, and coal) has also contributed to the practice of purchasing hay.

An important aspect of the general agricultural land use pattern of the northern Powder River Basin is the existence of the Crow and Northern Cheyenne Indian Reservations. Stream valleys, if owned by the tribes, are usually not developed for hay production, even if the valleys have the physical characteristics which would permit such development. With only few exceptions, all developments in stream valleys on these reservations have been undertaken by nontribal ranchers. A good example of this pattern is the valleys draining the Wolf Mountains, where the only irrigation developments are on nontribal ranch inholdings on the Crow Reservation.

Throughout the Powder River Basin, surface-water developments have been initiated sporadically ever since the need for winter feed production became apparent in the late 1880's. At that time, vast herds of cattle left to graze on the open range died during the hard winter of 1886-87. Following this disaster, stockpiling of hay and winter feeding of cattle became common practices. Beginning in the early 1900's, homesteading transformed the nature of agriculture in the Powder River Basin. For the first 20 years of this century, settlers poured into the area to homestead 160-acre tracts. They fenced and plowed much of the rangeland into cropland.

Soon after white settlement occurred in the late 1800's, ditch irrigation systems were constructed, particularly in the major valleys of streams heading in the Big Horn Mountains and along other large

perennial streams. The potential for irrigation development in these valleys was apparent, and the early settlers were quick to take advantage of it. These systems have continued, for the most part, to be improved and maintained up to the present.

Under the Desert Land Act of 1887, a prospective landowner could purchase an additional 640 acres of land for 25¢ per acre if an irrigation system was developed on the tract. Many of these original irrigation projects were poorly designed because the developers often knew little about engineering, the climate, or irrigation needs. Though a few of the Desert Land Act irrigation projects still exist, most have been abandoned or were redesigned long ago. Many of the abandoned systems, however, are still visible on the ground and on aerial photographs.

Drier weather conditions began in the 1920's, and when the drought and depression occurred in the 1930's, homesteaders fled, cutting the region's population nearly in half. Destitute landowners sold when they could find a purchaser, and the trend toward consolidation and enlargement of ranches began. Much land reverted to Government ownership. Some of the land acquired by the Federal Government during this period was consolidated into the Thunder Basin National Grasslands in east-central Wyoming. Many of the families who survived this decade still ranch in the Powder River Basin.

Soil erosion brought about by drought, overgrazing, and abandoned fields became a serious problem in the 1930's. In an attempt to reduce soil erosion, the Federal Government sponsored the development of many spreader dike systems, particularly noticeable in the Mizpah and Sand Creeks area and the high plains around Gillette. The legacy of those programs remains as dikes on hillsides and in ephemeral channels.

Development of irrigation projects has continued to be supported by the Federal Government through technical aid offered by the Soil Conservation Service (SCS) and through cost-sharing programs sponsored by the Agricultural Stabilization and Conservation Service. Individual ranchers have built many spreader dike systems (fig. 6) and small-scale irrigation projects (fig. 7) with the aid of Federal programs such as the Great Plains Program. Not all ranchers have sought Government aid. During interviews, many people claimed that their own irrigation system designs were preferable to those promoted by the SCS.

Irrigation development has continued on a sproadic basis even during the recent years of high interest rates, high costs of earthmoving, and low livestock prices. For the most part, though, when asked if they had considered developing irrigation systems, many landowners responded affirmatively but that they had rejected the idea as too expensive.

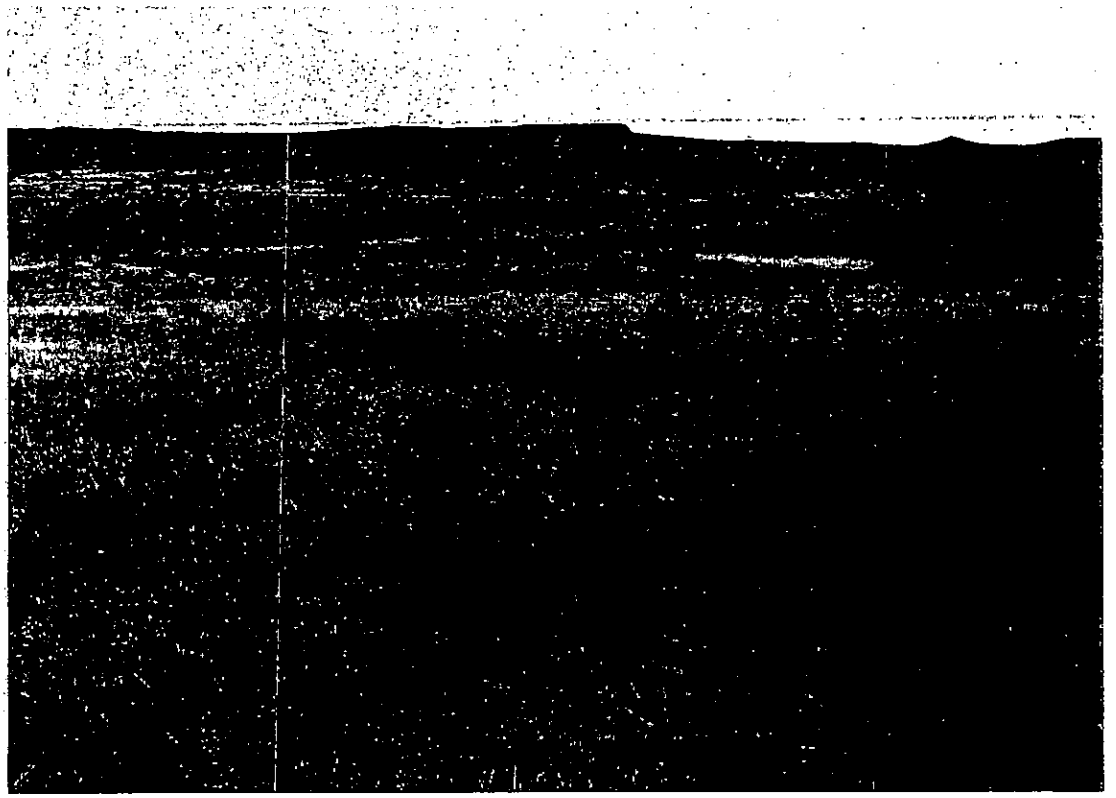

Figure 6. A spreader dike on Kinney Draw, tributary to the Powder River, Johnson County, Wyoming. The stream channel is near the boundary between the rangeland in the foreground and the hayfield in the middle distance. The spreader dike dams the stream and causes floodwaters to flow around the dike and over the hayfield. The drainage area above this spreader dike is about 13 square miles. The valley bottom has aggraded somewhat in response to spreader dikes in this drainage.

Figure 7. Contour dikes used to irrigate an alfalfa field along Pumpkin Creek, Powder River County, Montana.

IDENTIFICATION OF REGIONS

The intensity and style of agricultural land use in the Powder River Basin coal region is not uniform. Ranch management varies according to historical use and economic pressures, as well as physical and climatic conditions. Due to the differences in these factors throughout the Powder River Basin, ranch management styles have evolved differently in different areas. Based on the data collected, it is possible to divide the study area into seven regions (pl. 11), each with similar agricultural practices and similar physical and hydrologic characteristics.

The classification of the study area into regions of similar agricultural use and similar physical features permits a systematic assessment of the capability of undeveloped valleys to be developed for surface-water irrigation. As outlined in "Alluvial Valley Floor Identification and Study Guidelines" (U.S. Office of Surface Mining, 1983), mere assessment of physical characteristics of valleys (i.e., water quantity and quality, soils, topography) is insufficient to assess irrigation capability. Regional patterns of use must also be considered in the sense that farmers and ranchers may not view particular valley types as being developable, despite development of the same type of valleys elsewhere. For example, small ephemeral tributaries of the Tongue River are not developed because landowners are able to produce their required hay base on irrigated terraces of the Tongue. However, similar valleys are developed in other parts of the study area where no perennial water source comparable to the Tongue River is available. Thus, ephemeral tributaries of the Tongue River are not designated as flood irrigable because no area rancher utilizes these tributary valleys. On the other hand, some small valleys are developed along the Powder River, and, therefore, all others of similar characteristics in this particular area are designated as irrigable alluvial valley floors. Thus, the Tongue and Powder River areas are considered separate regions.

SUMMARY OF RESULTS

All irrigated and subirrigated valleys underlain by unconsolidated streamlaid deposits were identified as potential alluvial valley floors. However, some headwater areas which are indicated on the maps as being subirrigated may not be underlain by streamlaid deposits. Site-specific investigation (which was not possible for every drainage during this study) is needed in these areas to delineate the extent of alluvium. Consideration was also given to valleys irrigated with water transferred from other drainages. In all cases, valleys irrigated from interbasin transfer have sufficient water availability from that valley's stream to irrigate at least part of the valley.

Some nonirrigated valleys and nonirrigated parts of valleys with irrigation were also designated potential alluvial valley floors if these areas have the capability to be irrigated. As discussed in the previous section, irrigation capability was assessed within each agricultural region defined during this study by comparing physical characteristics

of developed and undeveloped valleys. An undeveloped valley was designated irrigable if it was physically similar to other developed valleys within the region. In using this method, characteristics of developed valleys, such as drainage area, water availability, mean valley slope, valley width, bed and bank materials, channel size, and channel width/depth ratio, were identified. Thus, a set (or sets) of physical attributes were identified for irrigated valleys within a region, and if a nonirrigated valley had these attributes, that valley was designated a potential irrigable alluvial valley floor. However, further sitespecific study may indicate that certain valleys or parts of valleys may not be considered alluvial valley floors due to unsuitable water supply, soils, or topography.

SUMMARY OF REGIONS

REGION I: NORTHERN POWDER RIVER BASIN

The several major streams (Sarpy, Rosebud, Otter, and Hanging Woman Creeks and the Tongue River) in this region (pls. 1, 2, and 3) are perennial. Bottomlands along these streams produce almost all of the region's hay, which is primarily alfalfa. The predominant method of surface irrigation is contour ditches. Water is diverted from the channel either by small dam-ditch systems or by pumps. Spreader dike systems have been developed on main stream terraces at the mouths of a few tributaries. Subirrigation is extensive and in some valleys is the only source of supplemental water available for the alfalfa hay crop. The availability of good hayland on the main streams coupled with large ranch size in this region has made it unnecessary to develop tributary valleys. Therefore, alluvial valley floor designations are limited primarily to the major streams. The downstream ends of some tributaries and subirrigated areas are also designated.

Rosebud Creek. Rosebud Creek is a subirrigated valley with extensive hayfields (fig. 4). In the past, ditch irrigation was practiced, but by mutual agreement among the ranchers living north of the Northern Cheyenne Reservation, their systems were abandoned to maintain the water quality of the stream. Ditch irrigation is still used in upstream parts of the valley around Busby and in Region III. The high alluvial water table subirrigates the major part of the valley. Most terrace levels (up to 60 feet) of the stream are designated as irrigable because of the current and previous successful use of surface irrigation and because of new irrigation development of higher terraces in the vicinity of Busby.

Sarpy Creek. The wide (1,000+ feet), low-lying terraces (3 to 10 feet) of Sarpy Creek are subirrigated and widely used for hay production. Little irrigation development has taken place in the valley because of the natural subirrigation and limited surface-water availability. The Sarpy Creek valley is designated an alluvial valley floor primarily because of its wide subirrigated terraces. On one tributary, a small dam and spreader dike system developed years ago is marginally successful.

Tongue River. The Tongue River valley is irrigated most frequently on the two lowest terraces (5 to 15 feet) and less frequently on the high terrace (25 feet). Diversion is by ditch or pumps, and small grains and row crops are grown in addition to hay. Subirrigated haylands occur on the lowest terrace and lower parts of the intermediate terrace. All terraces are designated as irrigable.

Hanging Woman Creek. Haylands along this stream are primarily subirrigated, but in places supplemental water is supplied by spreader dikes and ditch irrigation. Peak flows from tributaries are diverted by dike and ditch systems to the three terrace levels along Hanging Woman Creek in the vicinity of Haywood Gulch. The headwaters of Hanging Woman Creek above Corral Creek are included in Region III.

REGION II: MIZPAH AND SAND CREEKS AREA

The Mizpah and Sand Creek area (pls. 2 and 4) is unique in the Powder River Basin. Extensive development of spreader dikes in nearly every drainage whose basin is larger than 3 to 4 square miles, coupled with grain farming on the hillsides, distinguishes it from the more predominant ranching orientation of the rest of the Powder River Basin coal region. The reason for this intensive development is due to the historical maintenance of small parcel ownership of land, as well as favorable topography and climate. Both hay and grain are grown on valley floor areas, and most operations produce a mixture of grain and cattle. The area is more arid and has a gently rolling topography with overall low relief and broad valleys. Alluvial deposits and terrace landforms are difficult to distinguish in this area, and frequently stream channels have been obliterated by series of spreader dikes. Spreader dike systems also are occasionally found on hillslopes outside of alluvial valley floors. All parts of valleys underlain by alluvium, with flat bottoms and low gradients, and with drainage areas of at least 3 to 4 square miles, are designated alluvial valley floors with the potential to be irrigated.

REGION III: HIGH PLATEAUS

Streams in Region III (pls. 2, 3, 4, and 5) have their headwaters in the ponderosa pine-covered plateaus of the Wolf Mountains, the Custer National Forest, and the adjacent high country south to Prairie Dog Creek. These high elevation areas receive more precipitation than other regions. The streams have perennial or intermittent flows. However, the runoff season for these streams is shorter than that for Region IV streams, which are fed by snowmelt from the Big Horn Mountains. There are no large streams in the area, and therefore ranchers have developed fields in many of the drainages to produce adequate hay. Main streams and side streams are equally developed in many areas. Ditch irrigation is characteristic in larger drainages while streams with low gradients in their headwaters may be intensively developed with spreader dikes, as in upper Hanging Woman and Otter Creeks. The smaller valleys which have been designated as potentially irrigable could be irrigated with spreader dikes. These valleys have a

gentle gradient, low broad terraces, and a minimum drainage area of 3 to 4 square miles.

Wolf Mountain drainages. Surface-water development for irrigation is common in valleys heading in the Wolf Mountains (fig. 8). For streams draining the east slope of the Wolf Mountains, every valley mapped as having the potential for development has already been developed in some part of that valley. The smallest drainage basins developed are in upper Spring Creek and upper South Fork Rosebud Creek, where basins of about 3 square miles have been developed. Thus, a 3-square-mile threshold was used as the basis for potential irrigation determinations in other valleys of the region. Tributaries to the main valleys of the Wolf Mountains are very rarely developed, and only those with existing development in a part of them have been mapped as having further development potential.

Streams draining the western slope of the mountains are generally not developed, with development only in the Little Owl Creek valley. However, several valleys have similar size and hydrologic character, including Grey Blanket, Sioux Pass, Bear, and Owl Creek valleys. These valleys have been assigned surface-water development potential. Many of the nonirrigated terraces of these streams are currently planted in dryland wheat.

In the Wolf Mountains, streams with headwaters nearest the main drainage divide have perennial flow originating from numerous springs. Beavers have exploited the water and the aspens and are numerous in many valleys. Subirrigation is common, although in some instances subirrigated valleys are mostly beaver ponds and marshy areas and therefore are not useful for agriculture.

Otter Creek. Downstream from the Custer National Forest, the Otter Creek valley is wide (up to one-half mile) and has extensive irrigated and subirrigated hayfields. Irrigation water is supplied by spreader dikes and ditch/diversions from this perennial stream primarily onto the low terrace (1-4 feet). A second terrace is also irrigated, most commonly from several large (e.g., Paget and Tenmile Creeks) and several small unnamed tributaries. Several tributaries also have developed fields. Lower Otter Creek is surrounded by public lands and, therefore, agricultural development is extensive on the relatively limited private holdings.

Along the upper reaches above Bear Creek, in Region III, irrigation development is distinctly different. Spreader dikes irrigate the second terrace (10 to 15 feet) and even the colluvial mantle overlying some terraces. Subirrigation is common on lower terraces. Potential for spreader dike development is more often constrained by valley floor topography rather than sufficient drainage area.

Badger Creek. Poor water quality makes Badger Creek an anomaly in the region. The reason for the stream's very saline water, which cattle evidently will not drink during low flow periods, is not readily

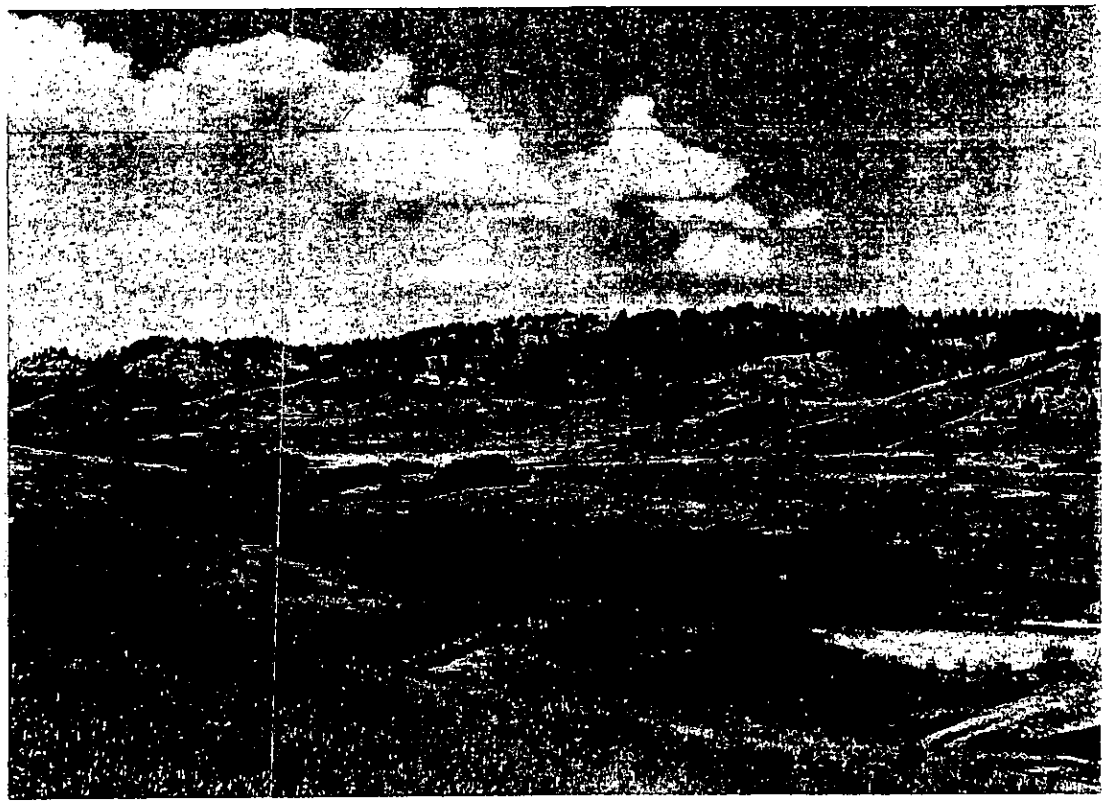

Figure 8. Irrigated and subirrigated alfalfa fields along Indian Creek near Kirby, Montana. Upper Indian Creek Reservoir is at lower right corner of the photograph.

apparent. Former spreader dikes and ground breaking caused saline seep to sour the soils, and therefore spreader dikes are not considered a viable development in the drainage. Ranchers report native hay to be the best use of bottomlands. Similar conditions exist in Coutant Creek. Water quality conditions in Little Badger Creek are reportedly not as poor, and this valley is designated as irrigable.

Dutch Creek. SR and Arkansas Creeks, Wagner Prong, and upper Dow Prong are subirrigated tributaries to Dutch Creek. Water supplies are generally insufficient for development of surface irrigation, but the higher rainfall in the headwater areas maintains subirrigation along these channels. Though no spreader dikes have been developed here, ranchers could probably use them to augment the hay crops from the subirrigated bottomlands. On Dutch Creek and the lower part of Dow Prong, there are three irrigated fields, two of which have water pumped to contour ditches (fig. 9). The other is a direct ditch diversion.

Little Pumpkin Creek. No irrigation water is diverted from Little Pumpkin Creek, except from one damsite. However, the valley is irrigated by diverting tributary flow onto terraces along the middle reaches of the stream, and these terraces are mapped as irrigable. There is no potential to develop the narrow terraces of the steep gradient tributaries of Little Pumpkin Creek. Downstream from Gaskill Creek, hayfields on the lower terrace are mostly subirrigated.

Pumpkin Creek. Pumpkin Creek has been primarily developed with spreader dikes on the lower, subirrigated terrace (4 to 8 feet). Ranchers report variable effectiveness for these systems. In places, a higher terrace (15 to 20 feet) also has water spread onto it. This high terrace is designated as potentially irrigable. Side streams have not been extensively developed, and according to the Soil Conservation Service, this has been mainly by choice of the landowners rather than a resource limitation. These tributaries have been designated irrigable on the basis of criteria stated for Region III.

Beaver Creek. This valley has a substantial amount of subirrigated land. Hayfields are also irrigated by spreader dikes diverting tributary flow onto Beaver Creek terraces.

Foster Creek. Foster Creek is primarily in rangeland except for some spreader dike development in the headwaters. Most of the stream is part of a large ranch with excellent haylands on the Tongue River and thus has not been developed. Some sections have many springs and are too wet for development. The valley is designated irrigable on the basis of its similarity to other streams in the region.

REGION IV: FOOTHILLS OF THE BIG HORN MOUNTAINS

A land of abundant water, this region (pls. 3, 5, and 7) receives the runoff from snowmelt in the Big Horn Mountains, which rise to over 13,000 feet (4,000 m) just west of this region. In Region IV, the limit

Figure 9. Irrigation water is supplied to contour ditches in hayfields (beyond telephone poles) by pumping from Dutch Creek, near Sheridan, Wyoming. Pump (foreground) has been pulled away from stream (at left end of pipeline) for winter storage.

of alluvial valley floor designation is based generally on geomorphic criteria because irrigation is extensively practiced on valley slopes and ridgetops as well as in valleys. For this reason, the region is unique in that available irrigation water exceeds available valleyland suitable for irrigation.

Irrigation water is dependable and is often transported long distances through systems of headwater dams, interbasin transfers, and extensive ditches and canals. Irrigation development primarily occurs on main stream valleys. However, wider tributary terraces are frequently irrigated by ditches from the main stream. Subirrigated side streams may be hayed but rarely are developed with spreader dikes because of the availability of high quality irrigated haylands along the main streams. The extent of irrigation is sometimes limited by ownership of water rights.

Development of small tributaries in this region is so limited that no side streams were designated as irrigable. On the major streams with extensive irrigation, all terraces presently not developed were designated as irrigable.

The lower stream terraces are subirrigated and in many areas are too wet to accept supplemental surface irrigation without waterlogging. The extensive irrigation makes it difficult at times to distinguish subirrigated areas at the reconnaissance level of this project.

Hanging Woman Creek. Above Trabbing, Hanging Woman Creek is included in Region IV because of the extensive ditch irrigation of this part of the valley.

Piney Creek and Clear Creek. Nearly all alluvial terraces of Piney Creek, Box Elder Creek, and Clear Creek are irrigated. Irrigation water in these streams comes from either the stream's drainage basin or from interbasin transfers via ditches built in the Big Horn Mountain foothills.

Prairie Dog Creek. The upper terraces of Prairie Dog Creek are extensively irrigated (figs. 10 and 11). Lower Wildcat Creek is also irrigated from Prairie Dog Creek via a diversion ditch and several pumps.

Goose Creek. Goose Creek and Little Goose Creek flow through broad shallow valleys in an area where even hilltops are irrigated.

Tongue River. Irrigation development along the Tongue River has been intensified over the past 20 years as large ranch operations have centralized their hay production in this valley. Large center pivot systems have been built, and these systems have replaced haylands along other smaller streams. The extent of irrigated fields in the valley is much wider than the extent of alluvial deposits.

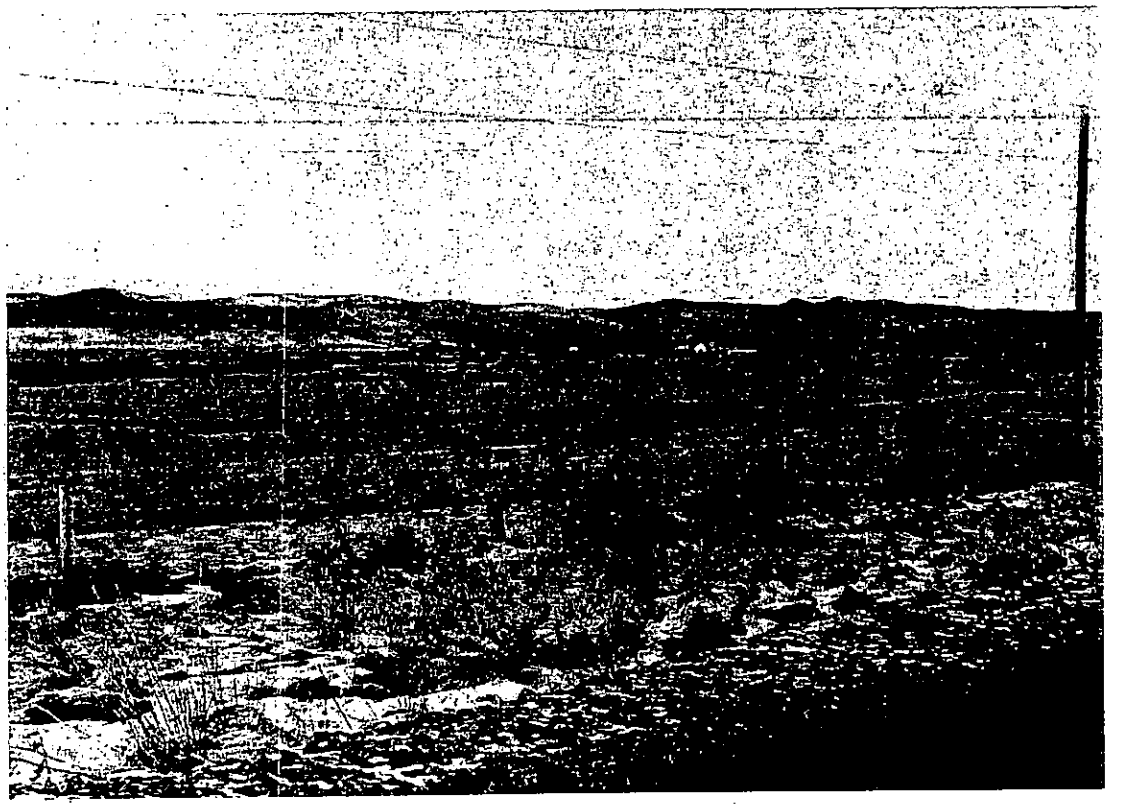

Figure 10. Irrigated alfalfa fields along Prairie Dog Creek, near Sheridan, Wyoming. The two main irrigation canals (lined with tall grass) feed contour ditches (thin lines in photograph) in each field.

Figure 11. Metal diversion dam on Prairie Dog Creek, near Sheridan, Wyoming. Diversion of the perennial flow of the stream occurs through the headgate on the far side of the stream to an irrigation canal, such as the ones pictured in figure 10.

REGION V: CENTRAL POWDER RIVER BASIN

Region V (pls. 4 through 10) encompasses the most arid parts of the Powder River Basin, including the Powder River itself, many of its tributaries, and the Little Powder River. The region also includes areas east and southeast of Gillette and in northern Converse County, where stream valleys cut through the breaks of the Fort Union Formation and are physiographically similar to other valleys in the region.

Most drainages have eroded well-defined, flat-bottomed valleys through otherwise rugged terrain. The rough uplands are used for grazing, while the valleys provide haylands and winter pasture. Native hay is the most important irrigated crop. The agricultural development in stream valleys consists primarily of dikes and ditches which spread the infrequent floodwaters over fields. This practice can often increase yields as much as two to three times. Some of the earlier and more poorly designed systems, reportedly, do not have this efficiency. Effective water-spreading systems can be built on fields having 1 to 2 percent slopes, nonsaline soils, and approximately 40 acres of upstream drainage area for each developed acre (French, 1978). However, our field observations indicate that, in practice, most effective water-spreading systems require a drainage basin of 12 square miles or larger in this region. Of the 18 spreader dike systems mapped in Region V, the 5 systems with drainage areas of less than 12 square miles generally are not considered useful by their respective ranchers. The majority of the systems with drainage areas of 12 square miles or more are considered effective. Appropriate valleys were thus designated as irrigable upstream to the point where the drainage area became less than about 12 square miles. Small drainages in Region V generally are not developed, but a few are diked at their mouths. Water is then spread on the terraces of the main stem stream. This is the dominant use pattern along Dry Creek, Crazy Woman Creek, the Powder River, and some small tributaries in the southern part of Region V.

Cache Creek. Cache Creek has limited irrigation development. The headwater reaches support several systems as does the lower reach near the Powder River. The middle part of the stream is undeveloped, reportedly, owing to flashy flows in Cache Creek and availability of better haylands along the Powder River. The potential does exist to develop border dikes to catch overbank floodflows, and therefore the valley is designated as irrigable. This same development potential exists on Bloom Creek and Fire Gulch. The bottomlands are important for winter grazing and calving.

Powder River. The Powder River is the largest stream in the region and has the most irrigation development. The valley bottom has subirrigated terraces and pumped and ditched irrigation systems. Spreader dike development occurs in tributary side streams. Downstream from Clear Creek, irrigation is common. Upstream from its confluence with Clear Creek, a perennial stream with good quality

water, the Powder River is reportedly too muddy and saline for irrigation use. Therefore, the dominant irrigation pattern is to trap the runoff from nearly every tributary and spread it over the Powder River terraces. All nonirrigated terraces are considered irrigable from side streams.

Streams in the northeastern part of Region V. East of the Powder River, 18 medium-sized drainages (60 to 120 square miles) cut through the rugged Powder River breaks, with 12 flowing into the Powder River (e.g., Bitter, Spotted Horse, and SA Creeks) and 6 joining the Little Powder River to the east of the study area (e.g., Rawhide and Wildcat Creeks). Most of these streams have their headwaters along the north- to south-trending divide between the Powder and Little Powder Rivers. Headwater elevations range from 4,000 feet in the north to 5,000 feet (1,200 to 1,525 m) in the south near Gillette. Characteristically, these streams have broad valley bottoms, 200 to 1,000 feet wide, bordered by cliffs 50 to 150 feet high.

These streams experience intermittent flows, 2 to 4 months a year, from snowmelt and major precipitation events. Most of these streams have some irrigation development ranging from simple dikes in channels designed to divert floodflows onto the adjacent broad and low-gradient terraces to complex sequences of spreader dikes in leveled fields with gates to hold and release ponded water. Irrigation development is primarily a management choice. While many systems have been in use since the 1940's and earlier, ranchers continue to occasionally develop new systems. All of the main valleys are irrigable. Few tributaries are irrigated, and most are not irrigable because they have drainage areas of less than 12 square miles.

Low terraces are fairly wide in many valleys; thus, there are large areas of subirrigated hayfields and rangeland. Many streams also experience natural flood irrigation over these low-lying terraces.

Buffalo Creek. There are two old spreader dike systems no longer in use in this valley. Although thin alkali soils are reported to be a limiting factor to spreader dike development, the valley is considered irrigable owing to its size and its similarity to other developed valleys in Region V.

Clear Creek tributaries. In the vicinity of Clearmont, several small tributaries to Clear Creek have been developed. Reservoir and ditch systems were identified in Lone Tree Creek, Whitmeyer Creek, and Black Stump Draw, and the water supply is, reportedly, undependable. Potentially flood irrigable alluvium was mapped in these drainages as well as in Double Crossing Creek, a similar but undeveloped drainage. A spreader dike system in Dead Mans Draw was also mapped, but no additional area was designated irrigable because the stream's drainage area is smaller than the 12-square-mile criterion established for Region V.

Crazy Woman Creek. Upstream from Trabbing, ditch irrigation is extensive. Downstream from Trabbing, only one rancher has water rights for surface irrigation. Therefore, border dikes to catch overbank flow and spreader dikes to catch tributary floodflows have been developed (fig. 12). Native hay is the predominant irrigated crop. The lower part of the valley has subirrigated terraces. All terraces are considered irrigable with ditch systems because water rights are the only limiting factor.

Dry Creek. Dry Creek is ephemeral and has about seven small spreader dikes. The rest of the valley is designated as an irrigable alluvial valley floor.

Wild Horse, Fortification, Barber, and Dead Horse Creeks. These streams flow west in flat-bottomed canyons through the breaks of the Powder River. Their drainage basins are of medium size (75 to 350 square miles), with Wild Horse and Dead Horse being the largest and supporting the most operations. The upland country is steep and rough, and the ranches have hayfields on the bottomlands. The extent of irrigation development varies from some recently established systems on Wild Horse Creek to abandoned Desert Claims Entry Act systems. Some reaches of the streams with a broad, low-lying terrace flood naturally and are usually in native hay. The smaller tributaries to these streams have not been developed for hayfields, but occasionally their runoff is diverted by spreader dikes on terraces of the main stream.

Wild Horse Creek is the most intensively developed stream. Near Echeta there are native hayfields which are naturally flood irrigated. Farther upstream small dams have been placed across the channel to flood fields. There are recently established spreader dikes and border dikes using main stream and tributary waters in the upper part of the valley. The headwater area of Wild Horse Creek is a high rolling plateau and is included in Region VI. Only one operation has active hayfields on Fortification Creek, and the spreader dikes in these fields are old. In lower Dead Horse Creek, west of the study area, there are spreader dikes which reportedly were designed to control erosion of the valley bottomland caused by runoff from tributaries.

Streams in the eastern breaks. Region V includes a narrow band of the southern Powder River Basin along the east edge of the study area, where streams flow through narrow valleys in rugged country similar to the rest of the region. There is somewhat less development in this part of Region V because stream valleys tend to be narrow. Usually greater development occurs on these streams east of the study area.

The Little Powder River is a dependable source of water downstream from its confluence with Rawhide Creek and is diverted into ditches for irrigation. Spreader dike development and subirrigated hayfields were observed upstream of the confluence within this region.

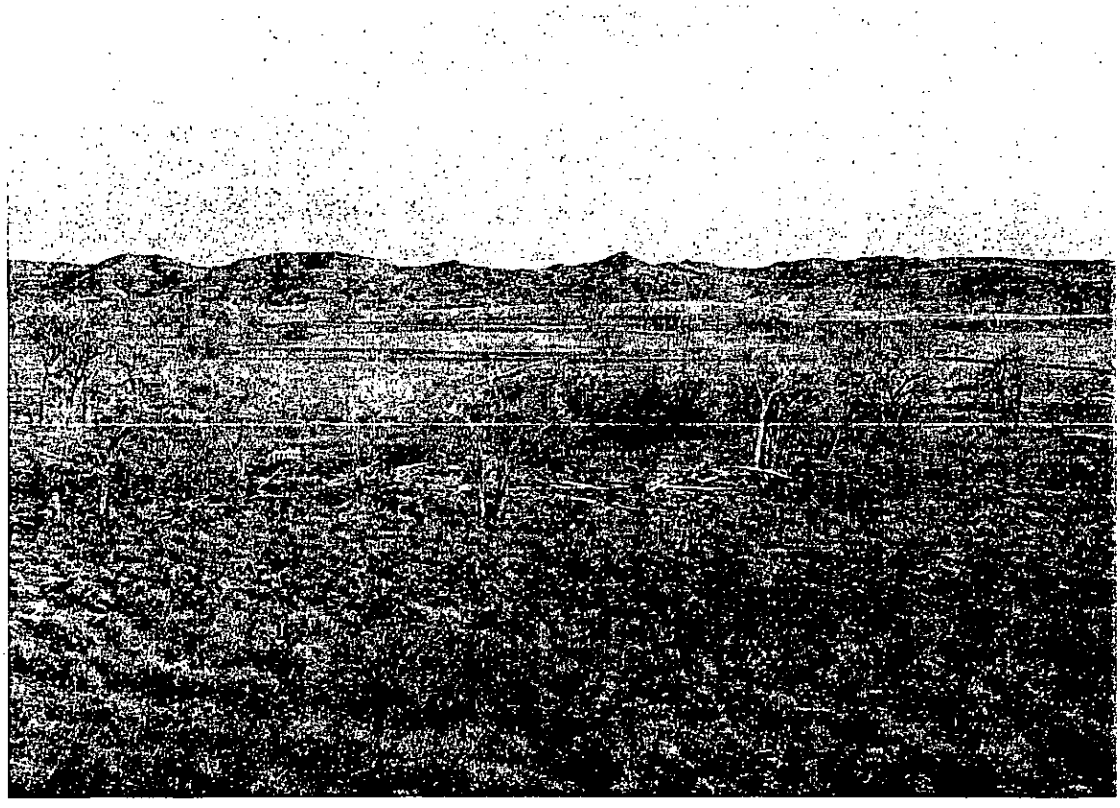

Figure 12. Dikes on terraces of Crazy Woman Creek, below Dry Creek, Johnson County, Wyoming, spread floodwaters from tributaries as well as impound overbank flow of Crazy Woman Creek. Many ranchers along lower Crazy Woman Creek do not have water rights to the stream and therefore must use this method of irrigation.

Cow Creek, Deer Creek, the lower half of Dry Donkey Creek, and Timber Creek cut through the eastern breaks of the Fort Union Formation. Occasional low terraces (2 to 4 feet) are subirrigated, but generally the lowest terrace is 10 to 15 feet above the channel. This terrace has been developed on Cow Creek with spreader dikes and on Dry Donkey Creek with a side stream reservoir, pump, and sprinkler system. In 1977 after the rancher died, this 20-acre system was abandoned by the rancher's grandson, who considered that the increased productivity was not worth the effort necessary to maintain the system. Farther upstream a spreader dike system was also observed, but the cause for abandonment is not known. Timber Creek, downstream from the confluence of Coon Track Creek, is reported to be naturally flood irrigated, and the low terrace is mapped as flood irrigable.

Black Thunder Creek, downstream from Keeline Road, has patches of subirrigation on an intermittent lower 2-foot terrace and two irrigation systems on a high terrace (4 to 7 feet). These systems are no longer operated because the ranch is used only for summer pasture. The low terraces (2 to 4 feet) on Cottonwood Creek appear suitable for irrigation development downstream from the confluence of an unnamed tributary in SE¼ sec. 1, T. 44 N., R. 70 W.

School Creek has several irrigation systems which were abandoned in 1979 after a change in ownership. The irrigated fields previously had been important haylands. Subirrigation is also prominent along School Creek (fig. 13).

Although no irrigation development occurs on Little Thunder Creek within the region, irrigation potential is mapped on the basis of upstream development and sufficient drainage area.

Several smaller streams of Antelope Creek and Dry Fork Cheyenne River drain the Red Hills and surrounding country. West Logan draw has some historical development in its upper stretch, but most of the drainage is too narrow and dissected for irrigation development. Beckwith Creek, Wildcat Creek, Lake Creek, Woody Creek, Rat Creek, Reed Draw, Conley Draw, and Dugout Creek all have flood irrigation on broad alluvial flats and additional flood irrigable areas have been mapped.

Neither Antelope Creek, Dry Fork Cheyenne River, nor the Cheyenne River have been successfully developed for irrigation within Region V. Therefore, no irrigation potential is shown, though there are broad alluvial flats and extensive areas of subirrigation, particularly along Antelope Creek.

As Dry Creek flows through the breaks, it is subirrigated and has one flood irrigation system.

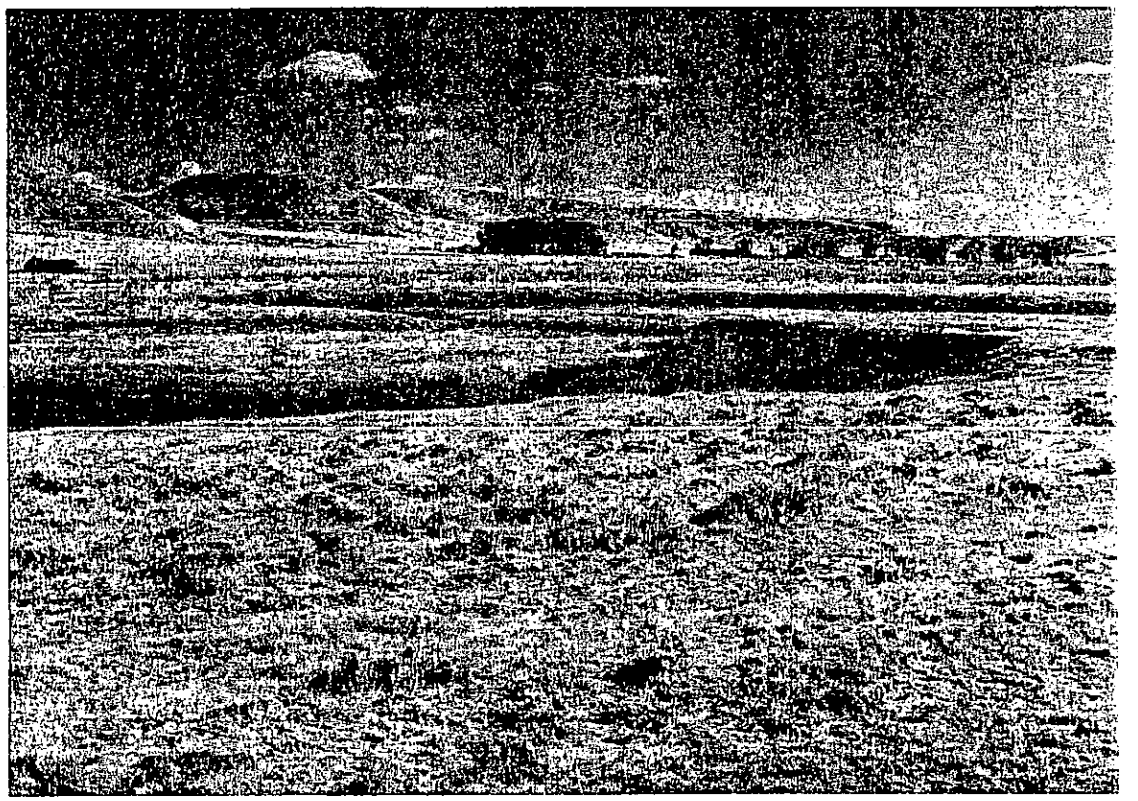

Figure 13. School Creek terraces (2 to 7 feet) are potentially flood irrigable on the basis of past irrigation of hayfields important to this ranch operation.

REGION VI: THE HIGH PLAINS

From the tributaries of the Little Powder River north of Gillette, the high plains (pls. 8, 9, and 10) extend southward 50 miles to the headwaters of the Belle Fourche River. These gently rolling plains average 4,500 to 5,000 feet (1,375 to 1,525 m) in elevation and are dissected by the branching tributaries of the Belle Fourche River, Caballo Creek, Donkey Creek, Wild Horse Creek, and the Little Powder River. In subirrigated valleys, however, irrigation development occurs even farther upstream, and 4 to 5 square miles is the approximate limiting size of the drainage area. Where no subirrigation exists, flood irrigation occurs in drainages of 23 square miles or more. The potential for irrigation is mapped according to these drainage area criteria.

Headwaters of the Little Powder River. The headwaters of the Little Powder River are on the high plateau of Region VI. Little Rawhide Creek, Dry Fork, Corral Creek, and Little Powder River all have existing or historic irrigation systems on 2- to 10-foot terraces as well as areas of extensive subirrigation. Potential for irrigation development is mapped on all these creeks. In the Garner Lake area parts of several hillside spreader dike systems irrigate alluvial deposits.

Upper Wild Horse Creek. Wild Horse Creek begins in the high plains along the Kingsbury Divide, and the development potential of its headwater tributaries is comparable to that of the headwaters of the Little Powder River. This conclusion is supported by the similarity of the valleys and the recent development of Red Top Draw.

Donkey Creek. Agriculture along Donkey Creek has been severely altered by the urban growth of Gillette. All irrigation systems have been abandoned due to management changes. Spreader systems used for erosion control were observed on small unnamed tributaries south of Wyodak.

Caballo Creek. Caballo Creek and its tributaries have been intensively developed with varying success. Spreader dikes are reported to be successful on Hoe Creek, Caballo Creek, Bone Pile Creek, a north tributary of Bone Pile Creek, and Gold Mine Draw. Figure 14 shows an undeveloped reach of Caballo Creek which could be developed with spreader dikes. Though the resource base appears very similar, the spreader dikes on upper Bluegate Creek are reported unsuccessful due to low runoff. Spreader dikes were developed for erosion control on upper Tisdale Creek, Duck Nest Creek, an unnamed tributary to Caballo Creek between Tisdale and Duck Nest Creeks, and an unnamed tributary to Hoe Creek flowing west of Highway 59. These systems have been mapped as unsuccessful systems. Two unsuccessful reservoir systems were developed, one in a middle reach of Bone Pile Creek and the other on Caballo Creek near its confluence with Hoe Creek. These reservoirs have not been used because of insufficient water. Salt accumulation problems from spreader systems have been

Figure 14. Caballo Creek meanders through a low terrace (2 feet), parts of which are subirrigated.

reported in Caballo Creek basin on Dry Donkey Creek and upper Tisdale Creek.

Belle Fourche River Basin. The Belle Fourche River from the study area boundary upstream to the confluence of Caballo Creek meanders through a wide valley (1,000 to 1,500 feet) with low terraces (6 to 10 feet). Parts of these are subirrigated. Two irrigation systems have been developed in this stretch--one spreader dike system and one pumped sprinkler system. Between the confluence of Caballo Creek and Hay Creek, the terraces are narrower and higher (6 to 15 feet) and are not irrigated. Above Hay Creek, the valley widens again and several irrigation systems exist. Above Wild Horse Creek spreader dikes have been built to catch overbank floodflows or to divert tributary flows. A diversion ditch systems also exists. Spreader dikes have been developed on the Belle Fourche River above Mud Springs Creek. These systems have been abandoned due to changes in management, but historically, they irrigated important hayfields. Above Mud Springs Creek, subirrigated areas and spring-fed ponds become more prevalent. These subirrigated pastures provide important winter feed. Only one irrigation development occurs on a high terrace (20- to 30-feet) of the Belle Fourche River. Other systems are on terraces about 12 feet or less in height, and therefore, only these lower terraces are mapped as flood irrigable.

Hay Creek has many flood irrigation systems developed on the low terraces (2 to 10 feet). Parts of the lower terrace are subirrigated as well (fig. 15). Streams flow mainly in response to precipitation events because the snowpack does not dependably produce spring runoff. However, the high water table creates ponded water yearround in places along the entire channel. Threemile, Wild Horse, and Mud Springs Creeks are drier and generally have higher terraces (6 to 12 feet) than Hay Creek. Spreader dikes have been built on Threemile Creek (currently abandoned due to changes in ownership) and on Wild Horse Creek, where they have created salt accumulation problems. Fourmile Creek, All Night Creek, and the headwaters of the Belle Fourche River above its confluence with All Night Creek have discontinuous channel forms; terrace heights range from 2 to 4 feet up to 12 to 15 feet. Subirrigated hayfields often occur on the low terraces of these streams, and spreader dikes have been built in these areas on All Night and Fourmile Creeks. Streamflow is ephemeral and the high water table is associated with sandy soils and springs. All of these streams, as well as Rocky Butte Creek and other unnamed tributaries, have intermittent subirrigated reaches that have been mapped as potentially flood irrigable.

On North Prong Little Thunder Creek a diversion ditch and spreader dikes irrigate 3 sites on 2- to 6-foot terraces. North Prong, as well as Little Thunder Creek, are mapped as potentially flood irrigable upstream to the appropriate minimum drainage area limit.

Coal Creek has been developed in three places: a ditch system on the main stem and two headwater spreader dikes that are reported to be

Figure 15. Reaches of Hay Creek support subirrigated hayfields such as these; however, spreader dike irrigation systems are also utilized.

unsuccessful due to lack of water. The flood irrigation systems on Dry Creek appear to be abandoned, but, because they occur in conjunction with subirrigation, they have been mapped as successful. Additional areas of subirrigated alluvium are mapped as flood irrigable.

Tributaries to Antelope Creek. Porcupine, Spring, Bates, and Ninemile Creeks are the main tributaries flowing from the north into Antelope Creek. Two irrigation systems in the headwaters of Porcupine Creek are reported as unsuccessful due to infrequent streamflow. Farther downstream, the spreader dikes on the 6- to 10-foot terraces are reported successful, and where Porcupine meets Antelope Creek, a reservoir and ditch irrigation system has been developed. On Spring Creek, the low terraces (up to 6 feet) are both subirrigated and flood irrigated. New spreader dikes have been developed on both Spring and Bates Creeks in the last 5 years. In the spring-fed headwaters of Bates Creek, a successful spreader dike system has been recently developed, and another system exists downstream on the 6- to 8-foot terrace. Flood irrigation has been developed on the part of Ninemile Creek within the study area. Subirrigation exists along all these streams, at times extending under low terraces several hundred feet wide.

REGION VII: SUBIRRIGATED SOUTHERN STREAMS

Throughout this region (pl. 10), there are extensive subirrigated areas where spring-fed, sandy-bottomed stream valleys produce lush native hay crops without irrigation. During the winter, the pastures are often free from snow cover, and, while some ranchers cut hay for feed, others leave the hay standing in the valley bottom for winter pasture. Because subirrigation is prevalent and produces successful crops, irrigation development is uncommon. There are only four systems in this region. For this reason, no irrigation development potential is identified, even on major streams such as Antelope Creek and Dry Fork Cheyenne River.

The four irrigation systems in the region consist of a spreader dike system on Stinking Water Gulch, a small floodwater diversion on Cottonwood Creek, and two reservoir/ditch irrigation projects on Dry Fork Cheyenne River and at the confluence of Sand Creek and Bear Creek. These latter two systems do appear to be increasing forage production and are considered successful but, reportedly, are plagued by poor water quality and inadequate water quantity. The system on Sand and Bear Creeks does not irrigate land underlain by alluvium and is therefore not mapped. Because of these problems, the high cost of reservoir development, and particularly the scarcity of irrigation systems in the region, irrigation development was determined not to be a regional practice in Region VII.

There are two major drainages in the region--Antelope Creek and Dry Fork Cheyenne River (fig. 16). Their headwaters flow from Pine Ridge, a north- to south-trending ridge, approximately 6,000 feet (1,825 m in elevation. Agricultural use of stream valleys begins at the

Figure 16. Broad subirrigated terraces of Dry Fork Cheyenne River play an integral role as pasture and/or hayfields for many ranches.

base of this ridge at an elevation of 5,500 feet (1,675 m) and continues as the streams meander through gently rolling hills. These streams are intermittent and have a snowmelt runoff season, reportedly, of 1 to 3 months. In the sandy subirrigated areas, the common stream form is a shallow (1 to 2 feet) grassy stream channel meandering through a broad (200 to 1,000 feet) valley flat. Cottonwood trees are common in parts of these valleys. Where the channel is more deeply incised (6 to 10 feet), subirrigation is not extensive. This geomorphic pattern is found in all stream valleys, regardless of drainage basin size, and is exemplified in the headwater springs of Brown Springs (fig. 5), Sage, Willow, and Duck Creeks; the subirrigated midstream reaches of South Fork Bear, Stinking Water, and Sand Creeks (fig. 17); and the subirrigated terraces of Antelope Creek and Dry Fork Cheyenne River.

Figure 17. Subirrigated pasture on Sand Creek provides for winter and other seasonal grazing needs.

REFERENCES

Branson, F. A. 1952. Range forage production changes on a water spreader in southeastern Montana: J. of Range Management, v. 9, p. 187-191.

Denson, N. M., and Horn, G. H. 1978. Geologic map of Tertiary and uppermost Cretaceous rocks showing structure contours, oil and gas fields, dry holes, and mines in southern part of Powder River Basin, Converse, Niobrara and Natrona Counties, Wyoming: U.S. Geol. Surv. open-file rep.

French, N. H. 1978. Water spreading around the world, in D. N. Hyder, (ed). Proceedings of the First International Rangeland Conference: Society for Range Management, Denver.

Frickel, D. G., and Shown, L. M. 1974. Map showing streamflow volumes in northeastern Wyoming and southeastern Montana: U.S. Geol. Surv. Map I-847-B.

Hadley, R. G., and McQueen, I. S. 1961. Hydrologic effects of water spreading in Box Creek basin, Wyoming: U.S. Geol. Surv. Water-Supply Pap. 1532-A.

Hopkins, W. B. 1973. Water resources of the Northern Cheyenne Indian Reservation and adjacent area, southeastern Montana: U.S. Geol. Surv. Atlas HA-468.

Keefer, W. R. 1974. Geologic map of the northern Great Plains: U.S. Geol. Surv. open-file rep. 74-50, plate A-3.

Lewis, B. D., and Roberts, R. S. 1978. Geology and water-yielding characteristics of rocks of the northern Powder River basin, southeastern Montana: U.S. Geol. Surv. Map I-847-D.

Love, J. D., Weitz, J. L., and Hose, R. K. 1955. Geologic map of Wyoming: U.S. Geol. Surv. map series 7B.

Malde, H. E., and Boyles, J. M. 1976. Maps of alluvial valley floors and strippable coal in forty-two 7½-minute quadrangles, Bighorn, Rosebud, and Powder River Counties, southwest Montana: U.S. Geol. Surv. open-file rep. 76-162.

Montana State Engineer's Office. 1961. Water resources survey, Powder River County: State Engineer's Office, Helena.

_____. 1951. Water resources survey, Treasure County: State Engineer's Office, Helena.

_____. 1948. Water resources survey, Rosebud County: State Engineer's Office, Helena.

Montana State Engineer's Office. 1947. Water resources survey, Big Horn County: State Engineer's Office, Helena.

Reheis, M. C. 1982. Geologic map of the Gillette 30° x 60° quadrangle, Campbell and Crook Counties, Wyoming: U.S. Geol. Surv. Map MF-1387.

Reheis, M. C., and Coates, D. A. 1982. Surficial geologic map of the Reno Junction 30° x 60° quadrangle, Campbell and Weston Counties, Wyoming: U.S. Geol. Surv. Map MF-1428.

Reheis, M. C., and Williams, V. S. 1979. Preliminary surficial geologic map of the Recluse 1° and ½° quadrangle, Wyoming and Montana: U.S Geol. Surv. open-file rep. 79-1315.

Robinson, C. S., Mapel, W. J., and Bergendahl, M. H. 1964. Stratigraphy and structure of north and west flank of the Black Hills uplift, Montana, Wyoming, and South Dakota: U.S. Geol. Surv. Prof. Pap. 404, 134 p.

Toy, T. J., and Munson, B. E. 1978. Climate appraisal maps of the rehabilitation potential of strippable coal lands in the Powder River basin, Wyoming and Montana: U.S. Geol. Surv. Map MF-932.

U.S. Forest Service. 1980. Federal coal management program: unsuitability criteria assessment, high to moderate coal potential, Thunder Basin National Grassland: Laramie, WY.

U.S. Office of Surface Mining. 1983. Alluvial valley floor identification and study guidelines: Denver, Colorado, Western Technical Center, 278 p.

U.S. Office of Technology Assessment. 1981. As assessment of development and production of Federal coal leases: Washington, D.C. 473 p.

U.S. Soil Conservation Service. 1977. Soil Survey of Big Horn County area, Montana.

_____. 1975. Soil Survey of Johnson County, Wyoming, southern part.

_____. 1971. Soil Survey of Powder River area, Montana.

_____. 1967. Soil Survey of Treasure County, Montana.

Wells, D. K. 1982. Ground-water data from selected wells in alluvial aquifers, Powder River basin, northeastern Wyoming: U.S. Geol. Surv. open-file rep. 82-856, 35 p.

Wyoming State Engineer's Office. 1979. Tongue River Irrigation Survey.

Wyoming State Engineer's Office. 1971. Irrigated land inventory for Wyoming: Report #7, Cheyenne.

_____. 1963-1971. Powder River Irrigation Survey.

Wyoming Water Development Commission. 1981. Wyoming irrigated and irrigable lands: map prepared November 1981.

EFFECTS OF POTENTIAL SURFACE COAL MINING ON DISSOLVED SOLIDS IN OTTER CREEK AND IN THE OTTER CREEK ALLUVIAL AQUIFER, SOUTHEASTERN MONTANA

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Water-Resources Investigations Report 85-4206

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by M. R. Cannon

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Helena, Montana
October 1985

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CONVERSION FACTORS

The following factors can be used to convert inch-pound units in this report to the International System (SI) of units.

Multiply inch-pound unit	By	To obtain SI unit
	Length	
foot	0.3048	meter
inch	25.40	millimeter
mile	1.609	kilometer
	Area	
acre	4,047	square meter
square mile (mi^2)	2.590	square kilometer
	Volume	
acre-foot	1,233	cubic meter
	Weight	
ton (short)	0.9072	megagram
	Flow	
cubic foot per day	0.02832	cubic meter per day
cubic foot per second	0.02832	cubic meter per second
gallon per minute (gal/min)	0.06309	liter per second
	Gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer
	Transmissivity	
foot squared per day (ft^2/d)	0.09290	meter squared per day

Temperature can be converted to degrees Celsius (°C) or degrees Fahrenheit (°F) by the equations:

$$°C = 5/9\ (°F - 32)$$
$$°F = 9/5\ (°C) + 32$$

EFFECTS OF POTENTIAL SURFACE COAL MINING ON DISSOLVED SOLIDS IN OTTER CREEK AND IN THE OTTER CREEK ALLUVIAL AQUIFER, SOUTHEASTERN MONTANA

By

M. R. Cannon

ABSTRACT

Otter Creek drains an area of 709 square miles in the coal-rich Powder River structural basin of southeastern Montana. The valley of Otter Creek is used extensively for the production of crops and livestock and contains a shallow alluvial aquifer that provides water for subirrigation. Shallow bedrock aquifers that discharge water to the Otter Creek valley include coal, sandstone, and clinker beds in the Tongue River Member of the Paleocene Fort Union Formation. Mining of the 40- to 70-foot-thick Knobloch coal bed in the downstream part of the basin would have the potential to increase the dissolved-solids load to Otter Creek and the alluvial aquifer through the leaching of soluble minerals from mine spoils.

A mass-balance model was developed to evaluate the pre-mining hydrologic system and to estimate the effects of potential large-scale surface mining on the dissolved-solids concentration in Otter Creek and the alluvial aquifer. The area modeled contains about 15 miles of the most downstream part of Otter Creek valley near Ashland, Montana. Model results are based on the assumption that all strippable reserves within the Knobloch coal beds would be mined from the study area.

The annual post-mining load of dissolved solids to Otter Creek at Ashland at median streamflow could increase by 2,873 tons, or a 32-percent increase over the mean annual pre-mining load of 8,985 tons. Increased monthly loads of Otter Creek, at the median streamflow, could range from 15 percent in February to 208 percent in August. At the median streamflow, mean dissolved-solids concentrations of Otter Creek at Ashland could range from 1,970 mg/L (milligrams per liter) in March to 6,500 mg/L in August, an increase from the pre-mining range of 1,640 mg/L in March to 2,460 mg/L in December.

The annual post-mining dissolved-solids load to the subirrigated part of the Otter Creek alluvial valley could increase by 2,873 tons or 71 percent. The median dissolved-solids concentration in the subirrigated part of the alluvial valley could be 4,430 mg/L compared to the pre-mining median concentration of 2,590 mg/L.

Post-mining loads from the potentially mined landscape were calculated using saturated-paste-extract data from 506 overburden samples collected from 26 wells and test holes. Post-mining loads to the Otter Creek valley would likely continue at increased rates for many years (possibly hundreds) after mining. If the actual area of Knobloch coal beds disturbed by mining were less than that used in the model, post-mining loads to the Otter Creek valley would be proportionally smaller.

INTRODUCTION

Otter Creek is a small perennial stream in the northern part of the coal-rich Powder River structural basin in southeastern Montana (fig. 1). Within the Otter

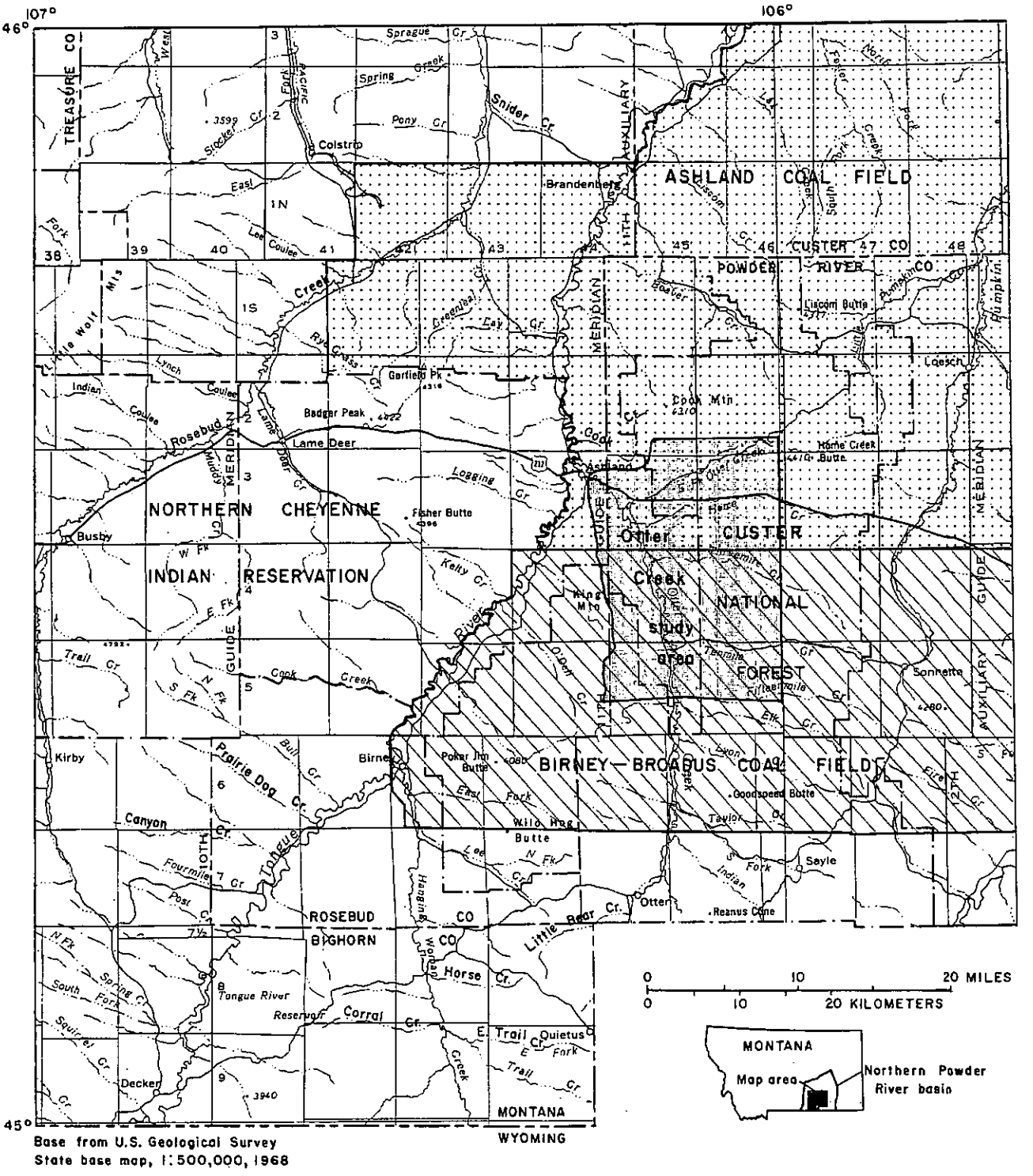


Figure 1.--Location of the Otter Creek study area.

Creek basin are vast reserves of low-sulfur strippable coal that have a good potential for development in the near future. Some of the thickest and most accessible coal deposits are located near or adjacent to the alluvial valley floor of Otter Creek.

Otter Creek is situated in a relatively flat alluvial valley that is used extensively for the production of crops and livestock. Crops in the valley are flood irrigated during times of high flow in Otter Creek and are subirrigated by the shallow water table during the growing season. Otter Creek and shallow wells in the Otter Creek valley are important sources of water for livestock.

Surface coal mining along the Otter Creek valley has the potential to conflict with the water needs of the agricultural users. Surface coal mining would remove coal and sandstone aquifers that discharge to the Otter Creek valley. After mining, ground water would flow through the backfilled mine pits and could transport large concentrations of dissolved solids into the alluvial aquifer and Otter Creek. Discharge of water having a large dissolved-solids load from the mined areas would increase the salinity of water in Otter Creek and the shallow alluvium, possibly decreasing the agricultural productivity of the valley.

Purpose and scope

The purpose of this study was to describe the pre-mining hydrology of the Otter Creek stream-alluvial aquifer system and to assess the effects of potential surface coal mining on the dissolved solids of surface water and shallow ground water in the Otter Creek valley. Results of the study could be used by State and Federal agencies, residents of the Otter Creek area, and coal-mining interests to help evaluate cumulative effects of coal mining on the water resources of the area.

Existing data were used to characterize the hydraulic properties of aquifers, flow of Otter Creek, and water quality of surface and ground waters. During the 1983 water year (October 1982 through September 1983), many additional data were collected concerning streamflow, water quality, water levels in aquifers, and hydraulic properties of coal and sandstone aquifers. These data were used to calculate a pre-mining water budget and dissolved-solids-load budget for the Otter Creek stream-alluvial aquifer system. The budget equations are a mass-balance model where all inflows during a given time interval are equal to all outflows during the same time interval. The hydrologic data collected during the 1983 water year were used to evaluate components of the budget equations that have large temporal variations.

To evaluate the effects of potential surface coal mining on the dissolved-solids concentration in the Otter Creek stream-alluvial aquifer system, it was necessary to estimate the dissolved-solids load that mining would add to the system. Overburden samples from 26 wells and test holes were analyzed to estimate post-mining quality of water from mine spoils. For the purpose of assessing the cumulative effect of large-scale mining on the Otter Creek valley, all strippable coal within the Knobloch coal beds (as mapped by Matson and Blumer, 1973) was assumed to be mined eventually from the study area. The post-mining loads of dissolved solids were added to the median monthly flows of Otter Creek at Ashland to determine effects of mining on the stream. To evaluate the effects of mining on subirrigated alluvium in the valley, the estimated dissolved-solids load from mine spoils was added to the pre-mining load of the alluvium.

Location and description of area

The Otter Creek study area consists of about 195 mi^2 of the Otter Creek basin in Powder River and Rosebud Counties, Montana (fig. 1). The study area includes about 15 miles of the Otter Creek valley and extends from Fifteenmile Creek at the southern boundary to Ashland at the northern end. The western boundary of the study area coincides with the drainage divide between the Tongue River and Otter Creek, and the eastern boundary is located from 7 to 11 miles east of the Otter Creek valley.

Boundaries of the study area were based on areas of Federal coal under consideration for lease, mine development plans, hydrologic boundaries, and potential effects on water quality in the basin. The study area contains coal lands that are adjacent to the alluvial valley floor of Otter Creek and probably have the greatest potential for development in the basin. Additional coal lands in the upstream reaches of the Otter Creek basin have the potential for large-scale surface mining, but were not included in this study because they are not located along an extensive alluvial valley floor such as those in the study area. A large part of the Otter Creek basin lies in the Custer National Forest (fig. 1). Most of the forest lands within the basin also contain vast coal deposits, but will not be mined, as stated in the "Surface Mining Control and Reclamation Act of 1977" (Public Law 95-87).

Topography and drainage

Otter Creek and its tributaries drain the entire study area. Otter Creek is a perennial northward-flowing tributary to the Tongue River and has a drainage area of 709 mi^2. The reach of Otter Creek within the study area drains about 256 mi^2 or 36 percent of the basin. The basin of Otter Creek is asymmetrical with short, small drainages on the west side and longer drainages on the east side. Tributaries on the west side of Otter Creek typically have drainage areas of 2 to 8 mi^2, and the larger tributaries on the east side have drainage areas of about 46 to 60 mi^2. Headwaters of the tributaries typically are eroded into steep, narrow upland draws. The tributaries have relatively straight and narrow channels in the upstream and middle reaches and narrow alluvial valleys in the downstream reaches. Within the study area, almost all tributaries to Otter Creek are ephemeral.

The land surface ranges from rugged, steep-sided buttes and narrow ridges along the Tongue River-Otter Creek basin divide to the relatively flat alluvial valley of Otter Creek. The land surface was formed by erosion of flat-lying sedimentary rocks having various degrees of resistance. Hard red beds of clinker, formed where coal beds have burned along their outcrops and baked the overlying rock, are the most resistant to erosion and cap many of the steep buttes and ridges. Maximum topographic relief in the study area is about 1,270 feet, with altitudes ranging from 4,175 feet on the Tongue River-Otter Creek divide to about 2,905 feet at the mouth of Otter Creek.

Otter Creek meanders within a 1,500- to 3,000-foot-wide alluvial valley. The valley slopes about 14 ft/mi from an altitude of 3,135 feet at the upstream end of the study area near Fifteenmile Creek to 2,920 feet at the downstream end near Ashland.

Climate

Average annual precipitation at Ashland is about 13 inches based on 25 years of record (1956-80). Precipitation increases significantly with altitude, and highland areas on interstream divides may receive an additional 3 to 4 inches of precipitation per year. April, May, and June generally have the greatest monthly precipitation and together receive about 40 percent of the annual precipitation. The average annual lake evaporation is about 40 inches or about 3 times as large as precipitation (Farnsworth and others, 1982). Air temperatures in the study area have an annual range from about -35° to +100°F. The average January temperature is about 18°F and the average July temperature is about 70°F.

General geology

Strata of the Tongue River Member of the Paleocene Fort Union Formation and Holocene and Pleistocene alluvium, consisting of reworked material from the Tongue River Member, compose the surface of the study area (pl. 1). More than 1,000 feet of the upper and middle parts of the Tongue River Member is exposed from King Mountain, on the west side of the Otter Creek basin, to the Otter Creek flood plain (fig. 2). The Tongue River Member attains a thickness of about 1,500 feet in the study area and is composed of shale, sandstone, siltstone, and coal beds. The Knobloch coal bed, which is 40 to 70 feet thick, is the thickest coal bed in the area and is the prime target for coal mining (McClymonds, 1984). In the northern part of the study area, the Knobloch is one massive bed (fig. 3), but southward and westward it is interbedded with increasingly thicker shale and sandstone beds. At the south end of the study area, the Knobloch consists of four distinct coal seams, each 5 to 20 feet thick (fig. 3). Massive beds of fractured, red clinker exist in the northern part of the study area where the Knobloch coal bed has burned along its outcrop (pl. 1).

The Tongue River Member contains several massive beds of sandstone. In the middle part of the Tongue River Member, thick extensive sandstone beds exist between the Sawyer and Knobloch coal beds and below the Knobloch coal bed (fig. 2). In the lower part of the member, thick beds of sandstone exist below the Flowers-Goodale coal bed and near the base of the member (McClymonds, 1984). In places, the sandstone beds attain a thickness of 100 feet or more and extend throughout many square miles. In general, the thick sandstone beds are not lenticular bodies of local extent, such as river channel deposits, but rather have an extensive sheetlike occurrence (Bass, 1932). The sandstone beds are composed mostly of friable, fine-grained quartz, but also contain a comparatively large percentage of clay, which with calcium carbonate, forms a weak cementing material.

The Lebo Shale and Tullock Members of the Fort Union Formation underlie the entire study area, but are not exposed at the surface. The Lebo Shale Member is nearly 300 feet thick and consists mostly of dark-gray shale. The Tullock Member consists of interbedded sandstone and shale with thin coal beds.

Alluvium underlies the valley of Otter Creek and many of its tributary valleys (pl. 1). Alluvium in the Otter Creek valley is as much as 70 feet thick and is composed of silt, clay, sand, and gravel. In many locations in the Otter Creek valley, the alluvium contains a large thickness of well-sorted, coarse sand and gravel derived from fragments of clinker.

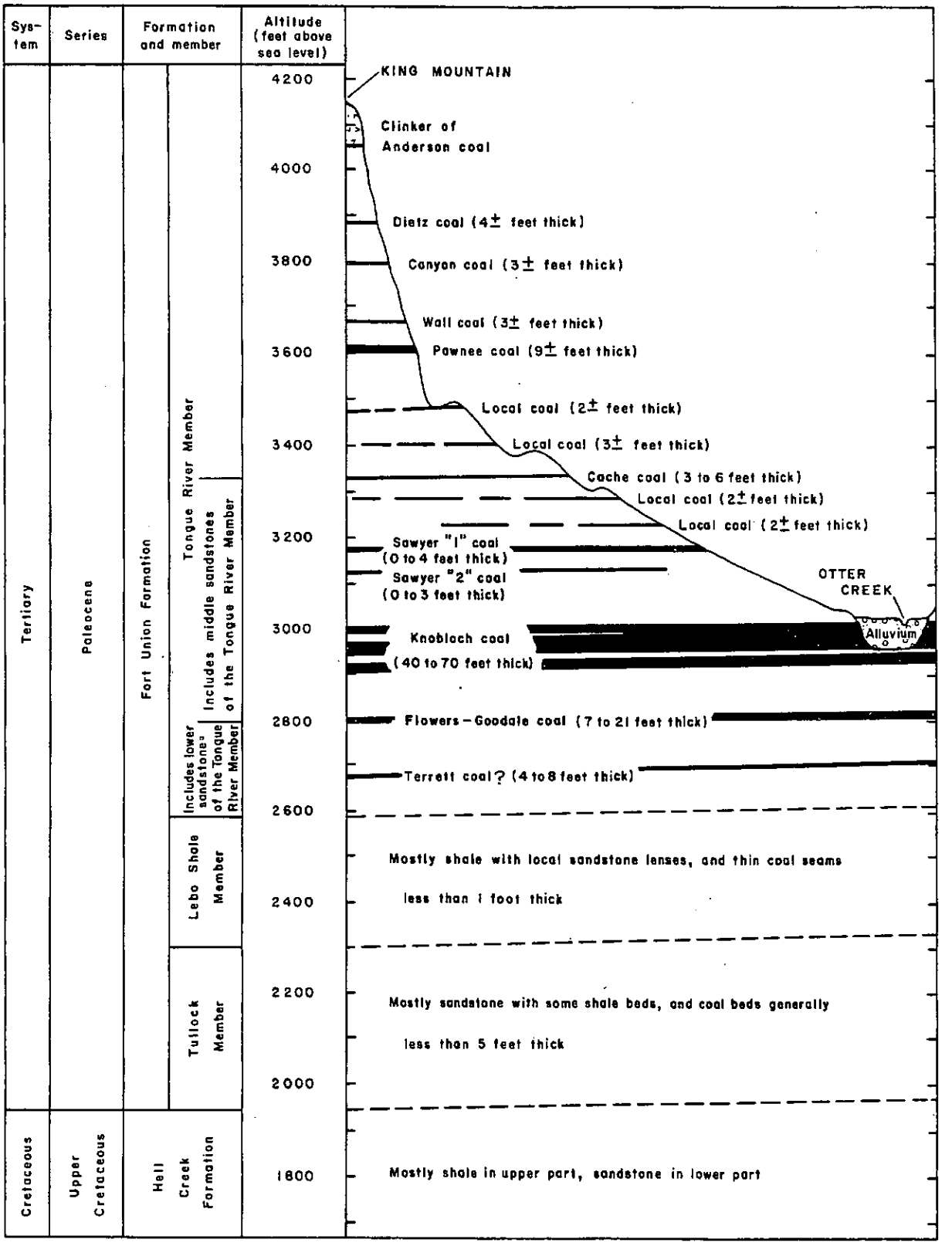


Figure 2.--Idealized section from King Mountain eastward to Otter Creek showing coal intervals and relative thicknesses of members of the Fort Union Formation.

Ground water

The primary shallow aquifers in the Otter Creek study area are the Knobloch coal bed, Knobloch clinker, sandstone beds above and below the Knobloch coal bed, and alluvium. The average rate of recharge to the shallow aquifers is very small because of the small annual precipitation relative to evapotranspiration and the generally small permeability of the fine-grained sediments of the Tongue River Member. Mean annual recharge to shallow aquifers in the Tongue River Member is estimated to be in the range of 0.01 to 0.1 inch, based on calculated discharge rates. A large percentage of recharge probably occurs at outcrops of permeable clinker and sandstone and throughout the extent of the alluvial deposits. Mean annual recharge to clinker and alluvium probably is in the range of 1 to 3 inches, based on a study by Woessner and others (1981).

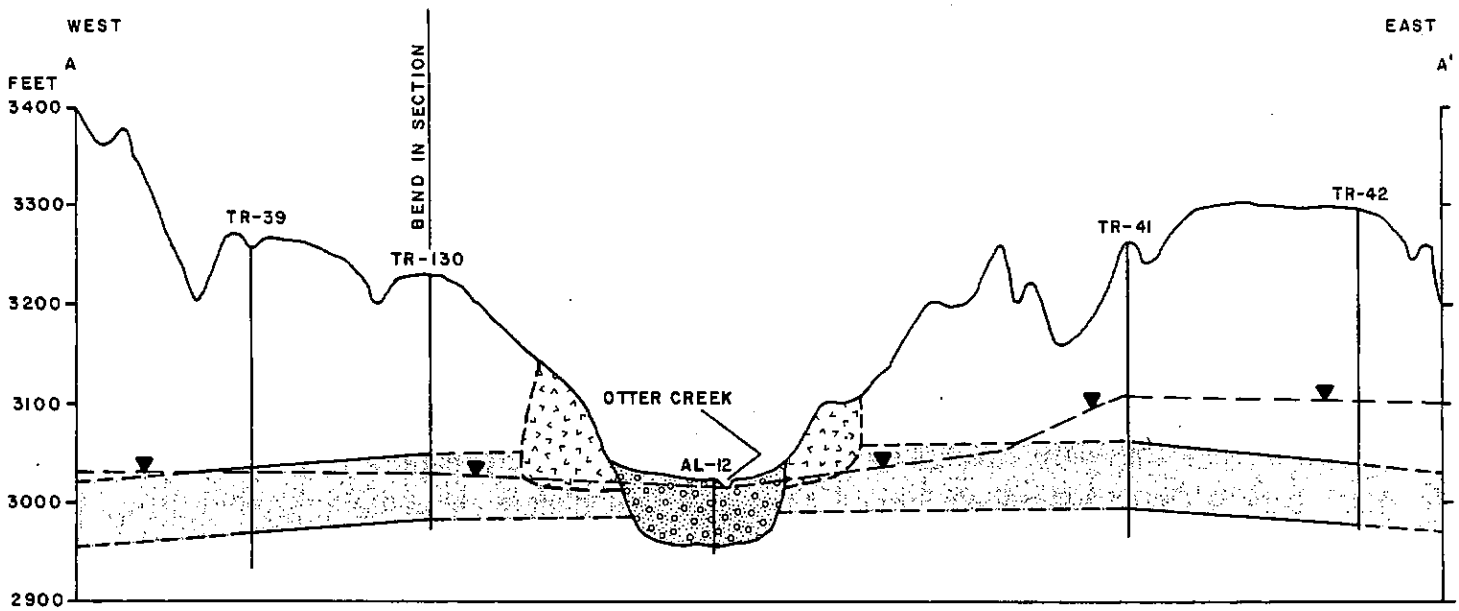
Water in shallow aquifers of the study area moves from the upper basin slopes toward Otter Creek and the Otter Creek alluvial valley, as shown by the water-level contours on plate 2. Water-level contours shown on the map are only approximate because many of the wells used as data points are open to the aquifer in a zone below the water table and have a hydraulic head slightly different than would exist at the water table. Water-level data for the map (table 1; all tables are in the Supplemental Information section at the back of the report) were collected in various years between 1959 and 1983. Water levels during the time of data collection are assumed to represent almost steady-state conditions.

In the northern part of the study area, downstream from East Fork Otter Creek, a large percentage of the ground water that discharges to the alluvium along Otter Creek originates from the Knobloch clinker. Between East Fork Otter Creek and Threemile Creek, shallow aquifers that discharge toward Otter Creek are the Knobloch coal bed, Knobloch clinker, and alluvium in the tributary valleys. In this reach, the Knobloch coal aquifer discharges to the alluvium via the Knobloch clinker or discharges directly to the alluvium where the coal subcrops in the alluvial valley (fig. 3, section A-A'). Between Threemile Creek and the upstream end of the study area near Fifteenmile Creek, the Knobloch coal aquifer, clinker, sandstone, and alluvium in tributaries all discharge water to alluvium in the Otter Creek valley. Water within the alluvium discharges primarily to Otter Creek and by evapotranspiration; only a small percentage discharges downvalley through the alluvial aquifer.

Deeper aquifers exist in sandstone beds of the Lebo Shale and Tullock Members of the Fort Union Formation. These aquifers are part of the regional ground-water flow system and have no significant discharge to the Otter Creek valley. A sandstone aquifer in the Tullock Member has a hydraulic head above parts of the Otter Creek valley, but the thick shale beds in the Lebo Shale Member effectively retard upward discharge to the Otter Creek valley. Deep wells (780 to about 1,000 feet) drilled from the valley floor to the Tullock aquifer discharge 1.4 to 6 gal/min by artesian flow (McClymonds, 1984).

Previous investigations

Otter Creek and the surrounding areas have been the focus of many investigations, primarily because of the vast coal reserves of the region. Wegemann (1910) made a reconnaissance of part of the area to describe coals of the Custer National Forest. Coal deposits of the Ashland and the Birney-Broadus coal fields were



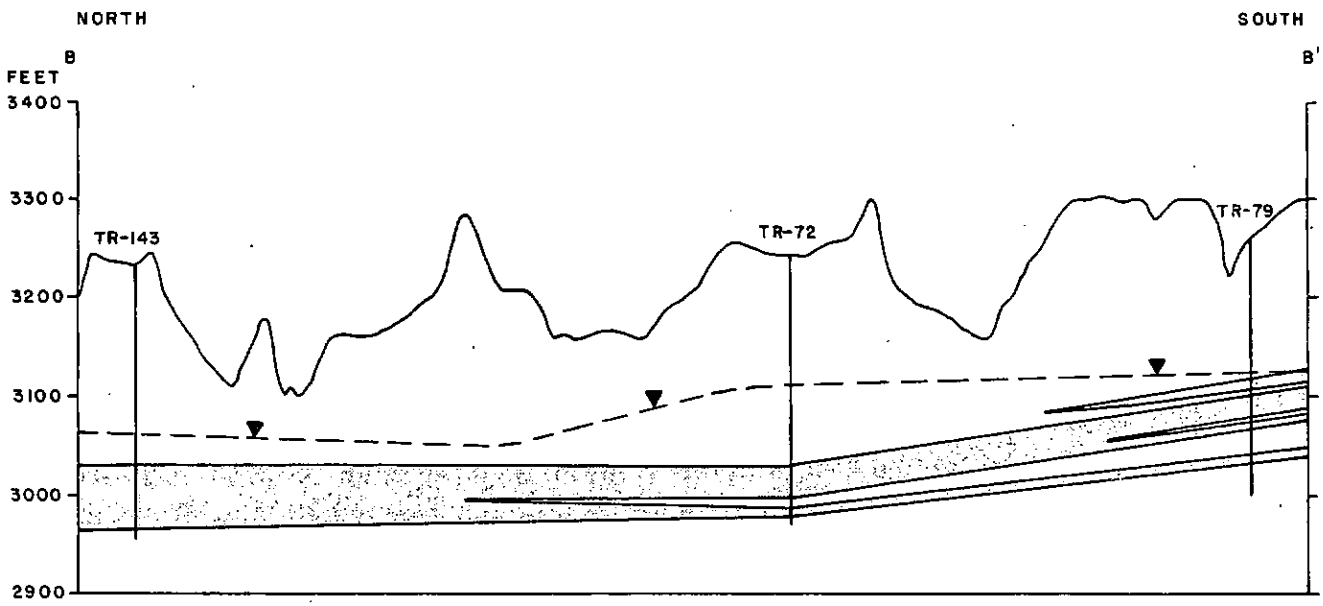
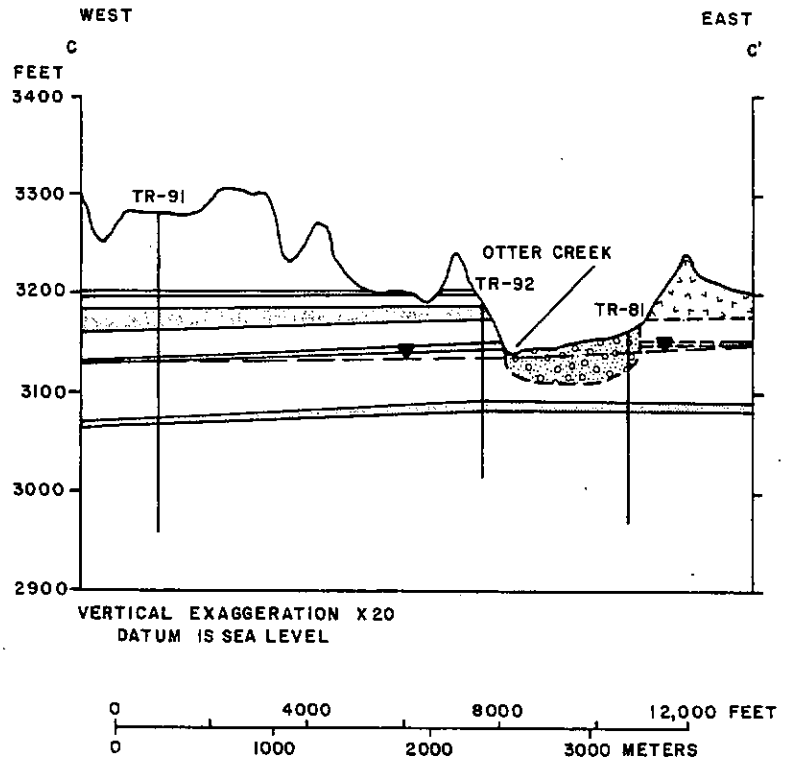


Figure 3.--Idealized stratigraphic sections A-A', B-B', and C-C'.



EXPLANATION

ALLUVIAL SAND, GRAVEL, SILT, AND CLAY (HOLOCENE AND PLEISTOCENE)

SHALE, SILTSTONE, SANDSTONE, AND COAL OF THE TONGUE RIVER MEMBER OF THE FORT UNION FORMATION (PALEOCENE)

CLINKER

KNOBLOCH COAL BED(S) WITHIN THE TONGUE RIVER MEMBER

CONTACT--Dashed where approximately located

WATER-LEVEL SURFACE, 1983

TR-39

OBSERVATION WELL OR TEST HOLE AND NUMBER

Trace of sections is shown on plate 1.

studied and described in detail by the U.S. Geological Survey (Bass, 1932; Warren, 1959) as part of a systemmatic study and classification of western coal lands. Matson and Blumer (1973) described the quality and quantity of strippable coal within the Otter Creek area in a comprehensive report on strippable coal deposits of southeastern Montana. The geology of the Willow Crossing and King Mountain quadrangles, which include much of the Otter Creek study area, was mapped in detail by McKay (1976a, 1976b).

Ground-water resources and hydrologic characteristics of rocks in the area have been studied by Renick (1929), Perry (1931), Hopkins (1973), Lewis and Roberts (1978), and Stoner and Lewis (1980). Slagle and Stimson (1979) have compiled ground-water data from many wells in the Otter Creek basin.

Chemical quality of ground water and geochemical processes that control the quality of water in the Fort Union Formation have been investigated by Lee (1979, 1981) and Dockins and others (1980). Studies have been made on the quality of surface water of the region (Knapton and McKinley, 1977; Knapton and Ferreira, 1980) and the quality of base flow of Otter Creek, the Tongue River, and Rosebud Creek (Lee and others, 1981).

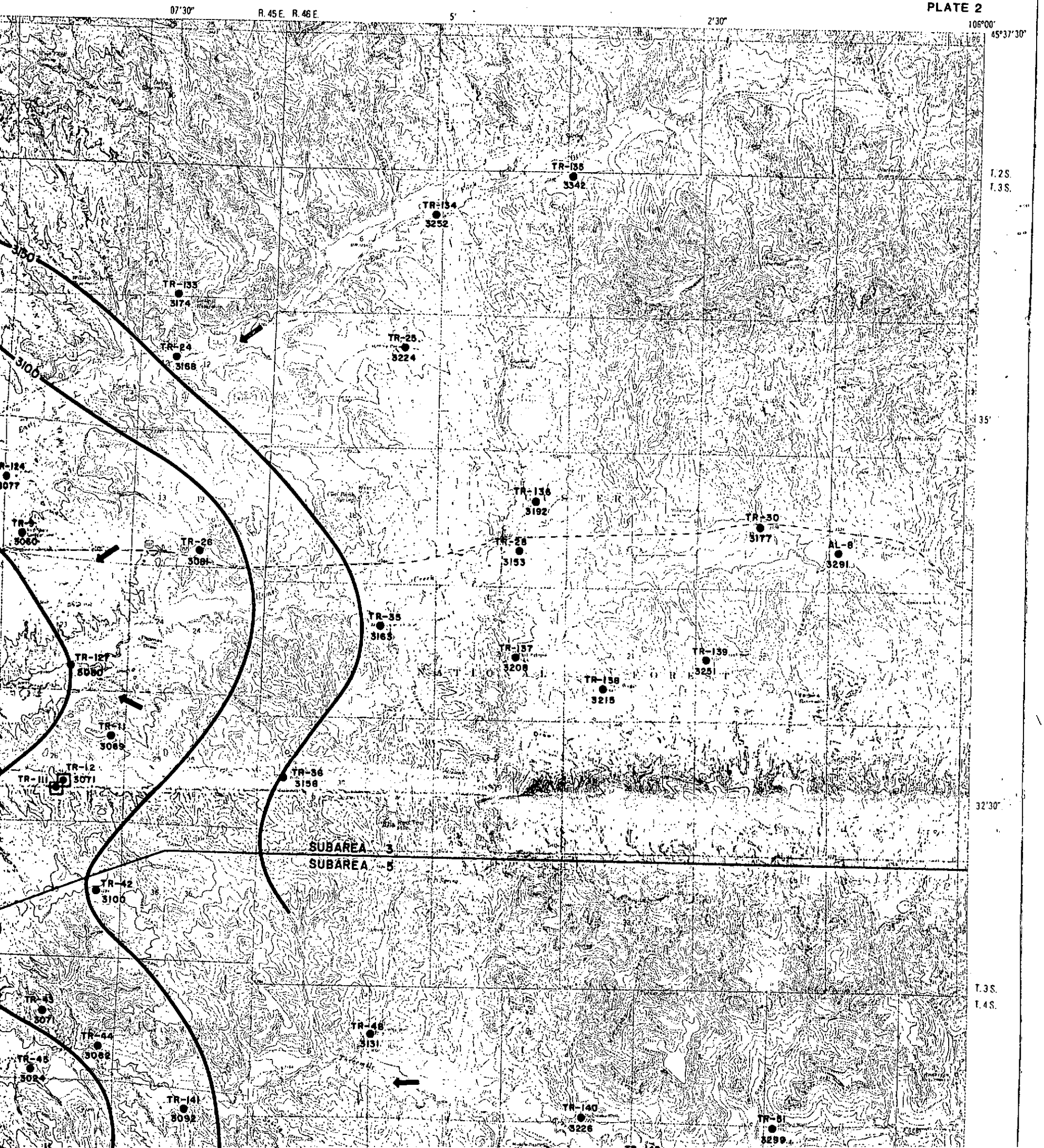
Potential effects of coal mining on water resources in the Tongue River drainage basin have been the focus of several studies. Van Voast (1974) and Van Voast and Hedges (1975) studied the effects of coal mining on water resources in the Decker area (50 miles southwest of Ashland). Woessner and others (1979) investigated the potential effects of coal mining on the quality of ground water and surface water on the Northern Cheyenne Indian Reservation. Woods (1981) developed a computer model to assess potential increases in dissolved solids in the Tongue River as a result of leaching of mine spoils. Cannon (1982) investigated the potential effects of surface coal mining on the hydrology of the Cook Creek area near Ashland. McClymonds (1984) studied the potential effects of surface coal mining on the hydrology of the West Otter area, which includes most of the study area west of Otter Creek.

Acknowledgments

Appreciation is expressed to the residents of the area who provided information about their wells and springs, and allowed access to their land for the drilling of observation wells and collection of hydrologic data. Thanks are extended to the Montana Bureau of Mines and Geology, Consolidation Coal Company, and Peabody Coal Company for providing data and support.

MASS-BALANCE MODEL OF THE PRE-MINING OTTER CREEK HYDROLOGIC SYSTEM

A mass-balance model was developed to evaluate the pre-mining hydrologic system in Otter Creek and its alluvial aquifer. Mass-balance equations were developed to quantify all pre-mining inflows and outflows of water and dissolved solids in the stream-alluvial aquifer system. Boundaries of the modeled stream-alluvial aquifer system were placed at the upstream end of the study area near Fifteenmile Creek and at the downstream end near Ashland (pl. 2). Lateral boundaries of the modeled stream-alluvial aquifer system were placed at the boundary between the subirrigated and non-subirrigated areas of the Otter Creek alluvial valley (pl. 2). Lateral boundaries were placed at the edge of the subirrigated valley because all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3174
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TR-28
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TR-137
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TR-111
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SUBAREA 3
SUBAREA 5
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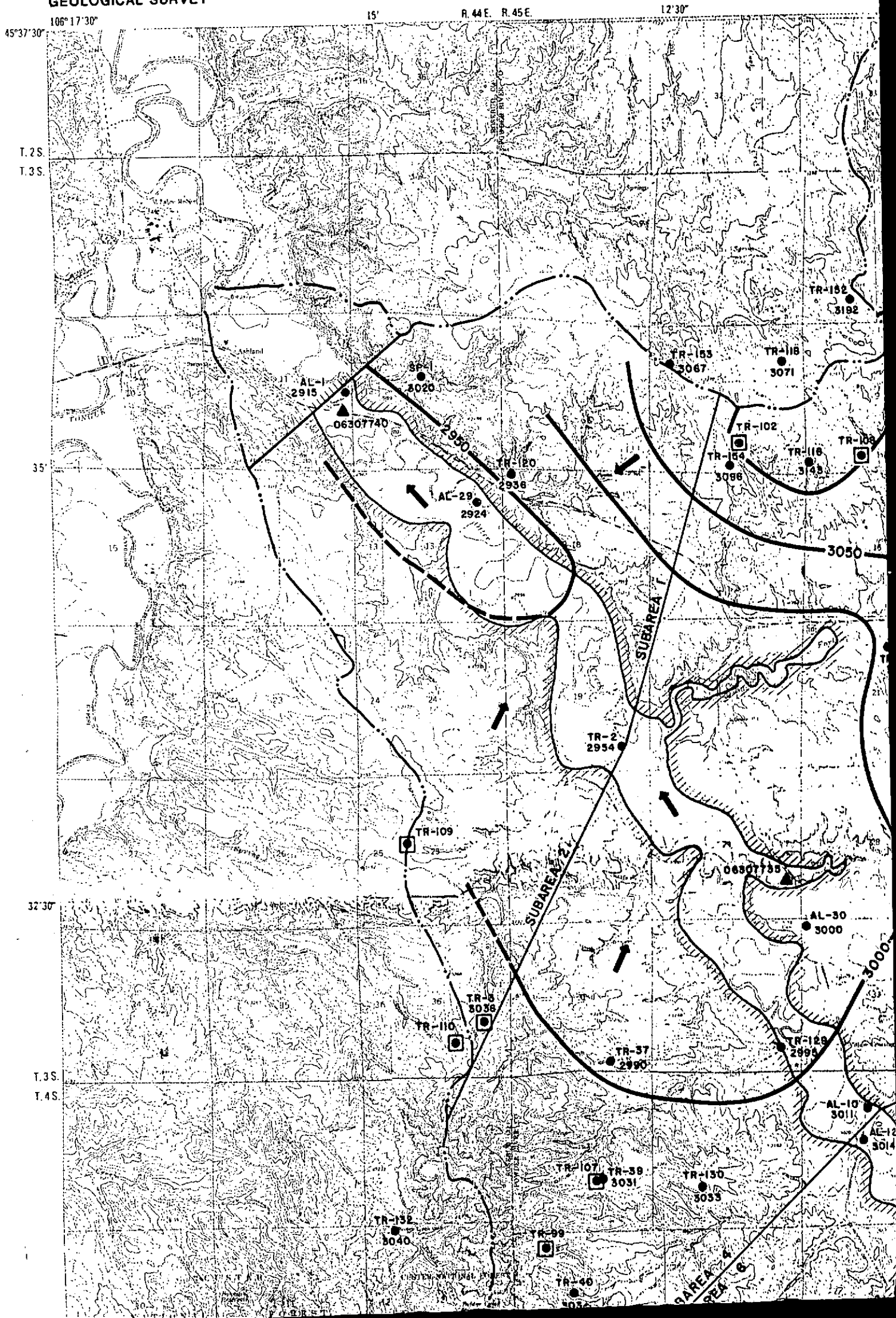


Base from U.S. Geological Survey Coleman Draw, 1966; Yeager Butte, 1967; Ashland, King Mountain, Willow Crossing quadrangles, photorevised 1978; 1:24,000

EXPLANATION

3100 — WATER-LEVEL CONTOUR--Shows approximate altitude at which water level would have stood in tightly cased wells completed in shallow aquifers, 1959-83. Dashed where approximately located. Contour interval 50 feet. Datum is sea level

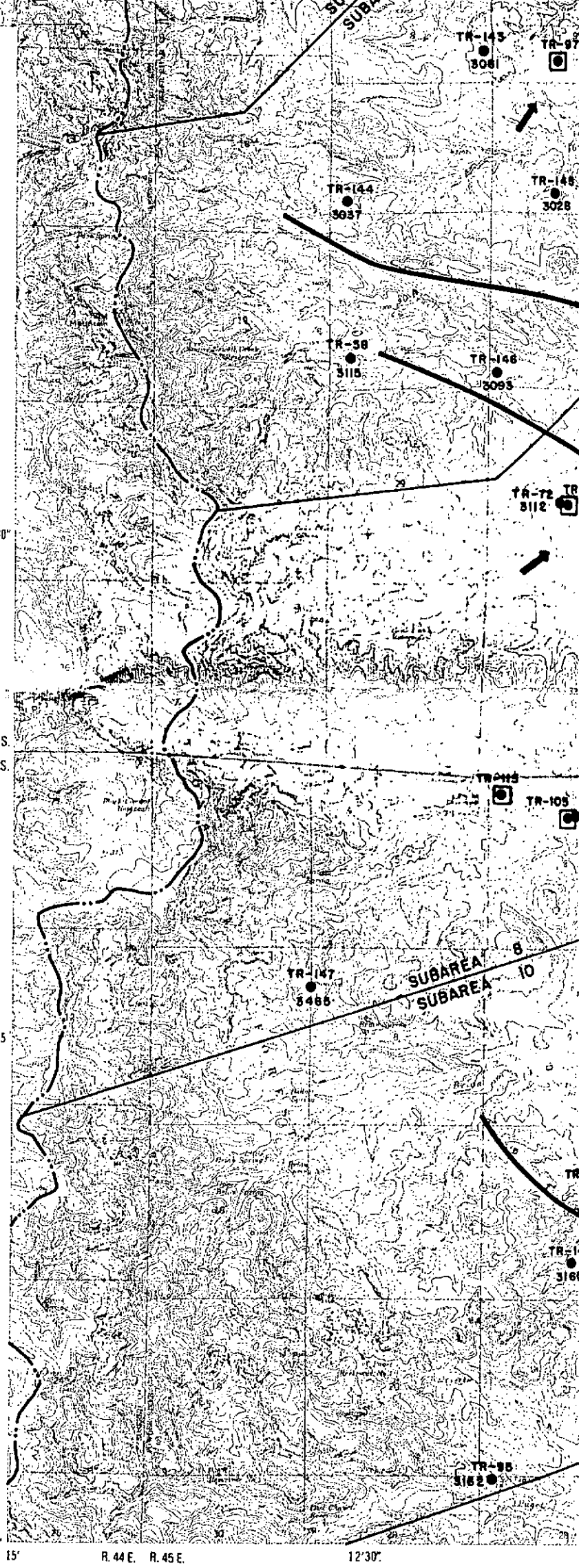
TR-73 3100 — DATA SITE AND NUMBER (table 1)—Upper abbreviation identifies type of site: AL, well completed in alluvium; TR, well or test hole completed in Tongue River Member of Fort Union Formation; SP, spring. Lower number is altitude of water level, in feet above sea level. Square around site symbol indicates well or test hole where overburden samples from Tongue River Member were collected for saturated-paste-extract analyses

06307740 — STREAMFLOW-GAGING STATION AND NUMBER

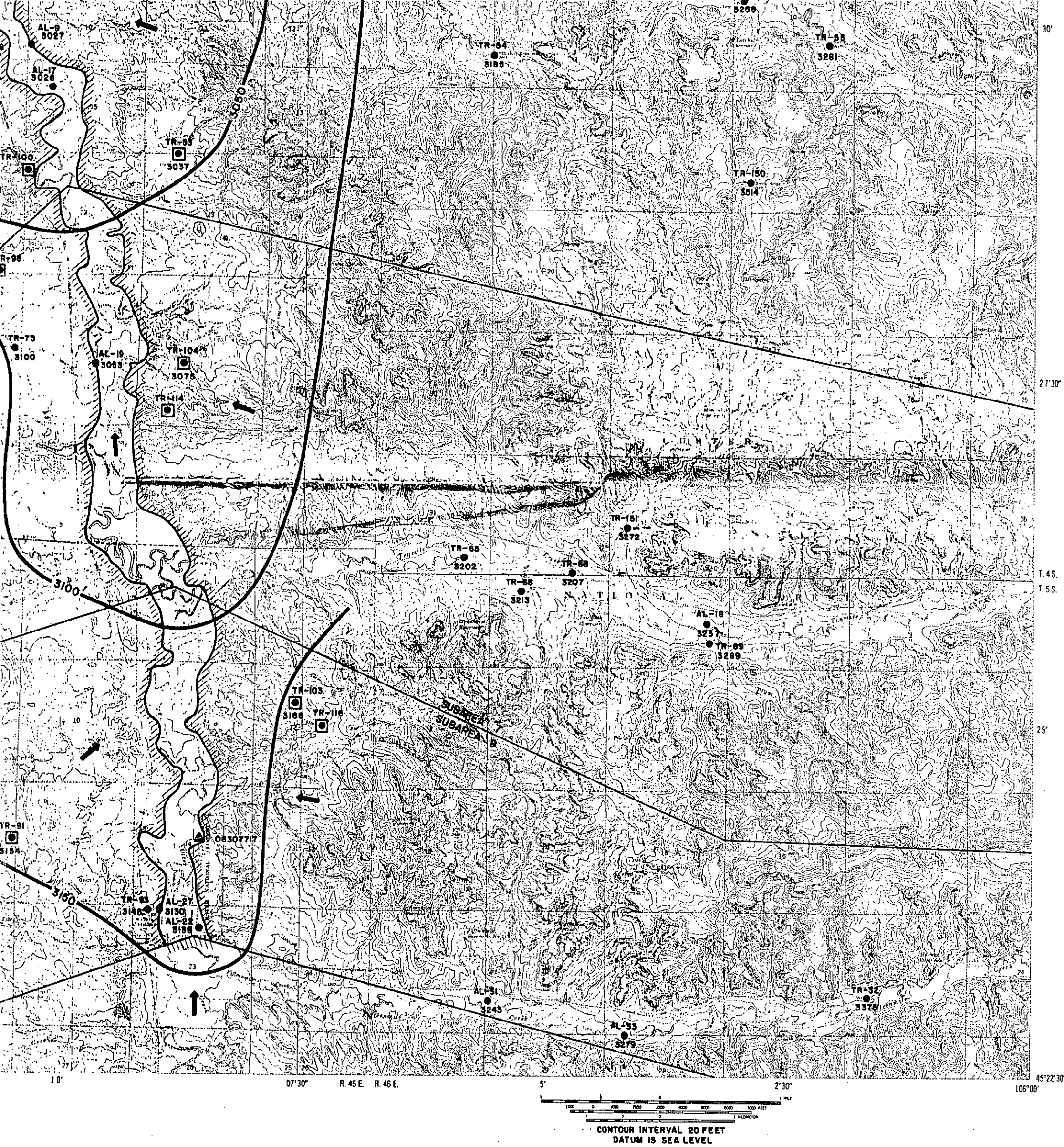
DIRECTION OF WATER MOVEMENT IN SHALLOW AQUIFERS

BOUNDARY OF MODELED AREA AND SUBIRRIGATED VALLEY ALLUVIUM

BOUNDARY OF OTTER CREEK DRAINAGE BASIN



MAP SHOWING ALTITUDE AND CONFIGURATIO
AND LOCATION OF O

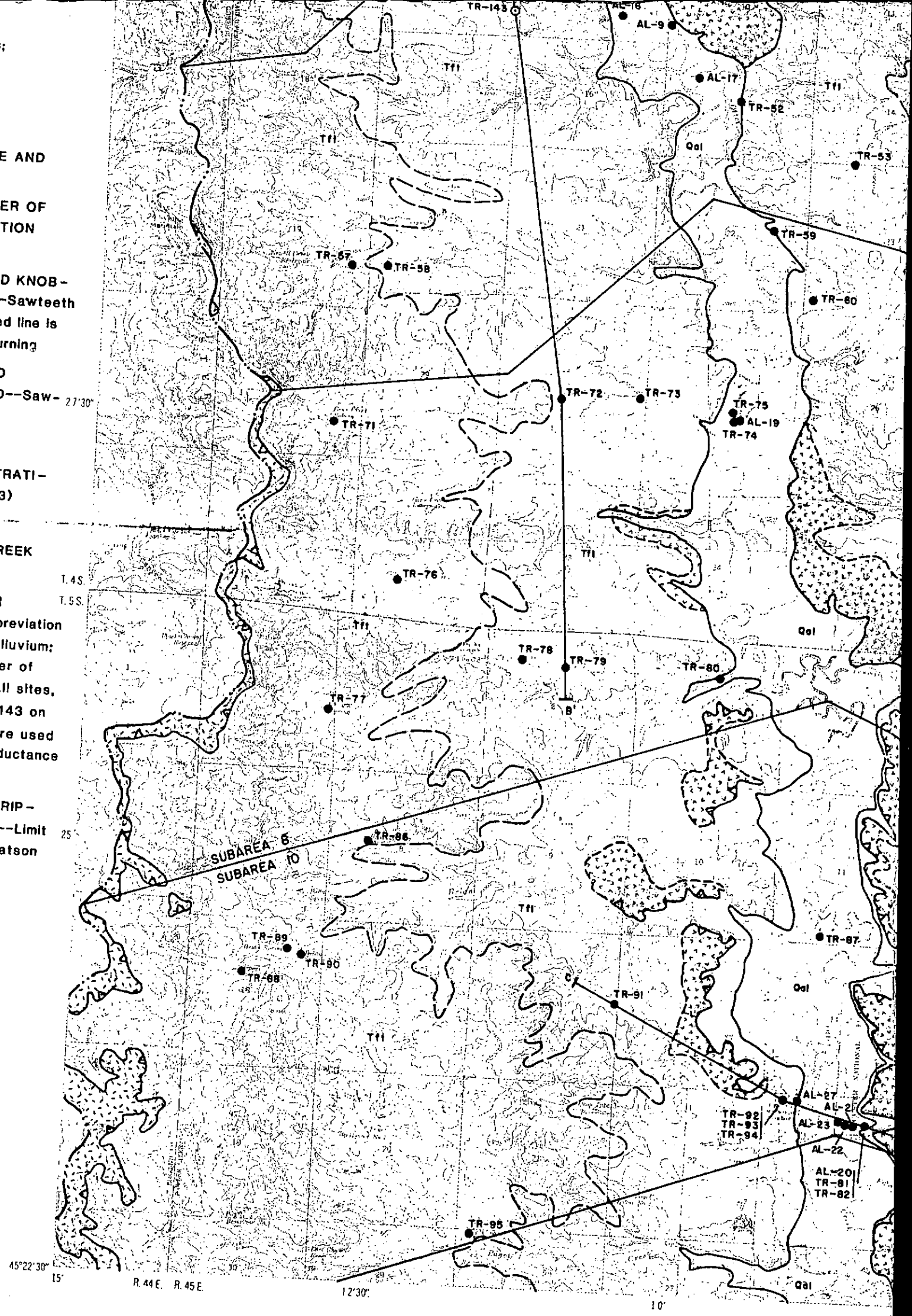


OF THE WATER TABLE, DIRECTION OF SHALLOW-GROUND-WATER FLOW, BOUNDARIES OF MODELED AREA,
RBURDEN SAMPLING SITES IN THE OTTER CREEK AREA, SOUTHEASTERN MONTANA

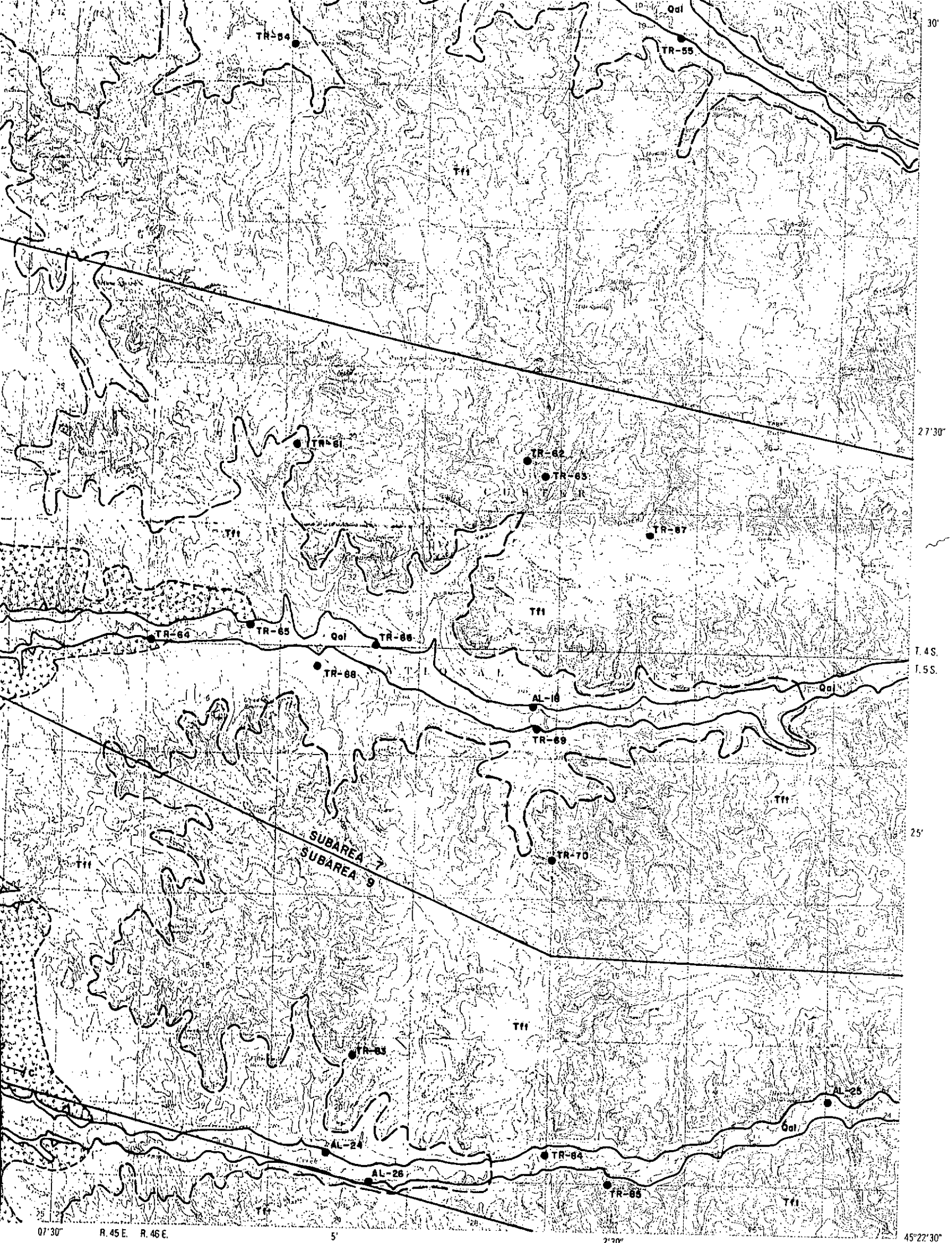
Coleman Draw, 1966; Yeager Butte, 1967; Ashland, King Mountain, Willow Crossing quadrangles, photorevised 1978; 1:24,000

EXPLANATION

- Qal — ALLUVIUM (HOLOCENE AND PLEISTOCENE)
- Tft — TONGUE RIVER MEMBER OF FORT UNION FORMATION (PALEOCENE)
- CLINKER FROM BURNED KNOBLOCH COAL BED(S)--Sawteeth on base of bed; dashed line is approximate limit of burning
- CLINKER FROM BURNED ANDERSON COAL BED--Sawteeth on base of bed
- CONTACT
- A—A' TRACE OF IDEALIZED STRATIGRAPHIC SECTION (fig. 3)
- SUBAREA BOUNDARY
- BOUNDARY OF OTTER CREEK DRAINAGE BASIN
- TR-91 DATA SITE AND NUMBER (tables 17 and 18)--Abbreviation identifies aquifer: AL, alluvium; TR, Tongue River Member of Fort Union Formation. All sites, except TR-130 and TR-143 on a trace of a section, were used to measure specific conductance of a water sample
- APPROXIMATE LIMIT OF STRIPPABLE KNOBLOCH COAL--Limit of strippable coal after Matson and Blumer (1973)



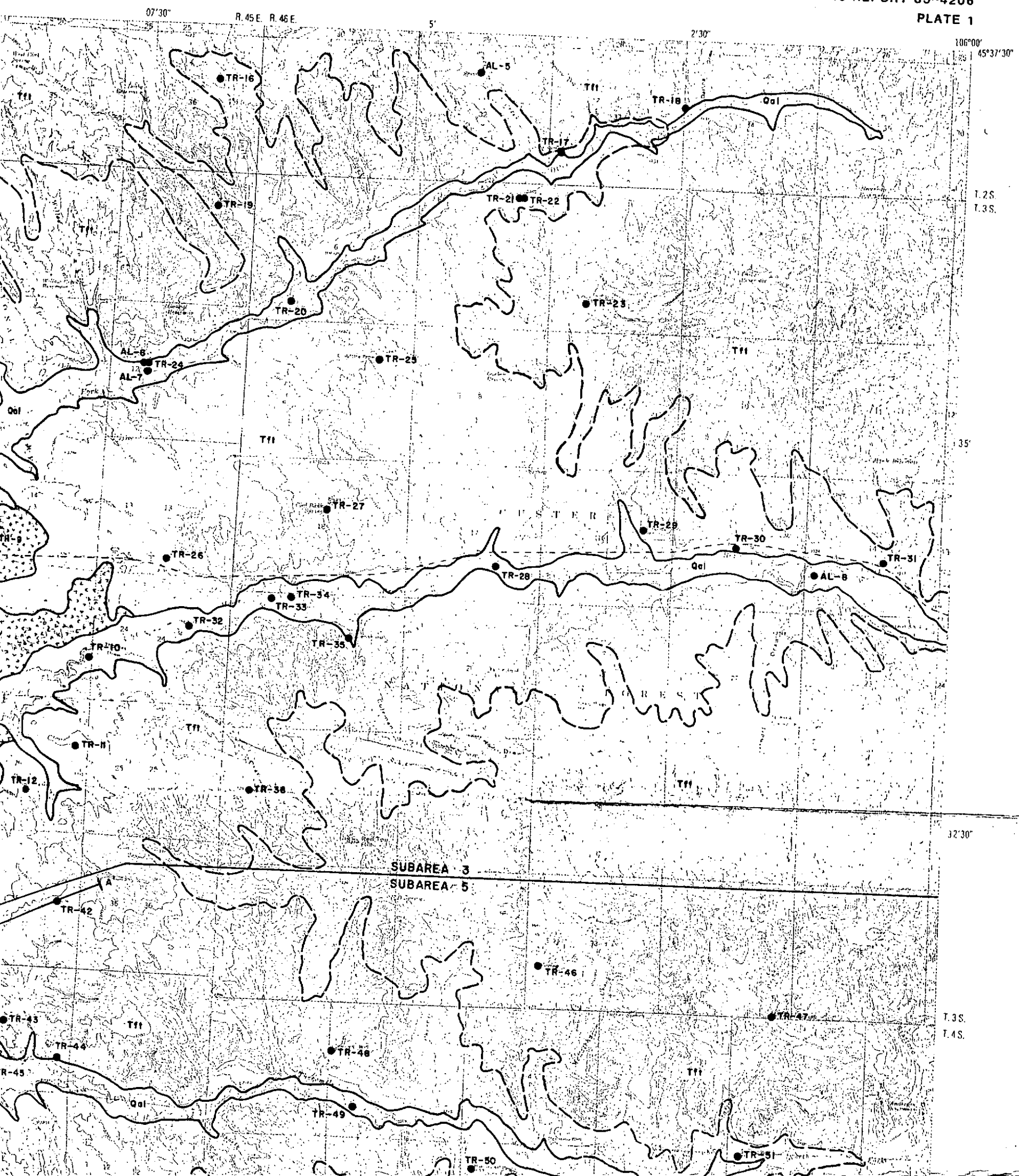
MAP SHOWING SURFICIAL GEOLOGY AND LOCATION OF WATER-QUAL



Geologic mapping after McKay (1976a, 1976 b)

CONTOUR INTERVAL 20 FEET
DATUM IS SEA LEVEL

TY SAMPLING SITES IN THE OTTER CREEK AREA, SOUTHEASTERN MONTANA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45°37'30"
35'
32'30"
T. 2 S.
T. 3 S.
T. 4 S.
AL-5
TR-16
TR-17
TR-18
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AL-6
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AL-8
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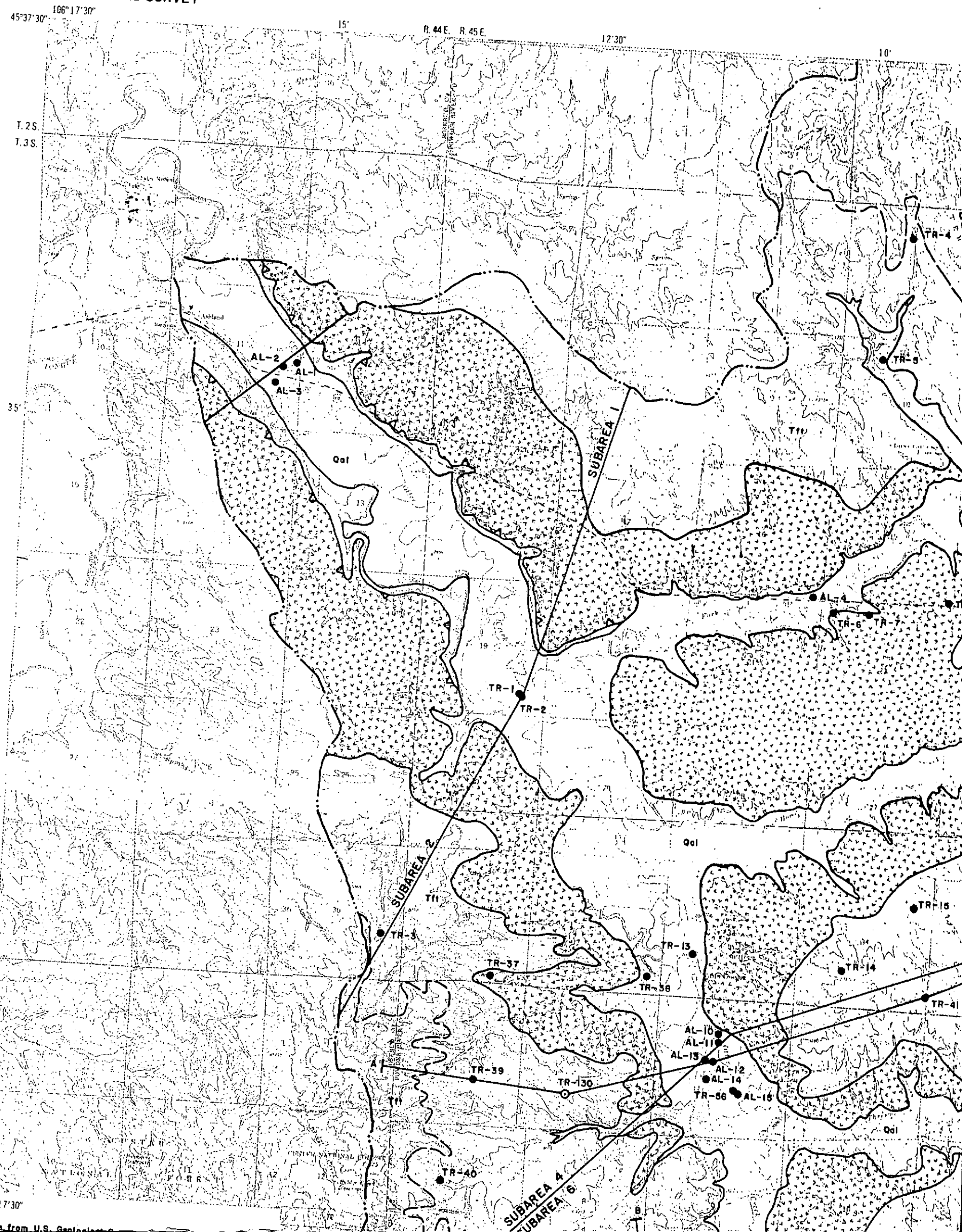


Base from U.S. Geological S...

inflows and outflows of water and dissolved solids ultimately occur within Otter Creek and the subirrigated part of the valley. Boundaries of the subirrigated valley were delineated from color infrared aerial photographs of the valley and from maps of the alluvial valley floor (Malde and Boyles, 1976).

The study area was divided into 10 subareas (pl. 1), because of spatial variations in the hydrologic characteristics of the area. Inflows and outflows of each subarea were entered into the mass-balance equations. A conceptual model of the Otter Creek hydrologic system (fig. 4) shows all inflows and outflows of water and dissolved solids to Otter Creek and the subirrigated alluvium.

Water budget

The annual water-budget equation for the Otter Creek stream-alluvial aquifer system is:

$$Q_{so} + Q_{ao} = Q_{sio} + Q_{sit} + Q_{ai} + Q_{bi} + R - ET_a - E_{fws} + \Delta\text{storage} \qquad (1)$$

where

Q_{so} = surface-water outflow from Otter Creek at the downstream end of the modeled reach (all volumes in acre-feet),

Q_{ao} = ground-water outflow from the alluvial aquifer at the downstream end of the model reach,

Q_{sio} = surface-water inflow from Otter Creek at the upstream end of the modeled reach,

Q_{sit} = surface-water inflow from tributaries along the modeled reach of Otter Creek,

Q_{ai} = ground-water inflow from the alluvial aquifer at the upstream end of the modeled reach,

Q_{bi} = ground-water inflow from bedrock (coal and sandstone) aquifers along the modeled reach,

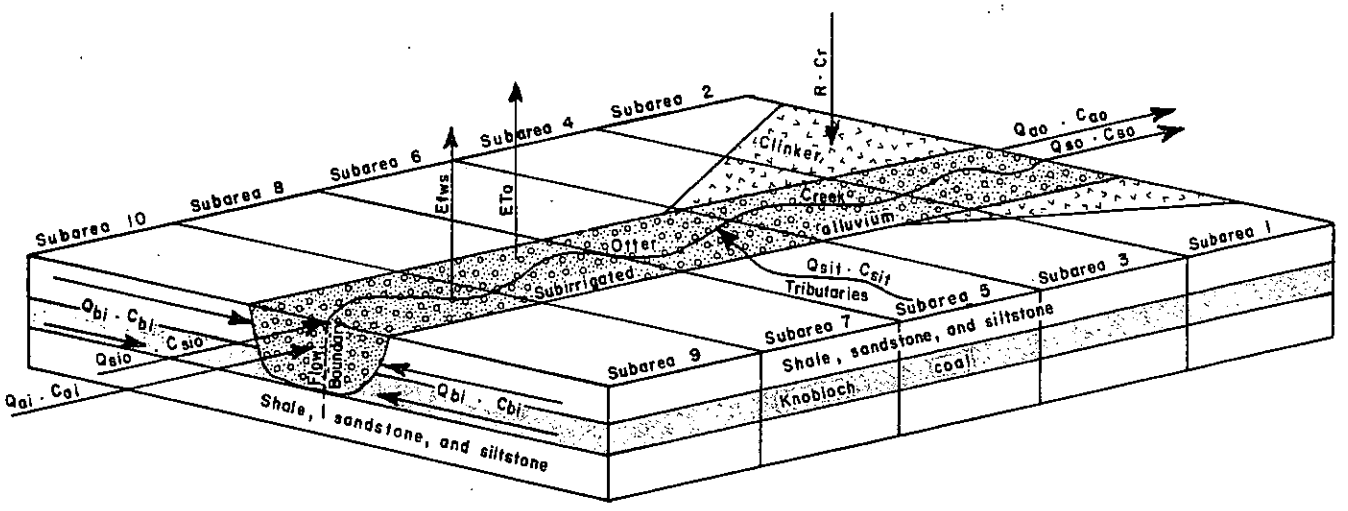
R = additional recharge to ground-water system that occurs in areas of clinker and non-subirrigated alluvium along the reach,

ET_a = net discharge from the subirrigated part of the alluvial aquifer by evapotranspiration,

E_{fws} = net evaporation from the surface of Otter Creek, and

Δstorage = change in ground-water storage within the study area.

Values for all components of the water-budget equation, except recharge, evapotranspiration, and evaporation rates, were determined from data collected in the study area. Recharge to clinker and non-subirrigated alluvium was calculated as a remainder in the water-budget equation, but was checked for validity against



EXPLANATION

Q_{so} = surface-water outflow from Otter Creek

Q_{ao} = ground-water outflow from the alluvial aquifer

Q_{sio} = surface-water inflow from Otter Creek

Q_{sit} = surface-water inflow from tributaries

Q_{ai} = ground-water inflow from the alluvial aquifer

Q_{bi} = ground-water inflow from bedrock aquifers

R = additional recharge in areas of clinker and non-subirrigated alluvium

ET_a = net discharge by evapotranspiration

E_{fws} = net evaporation from Otter Creek

C_{so} = dissolved-solids concentration of outflow from Otter Creek

C_{ao} = dissolved-solids concentration of outflow from the alluvial aquifer

C_{sio} = dissolved-solids concentration of inflow from Otter Creek

C_{sit} = dissolved-solids concentration of inflow from tributaries

C_{ai} = dissolved-solids concentration of inflow from the alluvial aquifer

C_{bi} = dissolved-solids concentration of inflow from bedrock aquifers

C_r = dissolved-solids concentration of recharge water percolating through clinker and alluvium

Figure 4.--Conceptual model of the Otter Creek hydrologic system including all inflows and outflows of water and dissolved solids.

recharge values reported in other studies conducted in the region. Evapotranspiration and evaporation rates were determined from regional data (Farnsworth and others, 1982). Data used in the mass-balance equations are from the 1983 water year (Oct. 1, 1982, to Sept. 30, 1983), except for precipitation and evaporation data, which are from long-term records. Precipitation enters the mass-balance equation in the net values for evapotranspiration and evaporation and in the ground-water and surface-water runoff values.

Surface water

Upstream inflow of water from Otter Creek (Q_{sio}) was determined at the U.S. Geological Survey streamflow gaging station 06307717, located on Otter Creek downstream from the confluence with Fifteenmile Creek (pl. 2). Total annual discharge (1983 water year) at the gaging station was 2,530 acre-feet. Daily discharge data for the station are listed in table 2.

Surface-water inflow from small tributaries along the modeled reach of Otter Creek (Q_{sit}) was minimal. Home Creek is the only perennial stream that enters Otter Creek within the modeled reach. Total annual discharge of Home Creek was estimated to be 43 acre-feet, based on the mean of nine measurements made between November 1982 and October 1983. All other tributaries along the reach are ephemeral and were inspected on a regular basis during the year. In most years these tributaries have small flows during spring snowmelt or early summer rainstorms; however, no flows were detected during the 1983 water year. Therefore, total tributary inflow was 43 acre-feet.

Outflow of surface water from the modeled reach (Q_{so}) was determined at the U.S. Geological Survey gaging station on Otter Creek at Ashland (station 06307740, pl. 2). Total discharge for the 1983 water year was 3,440 acre-feet. Daily discharge data for this station are listed in table 3.

Flow through alluvium

A line of test wells was installed across the alluvial valley at each end of the modeled reach to determine the thickness and hydraulic properties of the alluvial aquifer (data in table 4). Hydraulic data obtained from aquifer tests at the wells were used in the Darcy (1856) equation to determine flow rates through the alluvial aquifer.

At the upstream end of the reach, five wells (AL-20, AL-21, AL-22, AL-23, and AL-27) (pl. 1) were installed in the alluvium. Thickness of the alluvium ranged from 28 to 44 feet and transmissivity values obtained from aquifer tests at these wells ranged from 200 to 2,600 ft^2/d. The gradient of the water table within the alluvial aquifer in the vicinity of the wells was 0.0027. The calculated rate of annual inflow from the alluvial aquifer into the modeled reach (Q_{ai}) was 85 acre-feet.

At the downstream end of the modeled reach near Ashland, three test wells (AL-1, AL-2, AL-3)(pl. 1) were installed across the alluvial valley. Thickness of the alluvium ranged from 36 to 72 feet, and transmissivity values ranged from 1,100 to 2,900 ft^2/d. The hydraulic gradient of the water table within the alluvium in the vicinity of the wells was 0.0035. Using the Darcy equation for ground-water

flow, the calculated rate of annual discharge from the alluvial aquifer (Q_{ao}) was 130 acre-feet.

Bedrock inflow

Ground-water inflow from bedrock aquifers to the modeled stream-alluvial aquifer system (Q_{bi}) is through shallow coal and sandstone aquifers. These aquifers discharge directly to valley alluvium or discharge indirectly to the alluvium through clinker beds. Deeper sandstone and coal aquifers, those that do not crop out along the Otter Creek valley or intersect valley alluvium, are assumed to contribute little or no water to the modeled reach of the Otter Creek valley. This assumption is supported by the presence of thick beds of relatively impermeable shale underlying the entire valley and by small upward potentiometric gradients in deeper aquifers.

The rate of water flow through the shallow aquifers was estimated using the Darcy equation. Transmissivity values for the coal and sandstone aquifers were determined from single-well aquifer tests at 13 sites (table 5). The potentiometric gradient was determined from water levels in shallow bedrock wells distributed throughout the study area (pl. 2). Bedrock components of inflow to the modeled reach were computed for the 10 subareas and are summarized in table 6. Total annual inflow from the bedrock aquifers was 1,175 acre-feet (table 6).

Precipitation and evapotranspiration

Precipitation and evapotranspiration rates are applied only to the modeled reach; that is, to the area containing the subirrigated part of the alluvial valley and the surface of Otter Creek. Precipitation and evapotranspiration are not applied to the areas outside the modeled reach because they are reflected in the ground-water or surface-water inflows to the modeled reach. For example, the rate of water flow from a coal aquifer to the modeled reach is controlled, in part, by precipitation and evapotranspiration in the recharge zone.

Precipitation for the area is based on precipitation records at Ashland for the 25 years 1956-80. Mean annual precipitation for this period of record is 13.05 inches. Monthly distribution of precipitation, used for calculating precipitation and net evapotranspiration during the growing season, is given in table 7.

Precipitation during the 1983 water year was less than normal and was 8.8 inches (8.6 inches for the calendar year); precipitation was greater than normal the preceding year and was 15.0 inches (15.5 inches for the calendar year). The mean annual precipitation of 13.05 inches was used in the model, rather than the 8.8 inches for the 1983 water year, because of lag time associated with ground-water flow and antecedent soil moisture conditions from the preceding wet year. Using the mean annual precipitation in the model, instead of the 1983 precipitation, would not introduce significant error because surface-water runoff, a primary model component related to precipitation, is measured directly.

Evaporation data for the area were obtained from a report by Farnsworth and others (1982). Mean annual free-water-surface evaporation for the Otter Creek valley is about 40 inches. Free-water-surface evaporation for the growing season (May-October) is about 33 inches. Monthly distribution of free-water-surface

evaporation was calculated by a method of Farnsworth and Thompson (1982, p. A-1) and is given in table 8.

Free-water-surface-evaporation data were used to determine evaporation rates from the surface of Otter Creek and potential evapotranspiration from the subirrigated part of the valley. Free-water-surface evaporation is considered to be approximately equivalent to evaporation from a shallow water surface and to potential evapotranspiration from a vegetative surface having an unlimited supply of water (Farnsworth and others, 1982). Based on annual precipitation of about 13 inches and free-water-surface evaporation of 40 inches, the net annual evaporation rate from the surface of Otter Creek is about 27 inches. Annual evaporation loss from the surface of Otter Creek (E_{fws}), along the entire modeled reach, is 181 acre-feet (calculations in table 9).

Actual evapotranspiration from the subirrigated area within the modeled reach was estimated from published consumptive use rates for alfalfa and grass crops of the region (U.S. Department of Agriculture, 1974) and from water-budget studies of alfalfa and native range near Colstrip, Montana (Dollhopf and others, 1979; Dollhopf and others, 1981). Evapotranspiration during the growing season is reported to be 26.0 inches for alfalfa and 23.8 inches for grass (U.S. Department of Agriculture, 1974). For subirrigated alfalfa near Colstrip, evapotranspiration during the growing season was about 23.6 inches (Dollhopf and others, 1981). Average evapotranspiration for alfalfa and grass in the Otter Creek area, based on the above values, was assumed to be 24.5 inches.

Evapotranspiration of 24.5 inches and an average May through October precipitation of 8.8 inches result in a water deficit of 15.7 inches, which is supplied to plants from stored soil moisture and subirrigation. In water-budget studies near Colstrip, Montana (Dollhopf and others, 1979), subirrigated crops satisfied from 31 to 55 percent of their evapotranspiration requirement from subirrigation. Based on these studies, subirrigated crops in the Otter Creek valley extract about 11.5 inches of water from the water table and about 4.2 inches from soil moisture. Soil moisture accumulates in the root zone of the soil during the winter and spring and is depleted during the growing season.

On an annual basis, the net loss of water from the subirrigated alluvial system is equivalent to evapotranspiration (24.5 inches) minus precipitation (13.05 inches), or about 11.5 inches. The total annual volume of ground water consumed by subirrigated plants within the modeled reach of Otter Creek (ET_a) is 3,423 acre-feet, based on the rate of 11.5 inches for the growing season, which is also the rate for the year. Evapotranspiration calculations are given in table 10.

Recharge

A recharge value is applied to clinker and non-subirrigated alluvium to account for the ground-water flow that comes from these sources. As water flows from the coal and sandstone aquifers toward Otter Creek, much of it passes through clinker and alluvium before reaching the Otter Creek stream-alluvial aquifer system (pl. 1). Ground-water discharge increases downgradient from the clinker and alluvium because of recharge that readily percolates into the clinker and alluvium from rainfall and snowmelt.

The quantity of water entering the modeled reach, originating from recharge to clinker and non-subirrigated alluvium, was calculated as a remainder in the water-balance equation. Total annual volume of recharge (R) was calculated to be 2,016 acre-feet, which is equivalent to an annual rate of 1.54 inches over the total area of clinker and non-subirrigated alluvium in the Otter Creek valley and major tributaries (calculations in table 11). The calculated annual recharge rate of 1.54 inches appears to be reasonable. In a hydrologic study conducted on the Northern Cheyenne Indian Reservation 4 miles southwest of Ashland, Woessner and others (1981) calculated mean annual recharge rates of 1.2 inches in clinker and 2.8 inches in valley alluvium.

Storage

During the 1983 water year, water levels in the Otter Creek alluvial valley declined, reflecting a decrease in ground-water storage. Water-level data from six wells completed in the valley alluvium indicated an average decline of 0.83 foot from September 1982 to September 1983 (data in table 12). Assuming that the average specific yield of the alluvial materials is 0.22 (Johnson, 1967), the decrease in ground-water storage was 0.18 foot within the affected area. The decrease in storage occurred primarily within alluvium of the Otter Creek valley and its major tributaries, based on water-level data from the network of observation wells. The calculated decrease in ground-water storage (Δstorage) along the modeled reach of the Otter Creek valley was 1,325 acre-feet for the 1983 water year.

Dissolved-solids-load budget

The annual dissolved-solids-load budget for the Otter Creek stream-alluvial aquifer system is expressed by the equation:

$$[(Q_{so} \cdot C_{so}) + (Q_{ao} \cdot C_{ao})]\ cf = [(Q_{sio} \cdot C_{sio}) + (Q_{sit} \cdot C_{sit}) (Q_{ai} \cdot C_{ai}) + (Q_{bi} \cdot C_{bi}) + (R \cdot C_{r})]\ cf - \Delta\text{storage} \qquad (2)$$

where

C_{so} = dissolved-solids concentration of outflow from Otter Creek at the downstream end of the modeled reach (concentrations in milligrams per liter; loads in tons),

C_{ao} = dissolved-solids concentration of outflow from the alluvial aquifer at the downstream end of the modeled reach,

cf = a conversion factor (0.001359) to convert (acre-feet · milligrams per liter) to tons,

C_{sio} = dissolved-solids concentration of inflow from Otter Creek at the upstream end of the modeled reach,

C_{sit} = dissolved-solids concentration of inflow from tributaries (Home Creek) along the modeled reach of Otter Creek,

C_{ai} = dissolved-solids concentration of inflow from the alluvial aquifer at the upstream end of the modeled reach,

C_{bi} = dissolved-solids concentration of inflow from bedrock (coal and sandstone) aquifers along the modeled reach,

C_r = dissolved-solids concentration of recharge water percolating through clinker and alluvium,

Δstorage = change in soluble material stored within the soils and alluvial aquifer of the modeled reach, and

other parameters are as previously defined for the annual water-budget equation. In the dissolved-solids load budget, precipitation and evapotranspiration are assumed to not have a dissolved-solids load; therefore, they are not included in the equation.

Surface-water load

Dissolved-solids loads in Otter Creek for the 1983 water year were computed using a computer program developed by the U.S. Geological Survey (Wilson, 1977). Input data for the program were daily mean streamflow, daily mean specific conductance (once daily values were used to represent the mean for the day), and a linear regression equation to relate dissolved solids to specific conductance. The program retrieves the daily values, calculates daily loads, and sums the daily loads to determine the monthly load. Specific-conductance samples were collected at U.S. Geological Survey gaging stations at the upstream end of the modeled reach (station 06307717) and at the downstream end near Ashland (station 06307740). Specific-conductance data for the stations are listed in tables 13 and 14. Missing values of specific conductance were interpolated from adjacent values for the load calculations. Data for the linear regression equations are from water-quality analyses for water years 1981, 1982, and 1983 (regression equations are given in table 15). The calculated annual load at the upstream gage ($Q_{sio} \cdot C_{sio}$) was 7,311 tons and the load at the downstream gage ($Q_{so} \cdot C_{so}$) was 8,836 tons. Monthly and annual loads at these stations are given in table 16.

Annual dissolved-solids load from Home Creek to the modeled reach of Otter Creek was calculated using the estimated annual streamflow value and the mean dissolved-solids concentration. Mean dissolved-solids concentration in Home Creek was determined from analysis of water samples collected during the streamflow measurements. The calculated annual load from Home Creek ($Q_{sit} \cdot C_{sit}$) was 162 tons.

Load from alluvium

The annual dissolved-solids load entering the upstream end of the modeled reach from the Otter Creek alluvial aquifer ($Q_{ai} \cdot C_{ai}$) is 438 tons. The annual dissolved-solids load leaving the downstream end of the modeled reach through the alluvial aquifer ($Q_{ao} \cdot C_{ao}$) is 286 tons. The loads were determined from the mean dissolved-solids concentration of alluvial water at the upstream and downstream boundaries of the reach, and from flow rates through the alluvium. The mean dissolved-solids concentration at the upstream end, measured at four alluvial wells (AL-21, AL-22, AL-23, and AL-27), was 3,790 mg/L (milligrams per liter). The mean dissolved-solids concentration at the downstream end, measured at three alluvial

wells (AL-1, AL-2, and AL-3), was 1,620 mg/L. Data from the wells are listed in table 17.

Load from bedrock aquifers

Bedrock aquifers, composed of sandstone and coal beds, contribute a large dissolved-solids load to the alluvial aquifer and Otter Creek. The load contribution varies greatly from place to place along the valley because of the considerable range in hydraulic properties of the aquifers and the quality of ground water. Because of this variability, loads were calculated for each of the 10 subareas. The loads were calculated using the water discharge rate and dissolved-solids concentration of ground water in each subarea. The dissolved-solids concentration of ground water in each subarea (data in table 18) was assumed to be equal to the log mean of dissolved solids in all coal and sandstone wells sampled in the subarea. The log mean value was used because dissolved-solids concentrations of samples from the Tongue River Member were close to a log-normal distribution; the log mean value of dissolved solids was very similar to the median value for each subarea. The total annual load from the bedrock aquifers ($Q_{bi} \cdot C_{bi}$) was 2,732 tons per year. Loads from each subarea are listed in table 19.

Recharge

Recharge water that enters the clinker and non-subirrigated alluvium from precipitation percolates downward to the water table, dissolves minerals in the soil and rock before reaching the water table, and acquires a dissolved-solids load that eventually discharges to the Otter Creek stream-alluvial aquifer system. The dissolved-solids concentration of percolating recharge water is 315 mg/L, based on the quality of water from clinker in sec. 12, T. 3 S., R. 44 E. For non-subirrigated alluvium, the concentration of 315 mg/L represents the quality of recharge water in the unsaturated zone and not the quality of water in the aquifer, which is derived from several sources. No data are available on the quality of recharge water from the unsaturated zone in alluvium. The quality was assumed to be similar to that in clinker because a large part of the alluvium in the Otter Creek area consists of reworked clinker fragments. Based on the concentration of 315 mg/L, the total annual dissolved-solids load entering the modeled reach of the Otter Creek valley from clinker and non-subirrigated areas of alluvium ($R \cdot Cr$) is 863 tons.

Storage

The change in storage (Δ storage) is the change in soluble material stored in the soils and alluvial aquifer within the modeled reach. Change in storage was determined by the difference between inflows and outflows of dissolved-solids loads in the modeled reach. For the 1983 water year, 2,384 tons of dissolved material was stored within the modeled reach of the Otter Creek valley.

Water levels within the alluvial aquifer declined during the 1983 water year; a large part of the water deficit went to evapotranspiration in the subirrigated part of the valley. Because water that is transpired by plants has little or no dissolved solids, the dissolved solids that were contained in the ground water remain within the root zone of the soil. The soluble material remains within the

soils until sufficient recharge or ground-water flow flushes it from the root zone. After a long time, under natural hydrologic conditions, there would be no net change in storage of soluble material within the alluvium. However, during years when inflows do not equal outflows (such as 1983 water year), change in storage is a significant component of the budget.

Budget summary

The water budget for the Otter Creek stream alluvial aquifer system is represented by equation 1:

$$Q_{so} + Q_{ao} = Q_{sio} + Q_{sit} + Q_{ai} + Q_{bi} + R - ET_a - E_{fws} + \Delta\text{storage}$$

For the 1983 water year, the water budget equation has the values:

$$3{,}440 + 130 = 2{,}530 + 43 + 85 + 1{,}175 + 2{,}016 - 3{,}423 - 181 + 1{,}325$$

where all values are in acre-feet.

The load budget for the Otter Creek stream-alluvial aquifer system is represented by equation 2:

$$[(Q_{so} \cdot C_{so}) + (Q_{ao} \cdot C_{ao})]\, cf = [(Q_{sio} \cdot C_{sio}) + (Q_{sit} \cdot C_{sit})$$

$$(Q_{ai} \cdot C_{ai}) + (Q_{bi} \cdot C_{bi}) + (R \cdot C_r)]\, cf - \Delta\text{storage}$$

For the 1983 water year, the load equation reduces to:

$$8{,}836 + 286 = 7{,}311 + 162 + 438 + 2{,}732 + 863 - 2{,}384$$

where all values are in tons.

INITIAL POST-MINING DISSOLVED SOLIDS IN THE MINE SPOILS

After mining of coal beds and placement of spoils in the mine pits, ground-water flow systems would become established within the spoils material. Water would enter the spoils from adjacent coal and sandstone aquifers, and in some areas from vertical recharge by precipitation. Within the spoils, water would react chemically with the spoils material, generally resulting in an increase in dissolved-solids concentrations of the ground water. Variables that would affect the quality of spoils water include recharge to the spoils, spoil porosity and permeability, availability of readily soluble material within spoils, and chemical reactivity of the spoils.

Studies at existing coal mines in southeastern Montana have indicated that water in mine spoils contains greater concentrations of dissolved solids than does water in undisturbed aquifers of the area. In a study at the West Decker Mine at Decker, Montana, Davis (1984) reported that the concentration of dissolved solids in water from the mine spoils was about 2,500 mg/L, and from coal aquifers it was about 1,400 mg/L. At the Big Sky Mine near Colstrip, Montana, dissolved-solids concentration of water from spoils was about 3,700 mg/L and from coal aquifers it was about 2,700 mg/L (Davis, 1984). Van Voast and others (1978) reported that in

the Colstrip, Montana, area, theoretical mean dissolved-solids concentrations in spoils waters are 820 mg/L to 1,800 mg/L greater than those in nearby stock and domestic supplies. For surface coal-mine sites in western North Dakota, Groenewold and others (1983) reported that ground water in spoils at the study sites typically was two to three times as mineralized as ground water in undisturbed settings at these sites.

Methods and load calculations

Saturated-paste-extract (saturation extract) data for 506 overburden samples from 26 wells and test holes (see pl. 2 for locations) and batch-mixing-test data for overburden samples from 3 wells were used to predict post-mining concentrations of dissolved solids in mine spoils water. Of the two methods used, the saturated-paste-extract method probably best represents initial post-mining quality of water from the mine spoils because it is based on a large number of samples and represents the first pore volumes of water from the mined area.

An additional method of predicting post-mining quality of spoils water, using saturation-extract data, was investigated for possible future use. Post-mining dissolved-solids concentration and loads to the Otter Creek modeled area were calculated with this method, for comparison with results of the other methods.

Saturated-paste-extract method

The saturated-paste-extract method is a laboratory procedure used to measure the content of salts in a soil or sediment sample (U.S. Salinity Laboratory Staff, 1954). Samples for the tests are mixed to a saturated paste with distilled water and allowed to stand for a given time. The quantity of water required to saturate a dry sample varies with the texture and composition of the sample. Saturation percentage, calculated from the weight of oven-dry soil and water required for saturation, ranged from about 25 percent for sandy samples to 130 percent for some silty-clay samples from the Otter Creek area. Saturation extracts were recovered from the pastes by vacuum filtration and were analyzed for specific conductance and major cations.

Saturation extracts have been used by Van Voast and Hedges (1975) and Van Voast and Thompson (1982) to evaluate the post-mining quality of spoils water in Montana and Wyoming. For predicting post-mining quality of spoils water in the upper Tongue River area in Montana and Wyoming, Van Voast and Thompson (1982) assumed that dissolved-solids concentrations of saturation extracts were potential additions to concentrations in ground waters that would enter and eventually discharge from the mine spoils. In the method used by Van Voast and Thompson, log-normal mean concentrations of cations were determined from analyses of saturation extracts; dissolved-solids concentrations were computed from the ion concentrations and these concentrations were used in conjunction with ground-water flow rates to compute the added dissolved-solids load from mining. Dissolved-solids concentrations indicated by saturation extracts were assumed to be potential additions to the premining concentrations, based on actual quality of aquifer and spoils water at mine sites in southeastern Montana. At the Big Sky and West Decker Mines in Montana, log-normal mean concentrations of cations in spoils water were consistently greater than log-normal mean concentrations of cations in saturation extracts (Van Voast and others, 1978). Log-normal mean concentrations of cations typically

were two to three times greater in the spoils water than in saturation extracts. Studies of spoils waters, saturation extracts of spoils and overburden, and quality of water in undisturbed aquifers in southeastern Montana indicate an empirical relation between the dissolved-solids concentration of water in mine spoils and the sum of dissolved-solids concentrations in aquifer water and saturation extracts.

Saturation extracts also have been used to evaluate spoils water quality in Montana by Woessner and others (1979), in North Dakota by Groenewold and others (1983), and in Colorado by McWhorter and others (1975). In a publication of procedures for predictive analysis of hydrologic impacts of surface mining, McWhorter (1982, p. 12) states that "... probably the most reasonable estimate of concentration of dissolved solids in subsurface runoff from mined land can be made from a judicious study of the quality of spoil water from nearby mines in a similar geochemical environment." He further adds that the dissolved-solids concentration in extracts from saturated drill cuttings will provide a reasonable lower limit for dissolved-solids concentration in subsurface runoff from mined land; however, if the dissolved solids derive mainly from readily soluble sodium salts, concentrations in spoils water can be expected to be greater than the saturation-extract value, perhaps by as much as a factor of three.

For the Otter Creek area, dissolved-solids concentrations derived from the saturation-extract data were assumed to be potential additions to the dissolved-solids concentration in undisturbed aquifers, similar to the method used by Van Voast and Thompson (1982). For each of the 26 sampling sites, a weighted mean value of specific conductance was calculated from the specific-conductance values of the saturation extracts. The mean specific-conductance value was weighted, based on the depth interval of each overburden sample. The weighted specific-conductance value for each sampling site was then equated to dissolved-solids concentration by the regression equation:

$$DS = 0.762\ (SC) - 222 \qquad (3)$$

where

DS = dissolved-solids concentration, in milligrams per liter, and
SC = specific conductance, in microsiemens per centimeter at 25° Celsius.

Specific conductance, calculated dissolved solids, and other sample data are presented in table 20. The dissolved-solids values obtained from the saturation extracts were assumed to result from the dissolution of the readily soluble minerals in the overburden, which would also be present in the post-mining spoils.

The log-mean concentration of dissolved solids from all saturated-paste data sites was 1,970 mg/L. To estimate the maximum post-mining load of dissolved solids from the mined area, 1,970 mg/L was added to the dissolved-solids concentration of ground water in each of the 10 subareas. In subareas 1, 2, and 3 the additional load was applied to only a fraction of the subareas because parts of these areas do not contain strippable coal in the Knobloch bed. The rate of ground-water flow from the subareas was not changed from the pre-mining rate because there is no evidence to indicate that mining would cause a significant change in the rate of ground-water recharge. The calculated maximum increase in annual dissolved-solids load to the Otter Creek stream-alluvial aquifer system is 2,873 tons (load calculations are given in table 21). Because the rate of movement of ground water through the mined area would be very slow, the Otter Creek valley would receive this increased load for many years (possibly hundreds) after the completion of mining.

Batch-mixing-test method

Batch-mixing tests involved the mixing of local aquifer water with the overburden sample to simulate possible chemical changes in the water as it moves through mine spoils. The method was used by Davis (1984) to determine potential changes in the quality of ground water at the West Decker Mine at Decker, Montana, and at the Big Sky Mine near Colstrip, Montana. In the tests, aquifer water was mixed with granular overburden samples in a ratio of 2:1 (water, soil) by weight. After thorough mixing, the mixtures were allowed to settle and were filtered after a total contact time of about 24 hours. The filtrates were then analyzed for concentrations of common ions, dissolved-solids concentration, and specific conductance.

In a mixing ratio of 2:1, many pore volumes (50 to 1,000) of water are exposed to the overburden sample. In the batch-mixing tests, overburden samples are mixed with about 2 to 10 times as much water as in a saturated paste. Because samples are exposed to many pore volumes of water, the batch-mixing test may reflect the long-term quality of water that would discharge from the mine spoils.

Data from batch-mixing tests indicated that water in spoils would have an average increase in dissolved-solids concentration of 840 mg/L over the pre-mining concentration (data and calculations in table 22). Based on the increase of 840 mg/L, the annual dissolved-solids load contributed from the mine spoils would be 1,225 tons.

Possible direct method using saturation-extract data

Saturation extracts, prepared from overburden samples and distilled water, give a reliable indication of the quantity of soluble minerals available in the overburden and thus, probably give a direct means of estimating the post-mining quality of water in mine spoils. Theoretically, the dissolved-solids concentration in a saturation extract for a given soil is governed by the quantity of soluble minerals in the soil, if the quantity is small, or by the kinematics of the chemical reactions if the quantity of the soluble material is large. In soils with a large quantity of soluble minerals, leaching of the sample with distilled water or with ground water from the sampling site, probably produces the same type and concentration of leachate, for the first pore volumes.

Many horizons within the Tongue River Member of the Fort Union Formation appear to contain abundant soluble minerals, based on similar leachates derived from various tests such as saturated-paste extract, batch mixing, and column leaching. Other horizons may not contain abundant soluble minerals; based on dissimilar leachates from different tests. It is reasonable to assume that recharge water moving through mine spoils would react with horizons that contained abundant soluble minerals until the water reached an equilibrium concentration dependent on the kinematics of the involved reactions. If recharge water does attain a dissolved-solids concentration dependent on soil horizons with abundant soluble minerals, then saturation extracts from these soil horizons may give a good estimate of dissolved-solids concentration in post-mining spoils water. A mean or log mean of saturation extracts from all soil horizons at a sampling site produces too small a value for dissolved-solids concentration because it gives equal weight to all soil horizons, even those with limited soluble minerals. Using just the 75th percentile or even the 90th percentile of samples appears to emphasize the soil horizons with abundant soluble minerals--those which govern the dissolved-solids concentration of spoils water.

Dissolved-solids concentrations in mine spoils and loads to the Otter Creek modeled area were calculated by a direct method using saturation-extract data, and compared with the results of other methods. In this method, the 75th- and 90th-percentile values of specific conductance were calculated for each of the 26 data sites (506 overburden samples). Means were then calculated for the 26 values representing the 75th percentile and the 26 values representing the 90th percentile of specific conductance. The mean values of specific conductance were converted to dissolved-solids concentrations using equation 3. With this method, dissolved-solids concentration of water in mine spoils would be 3,400 mg/L, based on the 75th percentile, and 4,410 mg/L based on the 90th percentile. Annual loads to the Otter Creek stream-alluvial aquifer system are 4,960 tons for the 75th-percentile value of dissolved solids and 6,430 tons for the 90th-percentile value. Loads were calculated directly using ground-water flow rates and dissolved-solids concentration of spoils water; loads from spoils were not added to pre-mining loads as in the other two methods. For comparison, annual loads were 3,990 tons for the batch-mixing method and 5,600 tons for the original saturation-extract method. Loads computed with the 75th- and 90th-percentile values bracket the load computed using the original saturation-extract method. The dissolved-solids concentrations of spoils water calculated by this direct method are in the range of two to three times as large as pre-mining concentrations in ground water, which is in the range reported by several investigators. Further study is needed to determine the value of this method for directly estimating the dissolved-solids concentration of spoils water from saturation-extract data.

LONG-TERM POST-MINING DISSOLVED SOLIDS IN THE HYDROLOGIC SYSTEM

After ground-water flow systems have developed in the post-mining landscape, water would flow from the mine spoils, through clinker and alluvium, and discharge to Otter Creek. Dissolved-solids concentrations in Otter Creek would increase as a result of the increased dissolved-solids load originating in the mine spoils. Dissolved-solids concentrations in the shallow alluvial aquifer downgradient from the mine spoils also would increase. With complete mining development of the Knobloch coal in the study area, the annual dissolved-solids load to the Otter Creek stream-alluvial aquifer system could increase by 1,225 to 2,873 tons. The larger load figure is based on saturated-paste data and likely represents the increased load for many years (possibly hundreds) after mining; the smaller figure is based on batch-mixing data and likely represents the increased load after many (50 to 1,000) pore volumes of water have passed through the mine spoils. With less than complete mining of the Knobloch coal along the Otter Creek valley, post-mining dissolved-solids load to the valley would be proportionally smaller. Calculations of dissolved-solids concentrations in Otter Creek and the alluvial aquifer assume that dissolved solids from the mined area would move through the alluvial aquifer and discharge to Otter Creek at a steady rate; inflows of dissolved solids to the alluvial aquifer would equal outflows, averaged over a long time.

Otter Creek

Increases in dissolved-solids loads and concentrations in Otter Creek were calculated for the downstream end of the modeled reach where dissolved-solids increases from mining would be the greatest. To most accurately represent the general increase in dissolved-solids concentrations in Otter Creek, the additional dissolved-solids load was added to the mean monthly loads of Otter Creek at the Ash-

land gaging station (station 06307740). The mean monthly loads of Otter Creek at Ashland were calculated from the median (50th percentile) monthly flows and the mean monthly dissolved-solids concentrations, using almost 9 years of data (data and calculations in table 23). The mean annual load of Otter Creek at Ashland is 8,985 tons, based on the long-term data. This calculated mean annual load is only slightly larger than the load for the 1983 water year, which was 8,863 tons.

The monthly loads of Otter Creek showed a maximum post-mining increase of 15 to 208 percent, based on the annual addition of 2,873 tons of dissolved solids (paste-extract method) to the Otter Creek valley. Monthly loads of Otter Creek showed a minimum increase of 6 to 89 percent, based on the additional annual load of 1,225 tons (batch-mixing method) to the Otter Creek valley. Otter Creek would have the smallest concentrations of dissolved solids in March, with mean post-mining concentrations ranging from 1,780 to 1,970 mg/L. In August, post-mining concentrations of dissolved solids would be the greatest, with mean concentrations ranging from 3,980 to 6,500 mg/L. Post-mining concentrations of dissolved solids in Otter Creek would be greater than these monthly figures for streamflows less than the median flow, and would be smaller for streamflows greater than the median flow.

Annual loads of Otter Creek at Ashland (at median streamflow) would have a post-mining increase of 14 percent for the added load of 1,225 tons and an increase of 32 percent for the added load of 2,873 tons (see table 23). At the median streamflow, the annual post-mining load of Otter Creek at Ashland (station 06307740) would range from 10,210 to 11,858 tons.

Alluvial aquifer

Post-mining concentrations of dissolved solids would increase within the alluvial aquifer in the Otter Creek valley as a result of the additional dissolved-solids load from mine spoils. Post-mining quality of the ground water was estimated by assuming that the ratio of pre-mining dissolved-solids load to pre-mining dissolved-solids concentration is proportional to the ratio of post-mining dissolved-solids load to dissolved-solids concentrations, which in equation form is:

$$\frac{\textit{Pre-mining dissolved-solids load to subirrigated part of alluvial aquifer}}{\textit{Median pre-mining concentration of dissolved solids in subirrigated part of alluvial aquifer}} = \frac{\textit{Post-mining dissolved-solids load to subirrigated part of alluvial aquifer}}{\textit{Median post-mining concentration of dissolved solids in subirrigated part of alluvial aquifer}}$$

The equation should give a reasonable estimate of post-mining water quality, because the only factor affecting the dissolved-solids concentration in the subirrigated part of the valley, which would be changed after mining, is the additional dissolved-solids load to the alluvium from mine spoils.

Pre-mining dissolved-solids load to the subirrigated part of the alluvial valley is equal to the sum of annual loads from ground-water inflow at the upstream end of the alluvial aquifer (438 tons), from bedrock aquifers (2,732 tons), and from clinker and non-subirrigated alluvium (863 tons). The total annual pre-mining load to the subirrigated alluvium is 4,033 tons. The median pre-mining concentration of dissolved solids in the subirrigated alluvium is 2,590 mg/L. The median was obtained from 17 wells completed in the subirrigated part of the valley (table 17). The post-mining load to the subirrigated part of the alluvial aquifer was obtained by summing the annual pre-mining load (4,033 tons) and the additional load from mine spoils (1,225 to 2,873 tons). The total annual post-mining load to the subirrigated alluvium would be 5,258 to 6,906 tons.

Substituting the above values into the water-quality equation yields a post-mining dissolved-solids concentration with a median ranging from 3,380 to 4,430 mg/L. Based on these calculations, the median post-mining concentration of dissolved solids in the subirrigated part of the valley would increase by 31 to 71 percent over the pre-mining concentration. However, because of incomplete mixing of water from mine spoils with water in the alluvial aquifer, a large range of dissolved-solids concentrations could be expected. Some locations within the alluvial aquifer, such as just downgradient of a massive clinker bed or at the mouth of a tributary, might show no increase in dissolved solids, whereas other locations might have an increase in dissolved solids that is much greater than 71 percent.

CONCLUSIONS

The primary shallow aquifers in the Otter Creek study area are the Knobloch coal beds, Knobloch clinker, sandstone beds above and below the Knobloch coal beds, and alluvium along Otter Creek and its major tributaries. The Knobloch coal beds and clinker, sandstone beds, and alluvium in the tributary valleys all discharge water to Otter Creek through the valley alluvium.

Large-scale surface mining of the Knobloch coal bed along the Otter Creek valley would remove large sections of the Knobloch coal and sandstone aquifers and replace them with mine spoils. After mining, ground-water flow systems would develop in the mine spoils, dissolve soluble materials, transport them to the Otter Creek valley, and increase the dissolved-solids concentrations in Otter Creek and the Otter Creek alluvial aquifer.

A mass-balance model was developed to evaluate the pre-mining hydrologic system in Otter Creek and its alluvial aquifer. Data from the mass-balance model were used in conjunction with calculated dissolved-solids concentrations in mine spoils to estimate the concentrations of dissolved solids that might exist in Otter Creek and the subirrigated part of the Otter Creek valley once mining was completed. If the Knobloch coal is completely mined along both sides of the Otter Creek valley, annual dissolved-solids load to Otter Creek at Ashland (at median streamflow) could increase by 2,873 tons, or a 32 percent increase over the mean annual pre-mining load of 8,985 tons. With the additional annual load of 2,873 tons, monthly loads of Otter Creek, at the median streamflow, could increase from 15 percent in February to 208 percent in August. At the median streamflow, mean dissolved-solids concentrations of Otter Creek at Ashland could range from 1,970 mg/L in March to 6,500 mg/L in August, an increase from the pre-mining range of 1,640 mg/L in March to 2,460 mg/L in December. The annual post-mining dissolved-solids load to the subirrigated part of the Otter Creek alluvial valley could increase by 2,873 tons or 71

percent. The median dissolved-solids concentration in the subirrigated part of the valley could be 4,430 mg/L, a 71-percent increase from the pre-mining median concentration of 2,590 mg/L. Actual increases in concentrations of dissolved solids in the alluvium could vary significantly from the calculated increase, because of incomplete mixing of water in the alluvium.

The estimate of additional dissolved-solids load from the mined landscape was derived from saturated-paste-extract data for 506 overburden samples from 26 wells and test holes. The paste-extract data represent the soluble material available to the initial pore volume of water moving through the mine spoils. The post-mining loads calculated using the saturated-paste-extract data likely would continue for many years (possibly hundreds) after mining.

Post-mining loads of dissolved solids also were estimated using data from batch-mixing tests. The batch-mixing tests represent the passing of many (50 to 1,000) pore volumes of water through the spoils and may reflect the long-term quality of water that could discharge from the mine spoils. Post-mining loads calculated from the batch-mixing tests were smaller than those calculated from saturated-paste-extract data.

Of the two methods used to estimate post-mining loads of dissolved solids, loads calculated from the saturated-paste-extract data probably best represent initial post-mining loads from the mine spoils. The paste-extract results were based on a larger number of samples and represent the first pore volumes of water from the mined area. Results of the batch-mixing tests show that concentrations of dissolved solids would not decrease rapidly after the initial saturation and flushing of mine spoils, but would continue at increased concentrations for many pore volumes of water.

REFERENCES CITED

Bass, N. W., 1932, The Ashland coal field, Rosebud, Powder River, and Custer Counties, Montana, Part 2 *of* Contributions to economic geology: U.S. Geological Survey Bulletin 831-B, p. 19-105.

Cannon, M. R., 1982, Potential effects of surface coal mining on the hydrology of the Cook Creek area, Ashland coal field, southeastern Montana: U.S. Geological Survey Open-File Report 82-681, 30 p.

Cooper, H. H., Jr., and Jacob, C. E., 1946, A generalized graphical method for evaluating formation constants and summarizing well-field history: American Geophysical Union Transactions, v. 27, no. 4, p. 526-534.

Darcy, Henry, 1856, Les fontaines publiques de la ville de Dijon: Paris, Victor Dalmont, 647 p.

Davis, R. E., 1984, Geochemistry and geohydrology of the West Decker and Big Sky coal-mining areas, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report 83-4225, 109 p.

Dockins, W. S., Olson, G. J., McFeters, G. A., Turbak, S. C., and Lee, R. W., 1980, Sulfate reduction in ground water of southeastern Montana: U.S. Geological Survey Water-Resources Investigations Open-File Report 80-9, 13 p.

Dollhopf, D. J., Goering, J. D., Levine, C. J., Young, S. A., and Ayers, E. L., 1981, Crop production characteristics on subirrigated alluvial valley systems: Bozeman, Montana Agricultural Experiment Station, Montana State University, Research Report 178, 77 p.

Dollhopf, D. J., Wendt, G. W., Goering, J. D., and Hedberg, D. W., 1979, Hydrogeology of a watershed with subirrigated alluvial materials in crop production: Bozeman, Montana State University, Montana Agricultural Experiment Station Bulletin 715, 76 p.

Farnsworth, R. K., and Thompson, E. S., 1982, Mean monthly, seasonal, and annual pan evaporation for the United States: U.S. Department of Commerce, National Oceanic and Atmospheric Administration Technical Report NWS 34, 85 p.

Farnsworth, R. K., Thompson, E. S., and Peck, E. L., 1982, Evaporation atlas for the contiguous 48 United States: U.S. Department of Commerce, National Oceanic and Atmospheric Administration Technical Report NWS 33, 26 p.

Groenewold, G. H., Koob, R. D., McCarthy, G. J., Rehm, B. W., and Peterson, W. M., 1983, Geological and geochemical controls on the chemical evolution of subsurface water in undisturbed and surface-mined landscape in western North Dakota: North Dakota Geological Survey Report of Investigation 79, 276 p.

Hopkins, W. B., 1973, Water resources of the Northern Cheyenne Indian Reservation and adjacent area, southeastern Montana: U.S. Geological Survey Hydrologic Investigations Atlas HA-468, scale 1:125,000, 2 sheets.

Johnson, A. I., 1967, Specific yield--Compilation of specific yields for various materials: U.S. Geological Survey Water-Supply Paper 1662-D, 74 p.

Knapton, J. R., and Ferreira, R. F., 1980, Statistical analyses of surface-water-quality variables in the coal area of southeastern Montana: U.S. Geological Survey Water-Resources Investigations 80-40, 128 p.

Knapton, J. R., and McKinley, P. W., 1977, Water quality of selected streams in the coal area of southeastern Montana: U.S. Geological Survey Water-Resources Investigations 77-80, 145 p.

Lee, R. W., 1979, Ground-water-quality data from the northern Powder River Basin, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Open-File Report 79-1331, 55 p.

_____1981, Geochemistry of water in the Fort Union Formation of the northern Powder River Basin, southeastern Montana: U.S. Geological Survey Water-Supply Paper 2076, 17 p.

Lee, R. W., Slagle, S. E., and Stimson, J. R., 1981, Magnitude and chemical quality of base flow of Otter Creek, Tongue River, and Rosebud Creek, southeastern Montana, October 26-November 5, 1977: U.S. Geological Survey Water-Resources Investigations Open-File Report 80-1298, 25 p.

Lewis, B. D., and Roberts, R. S., 1978, Geology and water-yielding characteristics of rocks of the northern Powder River basin, southeastern Montana: U.S. Geological Survey Miscellaneous Investigations Map I-847-D, scale 1:250,000, 2 sheets.

Malde, H. E., and Boyles, J. M., 1976, Maps of alluvial valley floors and strippable coal in forty-two 7 1/2-minute quadrangles, Big Horn, Rosebud, and Powder River Counties, southeast Montana: U.S. Geological Survey Open-File Report 76-162, 2 p., 42 pls.

Matson, R. E., and Blumer, J. W., 1973, Quality and reserves of strippable coal, selected deposits, southeastern Montana: Montana Bureau of Mines and Geology Bulletin 91, 135 p.

McClymonds, N. E., 1984, Potential effects of surface coal mining on the hydrology of the West Otter area, Ashland and Birney-Broadus coal fields, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Report 84-4087, 70 p.

McKay, E. J., 1976a, Preliminary geologic map and coal sections of the Willow Crossing quadrangle, Rosebud and Powder River Counties, Montana: U.S. Geological Survey Miscellaneous Field Studies Map MF-802, scale 1:24,000, 1 sheet.

_____1976b [1977], Preliminary geologic map and coal sections of the King Mountain quadrangle, Rosebud and Powder River Counties, Montana: U.S. Geological Survey Miscellaneous Field Studies Map MF-817, scale 1:24,000, 2 sheets.

McWhorter, D. B., 1982, Procedures for predictive analysis of selected hydrologic impacts of surface mining: U.S. Environmental Protection Agency, EPA-600/7-82-055, 87 p.

McWhorter, D. B., Skogerboe, R. K., and Skogerboe, G. V., 1975, Water quality control in mine spoils, upper Colorado River basin: U.S. Environmental Protection Agency, EPA-670/2-75-048, 100 p.

Omang, R. J., Parrett, Charles, and Hull, J. A., 1983, Mean annual runoff and peak flow estimates based on channel geometry of streams in southeastern Montana: U.S. Geological Survey Water-Resources Investigations 82-4092, 33 p.

Perry, E. S., 1931, Ground water in eastern and central Montana: Montana Bureau of Mines and Geology Memoir 2, 59 p.

Renick, B. C., 1929, Geology and ground-water resources of central and southern Rosebud County, Montana, with Chemical analyses by H. G. Riffenberg: U.S. Geological Survey Water-Supply Paper 600, 140 p.

Slagle, S. E., and Stimson, J. R., 1979, Hydrogeologic data from the northern Powder River basin of southeastern Montana: U.S. Geological Survey Water-Resources Investigations Open-File Report 79-1332, 111 p.

Stoner, J. D., and Lewis, B. D., 1980, Hydrogeology of the Fort Union coal region, eastern Montana: U.S. Geological Survey Miscellaneous Investigations Map I-1236, scale 1:500,000, 2 sheets.

Theis, C. V., 1935, The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using ground-water storage: American Geophysical Union Transactions, v. 16, p. 519-524.

U.S. Department of Agriculture, 1974, Irrigation guide for Montana: Bozeman, Mont., Soil Conservation Service report, 177 p.

U.S. Salinity Laboratory Staff, 1954, Diagnosis and improvement of saline and alkali soils: U.S. Department of Agriculture Handbook 60, 160 p.

Van Voast, W. A., 1974, Hydrologic effects of strip coal mining in southeastern Montana--Emphasis, One year of mining near Decker: Montana Bureau of Mines and Geology Bulletin 93, 24 p.

Van Voast, W. A., and Hedges, R. B., 1975, Hydrogeologic aspects of existing and proposed strip coal mines near Decker, southeastern Montana: Montana Bureau of Mines and Geology Bulletin 97, 31 p.

Van Voast, W. A., Hedges, R. B., and McDermott, J. J., 1978, Strip coal mining and mined-land reclamation in the hydrologic system, southeastern Montana: Billings, Mont., Old West Regional Commission, Project completion report for OWRC grant 10570165, 122 p.

Van Voast, W. A., and Thompson, K. S., 1982, Estimates of post-mining water quality for the upper Tongue River, Montana and Wyoming: Montana Bureau of Mines and Geology Hydrogeologic Map 5 (Text), 10 p.

Warren, W. C., 1959 [1960], Reconnaissance geology of the Birney-Broadus coal field, Rosebud and Powder River Counties, Montana: U.S. Geological Survey Bulletin 1072-J, p. 561-585.

Wegemann, C. H., 1910, Notes on the coals of the Custer National Forest, Montana, Part 2 *of* Contributions to economic geology: U.S. Geological Survey Bulletin 381-A, p. 108-114.

Wilson, T. A., 1977, Daily values tables (Program H474), Chapter IV *of* National Water Data Storage and Retrieval System, *in* Hutchinson, N. E., compiler, U.S. Geological Survey WATSTORE User's Guide, v. 1: U.S. Geological Survey Open-File Report 75-426, p. C-1 to C-25.

Woessner, W. W., Andrews, C. B., and Osborne, T. J., 1979, The impacts of coal strip mining on the hydrologic system of the Northern Great Plains--Case study of potential impacts on the Northern Cheyenne Reservation, *in* Back, William, and Stephenson, D. A., eds., Contemporary hydrogeology--The George Burke Maxey Memorial Volume: Journal of Hydrology, v. 43. p. 445-467.

Woessner, W. W., Osborne, T. J., Heffern, E. L., Whiteman, Jason, Spotted Elk, Wesley, and Morales-Brink, Daniel, 1981, Hydrologic impacts from potential coal strip mining--Northern Cheyenne Reservation, Volume 1: U.S. Environmental Protection Agency, EPA-600/781-004a, 302 p.

Woods, P. F., 1981, Modeled impacts of surface coal mining on dissolved solids in the Tongue River, southeastern Montana: U.S. Geological Survey Water-Resources Investigations Open-File Report 81-64, 73 p.

SUPPLEMENTAL INFORMATION

Table 1.--*Water-level data for wells, test holes, or springs*

Well, test-hole, or spring No.	Location No.[1]	Date of water-level measurement (mo-day-yr)	Water level (feet below land surface)	Altitude of water level (feet above sea level)	Remarks
AL-1	03S44E11DAAA01	06-10-83	6.59	2,915	Observation well OC83-2
AL-4	03S45E16DDDC01	06-08-83	40.1	3,022	Observation well OC83-5
AL-8	03S46E14CBCD01	01-17-74	17.0	3,291	
AL-9	04S45E10CCBC01	05-29-80	7.5	3,027	Observation well OC-8
AL-10	04S45E04BADD01	12-05-79	3.6	3,011	Observation well WO-12
AL-12	04S45E04BDDB01	12-07-79	5.8	3,014	Observation well WO-14
AL-16	04S45E09DCAA01	06-23-80	14.5	3,020	Observation well OC-2A
AL-17	04S45E15BCDD01	08-25-80	9.5	3,026	Observation well OC-6
AL-18	05S46E04DACA01	01-16-74	45.0	3,257	
AL-19	04S45E27DBAB01	12-17-73	22.0	3,053	
AL-22	05S45E23ABCA02	10-25-80	11.7	3,138	Observation well WO-09
AL-27	05S45E23BBAA04	06-08-83	9.9	3,130	Observation well WO-04
AL-29	03S44E13AACD01	12-13-73	16.0	2,924	
AL-30	03S45E33BBBB01	10-08-74	10.1	3,000	
AL-31	05S46E20CBCC01	01-15-74	12.0	3,243	
AL-32	05S46E23CBDD01	01-18-74	30.0	3,375	
AL-33	05S46E28BBAB01	01-15-74	3.0	3,279	
SP-1	03S44E12BDDA01	--	--	3,020	Spring from clinker
TR-2	03S45E19DDBD01	12-18-73	9.0	2,954	
TR-3	03S44E36DACA01	06-08-83	233.9	3,036	Observation well OC83-1
TR-4	03S45E03BADD01	10-08-64	120.0	3,180	Water level reported by driller
TR-5	03S45E10BACD01	10-08-74	124.8	3,085	
TR-6	03S45E22BBBA01	12-20-73	50.0	3,026	
TR-7	03S45E22BAAB01	01-12-74	91.0	3,026	
TR-8	03S45E15DDDA01	12-17-73	132.0	3,048	
TR-9	03S45E14CCAB01	01-14-74	143.3	3,060	Well for Red Shale Campground
TR-11	03S45E26ADAC01	10-17-74	134.9	3,069	Observation well DH74-104
TR-12	03S45E26DBCB01	11-06-74	120.2	3,071	Observation well DH74-102
TR-14	03S45E34CACD01	08-09-74	229.6	3,030	Observation well DH74-101
TR-15	03S45E34AACD01	10-17-74	123.4	3,071	Observation well DH74-103
TR-24	03S45E12BDCB01	08-07-74	11.9	3,168	
TR-25	03S46E07ADBB01	01-18-74	44.9	3,224	
TR-26	03S45E13DCBC01	01-14-74	119.0	3,081	
TR-28	03S46E17DBDC01	01-17-74	55.0	3,153	
TR-30	03S46E15CAAA01	01-17-74	110.0	3,177	
TR-35	03S46E19ACBA01	01-11-74	47.4	3,163	Stock well
TR-36	03S46E30BCCC01	01-13-74	95.0	3,158	Stock well
TR-37	03S45E31DCDA01	08-13-75	140.0	2,990	Stock well
TR-39	04S45E06DBDB01	08-14-80	224.2	3,031	Observation well US77-23
TR-40	04S45E07CABA01	08-17-80	190.8	3,034	Observation well OC-30
TR-41	03S45E34DDDA01	12-12-74	156.0	3,106	Observation well DH74-105
TR-42	03S45E35DABA01	03-18-75	193.4	3,100	

Table 1.--*Water-level data for wells, test holes, or springs*--Continued

Well, test-hole, or spring No.	Location No.[1]	Date of water-level measurement (mo-day-yr)	Water level (feet below land surface)	Altitude of water level (feet above sea level)	Remarks
TR-43	04S45E02BDDD01	01-09-75	157.0	3,071	Observation well DH74-106
TR-44	04S45E02DACD01	01-22-75	43.2	3,062	Observation well DH74-107
TR-45	04S45E02CDDB01	12-21-73	56.0	3,024	
TR-48	04S46E05BCBC01	12-12-74	84.0	3,131	Stock well
TR-51	04S46E11BBBA01	01-13-74	58.0	3,299	
TR-53	04S45E14CDCC01	06-09-83	117.6	3,037	Observation well OC83-4
TR-54	04S46E08CBCC01	06-12-62	60.0	3,185	
TR-55	04S46E10DABC01	01-12-74	44.0	3,281	Stock well
TR-58	04S45E20CCAD01	12-19-73	130.0	3,115	
TR-65	04S46E31DDBC01	01-16-74	10.0	3,202	
TR-66	04S46E32DCDC01	01-16-74	35.0	3,207	
TR-68	05S46E05BDCB01	01-12-74	42.0	3,213	
TR-69	05S46E04DDAB01	01-16-74	41.0	3,269	
TR-72	04S45E28BDDD01	05-11-77	128.6	3,112	Observation well US77-25
TR-73	04S45E28ADDA01	12-17-73	60.0	3,100	
TR-79	05S45E04BADD01	10-27-80	142.0	3,120	Observation well US77-26
TR-91	05S45E16ADDD01	06-10-83	144.5	3,134	Observation well OC83-7
TR-93	05S45E23BBAA02	10-25-80	45.2	3,145	Observation well WO-02
TR-95	05S45E28BBBA01	06-01-62	163.0	3,162	
TR-103	05S45E12BDBA01	06-10-76	93.5	3,186	Coal exploration hole DH76-101
TR-104	04S45E26BDCD01	06-03-76	119.7	3,075	Coal exploration hole DH76-101
TR-118	03S45E08AACD01	08-19-80	170.4	3,071	Montco well 3458-1W
TR-119	03S45E09CCCB01	06-19-80	147.3	3,143	Stock well
TR-120	03S45E18BBBA01	08-13-75	78.6	2,936	
TR-122	03S45E16DDDB01	10-08-74	34.3	3,046	Stock well
TR-123	03S45E15DBBB01	12-17-73	27.0	3,067	
TR-124	03S45E14BCCB01	12-17-73	41.0	3,077	
TR-126	03S45E21ABCD01	12-17-73	38.0	3,002	
TR-127	03S45E23DCBA01	12-21-73	54.0	3,050	
TR-128	03S45E27ACBB01	12-20-73	41.0	3,021	
TR-129	03S45E32DDAC02	12-21-73	15.0	2,995	
TR-130	04S45E05CACD01	08-25-80	191.9	3,033	Observation well OC-39
TR-131	04S45E03DDDA01	08-13-75	42.4	3,018	
TR-132	04S44E12BBDA01	10-01-59	260.0	3,040	
TR-133	03S45E01CDCC01	08-07-74	55.7	3,174	
TR-134	03S46E06AADD01	08-07-74	28.1	3,252	
TR-135	03S46E04BBBB01	08-08-74	17.5	3,342	
TR-136	03S46E17ADBC01	05-05-65	48.0	3,192	
TR-137	03S46E20DBAB01	01-17-74	97.0	3,208	Stock well
TR-138	03S46E21CDBA01	01-13-74	132.0	3,215	Stock well
TR-139	03S46E22CBBA01	01-17-74	99.0	3,251	Stock well
TR-140	04S46E04DCDC01	01-16-74	48.0	3,226	Stock well

Table 1.--*Water-level data for wells, test holes, or springs*--Continued

Well, test-hole, or spring No.	Location No.[1]	Date of water-level measurement (mo-day-yr)	Water level (feet below land surface)	Altitude of water level (feet above sea level)	Remarks
TR-141	04S45E12ABBC01	01-01-74	25.0	3,092	
TR-142	04S46E10BCBA01	01-16-74	24.0	3,258	
TR-143	04S45E08DDAD01	03-24-81	169.0	3,061	Observation well OC-13
TR-144	04S45E17CCDC01	08-25-80	197.4	3,037	Observation well OC-26
TR-145	04S45E16CDAC01	09-13-80	92.3	3,028	Observation well OC-22
TR-146	04S45E21CCCA01	02-24-81	79.9	3,093	Observation well OC-28
TR-147	05S45E08BBCC01	08-12-75	85.0	3,465	
TR-149	05S45E16DBCB01	12-20-73	150.0	3,160	
TR-150	04S46E15CBDC01	01-12-74	102.0	3,514	Stock well
TR-151	04S46E33CBAC01	05-22-75	27.0	3,272	Stock well
TR-152	03S45E04CDBD01	09-18-80	148.0	3,192	Coal exploration hole US80-069
TR-153	03S45E08BCBA01	07-23-78	198.0	3,067	Montco hole 3458-2W
TR-154	03S45E08CDDD01	05-02-77	134.0	3,096	Coal exploration hole US77-16

[1]Location number based on Federal system of land subdivision. The first set of numerals indicates the township; the second, the range; and the third, the section. The first letter following the section denotes the 160-acre tract; the second, the 40-acre tract; the third, the 10-acre tract; and the fourth, the 2.5-acre tract. Letters are assigned in a counterclockwise direction, beginning with "A" in the northeast quadrant. Two-digit numerals at the end of the location number are assigned sequentially. For example, well 03S45E08CDDD01 is the first well inventoried in the SE1/4SE1/4SE1/4SW1/4 sec. 8, T. 3 S., R. 45 E.

Table 2.--*Daily discharge records for Otter Creek below Fifteenmile Creek (station 06307717), 1983 water year*

YELLOWSTONE RIVER BASIN

06307717 OTTER CREEK BELOW FIFTEENMILE CREEK, NEAR OTTER, MT

LOCATION.--Lat 45°24'11", long 106°08'31" in SW¼SW¼NE¼ sec. 14, T. 5 S., R. 45 E., Powder River County, Hydrologic Unit 10090102, Custer National Forest, on right bank, 2.8 miles downstream from Fifteenmile Creek, 9.0 miles north of Fort Howes Ranger Station, 16.5 miles northeast of Otter, and at mile 39.2.

DRAINAGE AREA.--453 square miles.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--June 1982 to current year.

GAGE.--Water-stage recorder. Altitude of gage is 3,140 feet, from topographic map.

REMARKS.--Water-discharge records fair except those for winter period, which are poor. Numerous diversions for irrigation above station.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge unknown; maximum gage height, 6.96 feet, revised, July 26, 1982; minimum discharge, 0.07 cubic foot per second Aug. 13, 17, 18, 1983.

EXTREMES FOR CURRENT YEAR.--Maximum discharge unknown; maximum gage height, 2.80 feet Jan. 12 (backwater from ice); minimum discharge, 0.07 cubic foot per second Aug. 13, 17, 18.

MEAN DISCHARGE, IN CUBIC FEET PER SECOND, OCTOBER 1982 THROUGH SEPTEMBER 1983

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2.8	2.6	2.2	2.2	7.0	4.6	4.0	2.8	1.7	1.0	0.35	0.22
2	2.3	2.8	2.2	1.9	5.0	4.4	3.9	2.3	1.6	.88	.24	.20
3	2.6	2.3	2.0	1.8	3.0	4.2	3.9	2.1	1.6	.82	.20	.18
4	2.3	2.5	1.9	1.8	2.4	4.4	3.7	2.0	1.6	1.1	.16	.20
5	2.3	2.5	1.9	1.9	2.5	4.0	3.7	2.0	1.5	1.1	.18	.22
6	1.6	2.3	1.8	3.0	3.0	3.9	3.6	2.0	1.5	1.1	.20	.22
7	2.9	2.3	1.7	7.0	3.5	4.4	3.7	2.1	1.4	1.1	.23	.22
8	2.8	2.6	1.6	12	4.5	4.4	3.4	2.3	1.6	.94	.22	.27
9	3.3	2.6	1.5	15	5.0	4.2	3.6	2.4	1.7	.82	.20	.24
10	3.1	2.6	1.6	20	6.0	3.9	3.7	2.5	1.5	.82	.14	.30
11	2.5	2.5	1.5	30	7.0	3.9	4.0	3.1	1.2	.62	.12	.30
12	2.8	2.0	1.5	40	7.0	3.9	3.4	4.7	1.1	.66	.09	.30
13	2.3	1.8	1.9	60	8.0	3.9	3.1	3.4	1.1	.57	.07	.30
14	2.2	1.8	2.4	35	8.0	3.9	2.9	3.4	1.4	.49	.10	.27
15	2.4	1.8	2.0	20	9.0	3.4	2.6	2.6	1.4	.49	.12	.33
16	2.5	2.0	3.6	9.0	10	3.7	3.4	3.0	1.4	.49	.09	.30
17	2.4	2.5	3.5	8.0	15	3.9	3.1	2.6	1.5	.49	.07	.42
18	2.3	2.6	3.0	7.0	15	4.6	3.1	2.6	1.4	.45	.08	.38
19	2.2	2.6	2.5	6.0	25	4.7	3.3	2.5	1.4	.45	.09	.49
20	2.3	2.4	2.0	5.5	40	4.6	3.7	2.4	1.3	.53	.09	.62
21	2.2	2.2	1.8	5.0	32	4.9	3.1	2.3	1.2	.53	.11	.62
22	1.9	2.1	2.0	4.5	38	4.7	2.6	2.4	1.1	.49	.35	.62
23	1.8	2.0	2.0	4.0	30	4.4	2.5	2.3	1.1	.57	.45	.76
24	1.9	2.0	1.8	3.5	20	4.4	2.2	2.3	1.0	.57	.38	.88
25	2.1	2.0	1.4	3.0	12	4.7	2.1	2.3	1.0	.53	.35	.82
26	2.0	2.0	1.6	2.5	9.0	4.6	2.3	2.2	.94	.53	.33	.82
27	2.1	2.0	1.6	3.0	9.0	3.9	2.5	2.2	.88	.66	.30	.71
28	2.1	2.1	1.3	5.5	7.5	3.4	2.4	1.9	.94	.57	.27	.71
29	2.4	2.2	1.6	9.0	---	3.6	2.8	1.7	1.5	.53	.24	.88
30	2.5	2.2	2.0	12	---	3.6	2.8	1.7	1.1	.57	.24	1.5
31	2.8	---	2.7	10	---	3.9	---	1.7	---	.49	.22	---
Total	73.7	67.9	62.1	349.1	343.4	129.0	95.1	75.8	39.66	20.96	6.28	14.30
Mean	2.38	2.26	2.00	11.3	12.3	4.16	3.17	2.45	1.32	.68	.20	.48
Maximum	3.3	2.8	3.6	60	40	4.9	4.0	4.7	1.7	1.1	.45	1.5
Minimum	1.6	1.8	1.3	1.8	2.4	3.4	2.1	1.7	.88	.45	.07	.18
Acre-feet	146	135	123	692	681	256	189	150	79	42	12	28

Water year 1983 Total = 1,277.30 Mean = 3.50 Maximum = 60 Minimum = 0.07 Acre-feet 2,530

Table 3.--*Daily discharge records for Otter Creek at Ashland (station 06307740), 1983 water year*

YELLOWSTONE RIVER BASIN

06307740 OTTER CREEK AT ASHLAND, MT

LOCATION.--Lat 45°35'18", long 106°15'17", in NE¼NE¼SE¼ sec. 11, T. 3 S., R. 44 E., Rosebud County, Hydrologic Unit 10090102, on left bank 200 feet downstream from bridge on U.S. Highway 212, 0.3 mile southeast of Ashland, and at mile 2.7.

DRAINAGE AREA.--707 square miles.

WATER-DISCHARGE RECORDS

PERIOD OF RECORD.--October 1972 to current year.

GAGE.--Water-stage recorder. Datum of gage is 2,916.57 feet above sea level.

REMARKS.--Water-discharge records poor. Diversions for irrigation of about 4,200 acres above station.

AVERAGE DISCHARGE.--11 years, 7.03 cubic feet per second, 5,090 acre-feet per year.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 425 cubic feet per second Mar. 21, 1978, gage height, 8.65 feet, backwater from beaver dam; no flow on many days in 1977 and 1982.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 75 cubic foot per second Feb. 21, gage height, 5.24 feet, only peak above base of 50 cubic feet per second; minimum daily, 0.29 cubic foot per second, on many days in August and September.

MEAN DISCHARGE, IN CUBIC FEET PER SECOND, OCTOBER 1982 THROUGH SEPTEMBER 1983

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.9	3.3	3.1	3.1	9.0	12	6.3	5.1	3.0	0.82	0.50	0.29
2	2.0	3.3	3.2	3.1	8.2	12	6.9	5.1	4.6	.93	.40	.29
3	2.2	3.3	3.3	3.3	8.0	9.7	6.8	5.1	3.0	.71	.40	.29
4	2.1	3.3	3.3	3.4	9.0	9.7	6.8	5.0	2.5	.71	.40	.29
5	2.1	3.5	3.5	3.4	8.5	10	6.3	5.1	2.6	.71	.40	.29
6	2.6	3.6	3.3	3.5	9.0	9.0	6.1	5.4	2.4	.71	.40	.29
7	2.8	3.6	3.3	3.4	9.0	8.7	6.3	5.1	2.4	.71	.40	.29
8	2.5	3.3	3.2	3.4	7.8	11	6.3	5.0	2.4	.71	.40	.29
9	3.2	4.1	3.3	3.4	7.0	9.5	6.1	4.8	2.8	.61	.40	.29
10	3.6	4.4	3.3	3.4	7.6	10	6.1	4.8	2.9	.61	.40	.29
11	3.6	3.9	3.2	4.0	8.0	10	5.9	5.0	2.9	.61	.29	.29
12	4.1	3.0	3.3	5.0	8.5	10	5.9	5.1	3.2	1.0	.29	.29
13	4.1	2.7	3.3	8.0	13	9.5	5.7	5.4	3.3	1.0	.29	.29
14	4.2	2.8	3.4	15	14	9.5	5.6	5.6	3.3	1.0	.29	.29
15	3.6	2.9	3.4	13	19	9.5	5.9	5.6	3.0	.71	.29	.29
16	3.8	3.0	3.5	10	27	9.0	6.3	5.1	2.6	.71	.29	.29
17	3.5	3.1	3.3	8.5	19	8.7	6.1	5.0	2.8	.61	.29	.29
18	3.3	3.2	3.2	8.0	36	8.5	5.7	4.6	2.2	.61	.29	.29
19	3.6	3.6	3.2	7.2	29	8.0	5.6	4.4	1.5	.61	.29	.29
20	3.6	4.4	3.3	6.9	35	7.4	5.4	4.0	1.0	.50	.40	.40
21	3.6	4.2	3.2	6.6	51	7.2	5.3	3.6	1.4	.50	.50	.40
22	3.6	3.9	3.2	6.3	40	7.4	5.3	3.2	1.7	.50	.40	.40
23	3.6	3.5	3.2	5.9	42	7.8	5.3	2.9	1.4	.50	.40	.40
24	3.6	3.4	3.1	5.6	39	7.6	5.3	3.0	1.0	.50	.40	.40
25	4.1	3.3	3.0	5.3	27	7.8	5.1	3.2	.71	.50	.40	.40
26	3.5	3.0	3.1	5.0	20	8.0	5.0	3.6	.71	.40	.40	.40
27	3.6	3.0	3.1	5.2	16	7.8	5.0	3.8	.71	.50	.40	.50
28	3.6	2.9	3.0	5.7	14	7.4	5.0	2.9	.71	.50	.40	.50
29	3.3	3.1	3.1	7.6	---	7.6	5.0	1.5	.71	.50	.29	.50
30	3.2	3.1	3.2	16	---	7.6	5.0	1.7	.71	.50	.29	.50
31	3.5	---	3.2	14	---	7.4	---	2.8	---	.50	.29	---
Total	101.6	101.7	100.3	202.2	540.6	275.3	173.4	132.5	64.16	19.99	11.28	10.31
Mean	3.28	3.39	3.24	6.52	19.3	8.88	5.78	4.27	2.14	.64	.36	.34
Maximum	4.2	4.4	3.5	16	51	12	6.9	5.6	4.6	1.0	.50	.50
Minimum	1.9	2.7	3.0	3.1	7.0	7.2	5.0	1.5	.71	.40	.29	.29
Acre-feet	202	202	199	401	1070	546	344	263	127	40	22	20

Water year 1983 Total 1,733.34 Mean = 4.75 Maximum = 51 Minimum = 0.29 Acre-feet = 3,440

Table 4.--*Hydraulic data for wells completed in alluvium*

Well No.	Location No.	Other identification No.	Subarea No.	Pumping rate (gallons per minute)	Transmissivity[1] (feet squared per day)	Storage[2] coefficient
AL- 1	03S44E11DAAA01	OC83-2	2	27.4	1,100	0.004
AL- 2	03S44E11DAAC01	OC83-3	2	27.4	2,400	--
AL- 3	03S44E11DACB01	OC83-6	2	26.7	2,900	--
AL- 4	03S45E16DDDC01	OC83-5	3	26.0	9,200	--
AL- 9	04S45E10CCBC01	OC-8	5	64.0	6,500	--
AL-10	04S45E04BADD01	WO-12	6	64.0	2,500	.0003
AL-11	04S45E04BDAA01	WO-13	6	10.0	3,500	.0003
AL-12	04S45E04BDDB01	WO-14	6	26.6	5,800	.01
AL-13	04S45E04BDDB02	WO-15	6	25.0	4,500	.002
AL-14	04S45E04CAAC01	WO-16	6	3.7	1,000	--
AL-16	04S45E09DCAA01	OC-2A	6	24.6	3,000	--
AL-20	05S45E23ABDA03	WO-7	9	2.8	250	--
AL-21	05S45E23ABCA01	WO-8	9	20.4	200	--
AL-22	05S45E23ABCA02	WO-9	9	21.8	2,600	--
AL-23	05S45E23ABCB01	WO-10	9	56.5	2,200	.003
AL-27	05S45E23BBAA04	WO-4	10	19.0	500	--

[1]Transmissivity values were computed from aquifer tests using either the non-equilibrium method of Theis (1935), or the straight-line solution method of Cooper and Jacob (1946).

[2]Storage coefficient was calculated only for multiple-well sites. Values reflect early-time storage coefficient before delayed yield from storage is complete.

Table 5.--*Hydraulic data for wells completed in the Tongue River Member of the Fort Union Formation*

Well No.	Location No.	Other identication No.	Sub-area No.	Aquifer	Pumping rate (gallons per minute)	Transmissivity[1] (feet squared per day)	Storage[2] coefficient
TR- 3	03S44E36DACA01	OC83-1	2	Knobloch coal bed	3.8	60	--
TR- 39	04S45E06DBDB01	US77-23	4	Knobloch coal bed	12.5	440	0.001
TR- 40	04S45E07CABA01	OC-30	4	Knobloch coal bed	5.2	3.0	--
TR- 53	04S45E14CDCC01	OC83-4	5	Knobloch coal bed	13.7	230	--
TR- 72	04S45E28BDDD01	US77-25	8	Sandstone and coal	7.6	200	--
TR- 79	05S45E04ABCC01	US77-26	8	Knobloch coal bed	3.6	8.0	--
TR- 81	05S45E23ABDA01	WO-5	9	Sandstone	20.4	400	--
TR- 82	05S45E23ABDA02	WO-6	9	Lower Knobloch coal bed	7.0	20	--
TR- 91	05S45E16ADDD01	OC83-7	10	Sandstone bed	6.0	130	--
TR- 92	05S45E23BBAA01	WO-1	10	Sandstone bed	8.5	2.5	--
TR- 93	05S45E23BBAA02	WO-2	10	Lower Knobloch coal bed	19.0	230	--
TR- 94	05S45E23BBAA03	WO-3	10	Sandstone and coal	18.0	250	--
TR-143	04S45E08DDAD01	OC-13	6	Knobloch coal bed	2.1	6.0	--

[1]Transmissivity values were computed from aquifer tests using either the non-equilibrium method of Theis (1935), or the straight-line solution method of Cooper and Jacob (1946).

[2]Storage coefficient was calculated only for multiple-well sites.

Table 6.--*Rates of water inflow from bedrock aquifers*

Subarea No.	Transmissivity[1] (feet squared per day)	Gradient	Width of area (feet)	Discharge (cubic feet per day)
1	30	0.016	15,200	7,300
2	60	.008	15,200	7,300
3	152	.005	15,500	11,780
4	222	.005	15,500	17,200
5	230	.005	15,000	17,250
6	152	.007	15,000	15,960
7	152	.007	18,000	19,150
8	104	.007	18,000	13,100
9	210	.007	15,000	22,050
10	153	.004	15,000	9,180
			Total	[2]140,270

[1]Transmissivity from aquifer tests in subarea or nearby area. In subareas where more than one test was done, the reported value is a simple mean.

[2]Equivalent to annual rate of 1,175 acre-feet.

Table 7.--*Average monthly precipitation at Ashland, Mont., for 1956-80*

Period	Precipitation (inches)	Period	Precipitation (inches)
January	0.62	August	1.03
February	.56	September	1.00
March	.60	October	.86
April	1.30	November	.66
May	2.37	December	.56
June	2.46	Annual	13.05
July	1.03		

Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration

Table 8.--*Monthly distribution*[1] *of free-water-surface evaporation for the Otter Creek valley for 1956-70*

Period	Evaporation (inches)	Period	Evaporation (inches)
January	0.61	August	6.83
February	.71	September	4.29
March	1.48	October	2.97
April	2.51	November	.97
May	5.38	December	.74
June	6.04	Total (annual)	40
July	7.46	Total (May-Oct.)	33

[1]Based on free-water-surface evaporation for Huntley, Mont. (about 100 miles west of Ashland); Terry, Mont. (about 115 miles north-northeast of Ashland); and Sheridan, Wyo. (about 65 miles southwest of Ashland) using method of Farnsworth and Thompson (1982).

Table 9.--*Average annual net evaporation*[1] *from the surface of Otter Creek*

Subarea No.	Stream length (miles)	Stream area (acres)	Annual evaporation rate (inches)	Evaporated volume (acre-feet)
1+2	7.28	14.12	26.95	31.7
3+4	9.87	19.14	26.95	42.9
5+6	6.95	13.48	26.95	30.3
7+8	9.81	19.02	26.95	42.7
9+10	7.76	15.05	26.95	33.8
			Total	181.4

[1]Calculations assume: Width of stream channel = 16 feet (from Omang and others, 1983), and

Net evaporation = free-water-surface evaporation minus precipitation (40 inches -13.05 inches = 26.95 inches)

Table 10.--*Annual volume*[1] *of ground-water loss to evapotranspiration in areas of subirrigated alluvium, 1983 water year*

Area No.	Area (square miles)	Water from subirrigation (inches)	Volume removed by subirrigation (acre-feet)
1+2	1.30	11.5	797
3+4	1.26	11.5	773
5+6	.82	11.5	491
7+8	1.27	11.5	779
9+10	.95	11.5	583
		Total	3,423

[1]Calculations assume: Consumptive use for year = 24.46 inches, precipitation during growing season = 8.75 inches, water deficit = 15.7 inches, and crops satisfied 11.5 inches of water requirement from water table and 4.2 inches from soil moisture.

Table 11.--*Calculations of average annual recharge rate for clinker and alluvium*

Area of clinker and non-subirrigated alluvium = 24.54 square miles.

Volume of annual recharge calculated as a remainder in the water-budget equation = 2,016 acre-feet

$$\text{Annual recharge rate} = \frac{(2{,}016 \text{ acre-feet})}{(24.54 \text{ square miles})} \frac{(\text{square mile})}{(640 \text{ acres})} \frac{(12 \text{ inches})}{(1 \text{ foot})} = 1.54 \text{ inches}$$

Table 12.--*Change in water storage in the Otter Creek alluvial aquifer, 1983 water year*

Well No.	Other identification No.	Date (mo-day-yr)	Water level (feet below land surface)	Change in water level (feet)	Change in storage during water-year (acre-feet)
AL-10	WO-12	09-20-82	5.69		
		09-30-83	[1] 6.21	-0.52	--
AL-12	WO-14	10-16-82	7.89		
		09-30-83	8.92	-1.03	--
AL-21	WO-08	09-20-82	15.56		
		09-30-83	[1]16.12	-0.56	--
AL-22	WO-09	09-20-82	11.57		
		09-30-83	12.92	-1.35	--
AL-23	WO-10	09-20-82	9.33		
		09-30-82	[1]10.15	-0.82	--
AL-27	WO-04	09-20-82	10.13		
		09-30-83	[1]10.85	-0.72	--
			Average change	-0.83	[2]1,325

[1]Water levels for these days were interpolated from measurements close to these days.

[2]Calculated as follows: Assume specific yield = 0.22; then average change in water = (-0.83) (0.22) = -0.18 foot.

Area of alluvium in main valley of Otter Creek plus in downstream parts of major tributaries = 11.5 square miles.

Therefore, change in storage for water year = (11.5 square miles) (640 acres per square mile) (0.18 foot) = 1,325 acre-feet.

Table 13.--*Daily specific-conductance values for Otter Creek below Fifteenmile Creek (station 06307717)*[1], *1983 water year*[2]

YELLOWSTONE RIVER BASIN

06307717 OTTER CREEK BELOW FIFTEENMILE CREEK, NEAR OTTER, MT

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1982 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: October 1982 to September 1983.

REMARKS.--Once-daily water temperatures are available in the Helena district office.

ONCE-DAILY SPECIFIC CONDUCTANCE, IN MICROSIEMENS PER CENTIMETER AT 25° CELSIUS, OCTOBER 1982 THROUGH SEPTEMBER 1983

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	---	3230	3290	3310	2920	2530	3460	3410	---	3120	---	---
2	---	3260	3380	3360	2910	2610	3460	3480	---	3140	3550	---
3	---	3250	3370	3290	3140	2790	3440	3480	---	3200	3580	---
4	---	3260	3370	3330	3290	2790	3430	3490	---	3170	---	---
5	3170	3240	3330	3090	3290	---	3440	3520	---	3120	---	---
6	3220	3250	3270	3330	3250	2900	3410	3490	3250	3080	---	---
7	3170	3180	3360	2570	3270	3020	3430	3440	3290	---	---	---
8	3170	3170	3310	2220	3130	3020	3440	3450	3300	3380	3660	---
9	3090	3190	3410	1490	3140	3170	---	3400	---	3260	3650	---
10	3160	3210	3430	2280	2870	3290	3430	3440	3290	3340	3740	---
11	3100	3250	---	2250	2870	3320	3420	3450	3230	3280	3830	---
12	3190	3370	3450	1250	---	3370	3410	3190	3300	---	3990	---
13	3260	3320	3470	1750	2620	3370	3410	3180	3250	3390	4010	---
14	3280	3500	3370	2250	2600	3380	3450	3410	3250	3470	---	---
15	3270	3520	3360	2730	2570	3400	3430	3240	3200	3410	---	---
16	3240	3450	3300	2980	---	3400	3460	3380	3250	---	4000	---
17	3230	3450	3360	2620	---	3430	3460	---	3250	3480	3980	---
18	3220	3300	3360	2950	---	3440	3490	3320	3250	3460	4010	---
19	3230	3220	3300	3430	---	3420	3480	3320	3280	3160	3930	---
20	3230	3330	3310	3030	---	3420	3480	---	---	3480	3930	---
21	3250	3330	3330	2770	1360	3400	3480	---	---	3470	3660	---
22	3280	3510	3280	2650	1350	3430	3490	---	3280	3520	3650	---
23	3290	3640	3350	3250	1640	3440	3480	---	3320	3390	3510	---
24	3270	3670	3320	3240	---	3420	---	---	3330	3440	3620	---
25	3250	3800	3190	3350	1810	3420	3560	---	3330	3400	3600	---
26	3260	3800	3250	---	2450	---	3490	---	3370	3390	3660	---
27	3150	3480	3260	---	2170	3400	3500	---	3360	---	3740	---
28	3200	3890	3320	2630	2170	3430	3440	---	3170	---	3740	---
29	3150	3560	3270	2630	---	3450	3460	---	---	---	3760	---
30	3170	3530	3210	2990	---	3440	3450	---	---	---	3750	---
31	3230	---	3280	3060	---	3470	---	---	---	---	3850	---
Mean	3210	3410	3330	2760	2610	3250	3460	3390	3280	3330	3770	

Water year 1983 Mean 3260 Maximum 4010 Minimum 1250

[1]Latitude 45°24'11", longitude 106°08'31"; drainage area 453 square miles.

[2]Number of missing days of record exceeded 20 percent of year.

Table 14.--*Daily specific-conductance values for Otter Creek at Ashland (station 06307740)*[1], *1983 water year*

YELLOWSTONE RIVER BASIN

06307740 OTTER CREEK AT ASHLAND, MT

WATER-QUALITY RECORDS

PERIOD OF RECORD.--Water years 1975 to current year.

PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: November 1980 to current year.

REMARKS.--Once-daily temperatures are available in the Helena district office.

EXTREMES FOR PERIOD OF DAILY RECORD.--
SPECIFIC CONDUCTANCE: Maximum daily, 3,440 microsiemens Dec. 16, 1982; minimum daily, 942 microsiemens Feb. 19, 1982.

EXTREMES FOR CURRENT YEAR.--
SPECIFIC CONDUCTANCE: Maximum daily, 3,440 microsiemens Dec. 16; minimum daily, 1,090 microsiemens Feb. 18.

ONCE-DAILY SPECIFIC CONDUCTANCE IN MICROSIEMENS PER CENTIMETER AT 25° CELSIUS, OCTOBER 1982 THROUGH SEPTEMBER 1983

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	2100	2810	3250	3300	1550	1650	3290	3340	3310	3090	3100	3100
2	2180	2820	3280	3310	1850	1700	3290	3360	3400	3100	3100	3090
3	2210	2830	3210	3270	1850	1760	3300	3340	3330	3110	3120	3070
4	2230	2870	3280	3230	2170	1840	3280	3340	3310	3100	3120	3070
5	2290	2830	3300	3220	2600	1960	3300	3350	3300	3100	3080	3060
6	2390	2840	3290	3150	2590	1960	3290	3370	3230	3120	3070	3060
7	2470	2860	3300	3150	2910	2020	3300	3360	3170	3110	3060	3050
8	2500	2860	3330	3180	3180	2070	3290	3350	3140	3090	3120	3040
9	2470	2840	3330	3150	3270	2110	3280	3310	3130	3090	3120	3050
10	2530	2880	3320	3150	2830	2200	3270	3380	3110	3090	3100	3030
11	2590	2880	3330	3130	2850	2280	3270	3380	3110	3110	3110	3020
12	2640	2910	3360	3120	2860	2460	3270	3280	3020	3100	3120	3000
13	2640	2960	3400	2790	2850	2460	3280	3220	2980	3090	3130	2980
14	2670	3020	3410	2120	2440	2710	3290	3220	2930	3090	3120	2970
15	2710	3110	3430	1360	1980	2760	3280	3230	2920	3090	3130	2950
16	2750	3070	3440	1570	1630	2820	3300	3230	2940	3070	3110	2950
17	2750	3070	3430	1590	1130	2850	3310	3250	2920	3070	3100	2950
18	2780	3130	3390	1610	1090	2880	3300	3220	2950	3050	3110	2960
19	2860	3170	3400	1880	1250	2920	3330	3220	2950	3030	3110	2830
20	2930	3070	3310	1880	1140	3000	3330	3280	3000	3050	3090	2810
21	2930	3020	3300	1830	1450	3050	3340	3290	3030	3040	3030	2830
22	2900	3110	3310	1860	1710	3060	3330	3280	3110	3050	2980	2800
23	2830	3170	3270	2170	1650	3050	3320	3290	3130	3040	2970	2790
24	2720	3190	3240	2180	1400	3090	3330	3300	3130	3050	2950	2790
25	2710	3300	3250	2290	1350	3150	3320	3310	3140	3070	3000	2780
26	2810	3290	3230	2550	1380	3170	3330	3320	3130	3090	3030	2750
27	2800	3370	3280	2700	1380	3170	3330	3300	3140	3070	3080	2750
28	2820	3360	3260	2650	1570	3260	3340	3320	3140	3060	3090	2710
29	2840	3360	3240	2770	---	3260	3330	3310	3110	3070	3090	2680
30	2830	3250	3360	2900	---	3280	3310	3310	3110	3070	3060	2680
31	2820	---	3360	2140	---	3310	---	3300	---	3100	3070	---
Mean	2640	3040	3320	2550	2000	2620	3300	3300	3110	3080	3080	2920

Water year 1983 Mean 2920 Maximum 3440 Minimum 1090

[1]Latitude 45°35'18", longitude 106°15'17"; drainage area 707 square miles.

Table 15.--*Regression equations relating dissolved-solids concentration*[1] *to specific conductance*[2]

Otter Creek below Fifteenmile Creek near Otter (06307717)
- Dissolved solids = 0.775 (specific conductance) + 34.6
- Number of samples = 11
- Coefficient of determination = 0.91

Otter Creek at Ashland (06307740)
- Dissolved solids = 0.784 (specific conductance) - 76.6
- Number of samples = 28
- Coefficient of determination = 0.92

Home Creek near Ashland (06307735)
- Dissolved solids = 0.714 (specific conductance) + 233
- Number of samples = 18
- Coefficient of determination = 0.88

Wells completed in the Tongue River Member of the Fort Union Formation
- Dissolved solids = 0.835 (specific conductance) - 281
- Number of samples = 95
- Coefficient of determination = 0.95

Wells completed in alluvium
- Dissolved solids = 0.889 (specific conductance) - 393
- Number of samples = 26
- Coefficient of determination = 0.98

[1]In milligrams per liter.
[2]In microsiemens per centimeter at 25° Celsius.

Table 16.--*Monthly and annual dissolved-solids loads in Otter Creek below Fifteenmile Creek (station 06307717)*[1] *and Otter Creek at Ashland (station 06307740)*[2], *1983 water year*

Dissolved-solids load, in tons												
Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Otter Creek below Fifteenmile Creek												
503.00	494.00	437.60	1712.00	1462.00	888.00	694.00	538.00	277.40	148.30	48.92	108.20	7311.42
Otter Creek at Ashland												
549.00	631.00	684.00	967.00	1833.00	1432.00	1174.00	896.00	412.00	125.90	71.80	60.70	8836.40

[1]Drainage area 453 square miles.

[2]Drainage area 707 square miles.

Table 17.--*Specific-conductance and dissolved-solids data for alluvial wells and springs*

[mg/L, milligrams per liter; microsiemens, microsiemens per centimeter at 25° Celsius]

Well No.[1]	Location No.	Other identification No.	Subarea No.	Specific conductance (microsiemens)	Dissolved-solids concentration (mg/L)
*AL- 1	03S44E11DAAA01	OC83-2	2	1,540	1,003
*AL- 2	03S44E11DAAC01	OC83-3	2	2,320	1,650
*AL- 3	03S44E11DACB01	OC83-6	2	2,860	2,200
AL- 4	03S45E16DDDC01	OC83-5	3	2,100	1,410
AL- 5	02S46E32ABCC01	Spring	3	2,390	1,670
AL- 6	03S45E12BDCB02	PRIV-12	3	1,880	1,410
AL- 7	03S45E12BDCD01	Spring	3	1,450	984
AL- 8	03S46E14CBCD01	PRIV-14	3	1,940	1,410
*AL- 9	04S45E10CCBC01	OC-8	5	3,260	2,460
*AL-10	04S45E04BADD01	WO-12	6	3,340	2,590
*AL-11	04S45E04BDAA01	WO-13	6	3,100	2,400
*AL-12	04S45E04BDDB01	WO-14	6	4,200	3,340
*AL-13	04S45E04BDDB02	WO-15	6	4,010	3,100
*AL-14	04S45E04CAAC01	WO-16	6	3,100	2,260
*AL-15	04S45E04DBDB01	PRIV-4	6	3,000	1,950
*AL-16	04S45E09DCAA01	OC-2A	6	3,420	2,600
*AL-17	04S45E15BCDD01	OC-6	6	4,050	3,110
AL-18	05S46E04DACA01	PRIV-4	7	2,560	1,670
*AL-19	04S45E27DBAB01	PRIV-27	8	2,700	1,960
AL-20	05S45E23ABDA03	WO-7	9	3,350	2,510
*AL-21	05S45E23ABCA01	WO-8	9	4,720	4,020
*AL-22	05S45E23ABCA02	WO-9	9	5,400	4,430
*AL-23	05S45E23ABCB01	WO-10	9	4,600	3,760
AL-24	05S46E20CDAB01	PRIV-20	9	3,640	2,940
AL-25	05S46E24BCCB01	PRIV-24	9	2,360	1,890
AL-26	05S46E29ABAA01	PRIV-29	9	2,650	2,080
*AL-27	05S45E23BBAA04	WO-4	10	3,800	2,960

[1]An asterisk denotes wells completed in the subirrigated part of the alluvial aquifer. The median dissolved-solids concentration in these wells is 2,590 milligrams per liter.

Table 18.--*Specific-conductance and dissolved-solids data for wells and springs in the Tongue River Member of the Fort Union Formation*

[mg/L, milligrams per liter; microsiemens, microsiemens per centimeter at 25° Celsius]

Well or spring No.	Location No.	Other identification No.	Sub-area No.	Specific conductance (microsiemens)	Dissolved-solids concentration (mg/L)
TR- 1	03S45E19DDBC02	PRIV-19	2	1,600	834
TR- 2	03S45E19DDBD01	PRIV-19	2	1,600	866
TR- 3	03S44E36DACA01	OC83-1	2	5,000	3,530
TR- 4	03S45E03BADD01	Coal Creek Mine well	3	4,600	3,540
TR- 5	03S45E10BACD01	Coal Creek well	3	2,030	1,280
TR- 6	03S45E22BBBA01	PRIV-22	3	1,900	1,130
TR- 7	03S45E22BAAB01	PRIV-22	3	2,400	1,490
TR- 8	03S45E15DDDA01	PRIV-15	3	2,400	1,360
TR- 9	03S45E14CCAB01	Red Shale Camp well	3	1,650	1,150
TR-10	03S45E23DADA01	PRIV-23	3	1,400	737
TR-11	03S45E26ADAC01	DH74-104	3	4,720	3,630
TR-12	03S45E26DBCB01	DH74-102	3	4,170	3,430
TR-13	03S45E33CBDA01	Shy flowing well	3	1,480	882
TR-14	03S45E34CACD01	DH74-101	3	6,160	5,500
TR-15	03S45E34AACD01	DH74-103	3	5,600	4,230
TR-16	02S45E36ACBA01	Spring	3	1,960	1,340
TR-17	02S46E33CCBA01	Spring	3	1,700	1,160
TR-18	02S46E34BCCB01	PRIV-34	3	3,450	2,900
TR-19	03S45E01ABDD01	Spring	3	2,300	1,790
TR-20	03S46E06CCBD01	PRIV-6	3	1,210	875
TR-21	03S46E05AABB01	PRIV-5	3	1,460	949
TR-22	03S46E05AABB02	PRIV-5	3	1,235	852
TR-23	03S46E04CDBB01	Spring	3	5,400	4,190
TR-24	03S45E12BDCB01	PRIV-12	3	1,790	1,320
TR-25	03S46E07ADBB01	Coal mine project well	3	5,200	3,030
TR-26	03S45E13DCBC01	PRIV-13	3	4,000	2,690
TR-27	03S46E18BDAC01	Coal Bank Spring	3	4,510	3,460
TR-28	03S46E17DBDC01	PRIV-17	3	3,000	2,030
TR-29	03S46E16ADCC01	Wiechman well	3	5,370	4,140
TR-30	03S46E15CAAA01	PRIV-15	3	2,400	1,730
TR-31	03S46E14DBBD01	Spring	3	2,870	2,060
TR-32	03S45E24ACDA01	PRIV-24	3	3,700	2,700
TR-33	03S46E19BBBB01	PRIV-19	3	5,000	4,260
TR-34	03S46E19BBAB01	PRIV-19	3	4,940	4,210
TR-35	03S46E19ACBA01	Coleman well	3	2,870	2,210
TR-36	03S46E30BCCC01	Thomas Draw well	3	5,250	4,500
TR-37	03S45E31DCDA01	PRIV-31	4	4,400	3,480
TR-38	03S45E32DDAC01	PRIV-32	4	1,400	846

Table 18.--*Specific-conductance and dissolved-solids data for wells and springs in the Tongue River Member of the Fort Union Formation*--Continued

Well or spring No.	Location No.	Other identification No.	Subarea No.	Specific conductance (microsiemens)	Dissolved-solids concentration (mg/L)
TR-39	04S45E06DBDB01	US77-23	4	1,560	930
TR-40	04S45E07CABA01	OC-30	4	8,600	6,240
TR-41	03S45E34DDDA01	DH74-105	5	5,600	3,890
TR-42	03S45E35DABA01	DH75-108	5	3,300	2,260
TR-43	04S45E02BDDD01	DH74-106	5	2,820	1,840
TR-44	04S45E02DACD01	DH74-107	5	1,930	1,250
TR-45	04S45E02CDDB01	PRIV-2	5	2,470	1,860
TR-46	03S46E33CBDA01	Spring	5	1,750	893
TR-47	03S46E34DDCD01	Stafford Spring	5	3,900	2,940
TR-48	04S46E05BCBC01	Threemile well	5	1,780	1,210
TR-49	04S46E05CCAA01	PRIV-5	5	2,500	1,980
TR-50	04S46E09BBCA01	Middle Pasture well	5	1,580	1,010
TR-51	04S46E11BBBA01	Stafford well	5	2,390	1,770
TR-52	04S45E15DBBC01	PRIV-15	5	2,300	1,460
TR-53	04S45E14CDCC01	OC83-4	5	1,060	662
TR-54	04S46E08CBCC01	McLatchy Draw well	5	5,150	3,770
TR-55	04S46E10DABC01	Nutter well	5	2,660	1,960
TR-56	04S45E04DBCA01	PRIV-4	6	1,250	669
TR-57	04S45E19DADC01	Newell Creek well	6	4,250	3,000
TR-58	04S45E20CCAD01	PRIV-20	6	2,600	1,840
TR-59	04S45E22ADCC01	PRIV-22	7	1,520	910
TR-60	04S45E23CCCB01	PRIV-23	7	1,010	613
TR-61	04S46E29CBBA01	Coal Creek Spring	7	5,670	5,010
TR-62	04S46E28DABC01	Mineral Yager Spring	7	5,720	5,250
TR-63	04S46E28DADC01	Spring	7	5,500	5,210
TR-64	04S46E31CCCC01	PRIV-31	7	2,210	1,520
TR-65	04S46E31DDBC01	PRIV-31	7	5,550	3,300
TR-66	04S46E32DCDC01	PRIV-32	7	2,240	1,470
TR-67	04S46E34ABDB01	Newcomer Spring	7	5,400	4,760
TR-68	05S46E05BDCB01	PRIV-5	7	2,060	1,500
TR-69	05S46E04DDAB01	PRIV-4	7	2,200	1,700
TR-70	05S46E09DADD01	Coombe Spring	7	2,320	1,680
TR-71	04S45E30DDBB01	Gene Creek Spring	8	1,790	1,350
TR-72	04S45E28BDDD01	US77-25	8	2,290	1,310
TR-73	04S45E28ADDA01	PRIV-28	8	4,100	3,070
TR-74	04S45E27DBBA02	PRIV-27	8	988	582
TR-75	04S45E27ACCD01	PRIV-27	8	890	596
TR-76	04S45E32CADC01	Spring	8	2,600	2,070
TR-77	05S45E06DAAD01	Chromo Spring	8	1,590	1,280
TR-78	05S45E04BBDD01	PRIV-4	8	960	610
TR-79	05S45E04ABCC01	US77-26	8	3,000	2,020
TR-80	05S45E03ACBA01	PRIV-3	8	1,630	1,110

Table 18.--*Specific-conductance and dissolved-solids data for wells and springs in the Tongue River Member of the Fort Union Formation*--Continued

Well or spring No.	Location No.	Other identification No.	Subarea No.	Specific conductance (microsiemens)	Dissolved-solids concentration (mg/L)
TR-81	05S45E23ABDA01	WO-5	9	760	477
TR-82	05S45E23ABDA02	WO-6	9	1,780	1,150
TR-83	05S46E20ABCA01	Willey Use Spring	9	3,000	2,470
TR-84	05S46E21DDAA01	PRIV-21	9	2,300	1,770
TR-85	05S46E27BAAA01	Smith Spring	9	4,300	3,970
TR-86	05S45E08BDDD01	Brian Spring No 3	10	1,820	1,310
TR-87	05S45E11CDCD01	PRIV-11	10	2,300	1,430
TR-88	05S45E18BDAD01	Upper Brian Spring	10	3,400	2,770
TR-89	05S45E18AACC01	Little Brian Spring	10	2,050	1,530
TR-90	05S45E18AACD01	Brian Spring No. 2	10	3,220	2,620
TR-91	05S45E16ADDD01	OC83-7	10	900	581
TR-92	05S45E23BBAA01	WO-1	10	860	535
TR-93	05S45E23BBAA02	WO-2	10	1,070	667
TR-94	05S45E23BBAA03	WO-3	10	3,400	2,510
TR-95	05S45E28BBBA01	Upper Paget well	10	1,950	1,100

Table 19.--*Annual pre-mining dissolved-solids load from bedrock aquifers*

Subarea No.	Discharge (cubic feet per day)	Annual discharge (acre-feet)	Dissolved-solids concentration (milligrams per liter)	Annual load (tons)
1	7,300	61	[1]1,750	145
2	7,300	61	1,360	113
3	11,780	99	2,070	278
4	17,200	144	2,030	397
5	17,250	144	1,710	335
6	15,960	134	1,540	280
7	19,150	160	2,180	474
8	13,100	110	1,210	181
9	22,050	185	1,570	395
10	9,180	77	1,280	134
			Total	2,732

[1]Used area log mean value.

Table 20.--*Saturated-paste-extract data*[1]

[mg/L, milligrams per liter; microsiemens, microsiemens per centimeter at 25° Celsius]

Well No.	Location No.	Other identification No.	Sub-area No.	Interval (feet below land surface)	Number of samples	Specific conductance[2] (microsiemens	Dissolved-solids[3] concentrations (mg/L)
TR- 3	03S44E36DACA01	OC-83-1	2	0-60	2	5,900	4,270
TR- 14	03S45E34CACD01	DH74-101	3	0-98	5	4,175	2,960
TR- 15	03S45E34AACD01	DH74-103	3	0-50	4	6,040	4,380
TR- 53	04S45E14CDCC01	OC-83-4	5	0-150	4	5,770	4,170
TR- 91	05S45E16ADDD01	OC-83-7	10	0-175	6	3,660	2,570
TR- 97	04S45E09CDAC01	80-OC-1	6	3-137	25	4,670	3,340
TR- 98	04S45E21DDCC01	80-OC-31	8	0-120	22	2,410	1,610
TR- 99	04S45E07BCAA01	80-OC-35	4	13-316	59	4,580	3,270
TR-100	04S45E22BBCB01	80-OC-55	6	0-101	16	4,360	3,100
TR-101	04S45E21ACDA01	80-OC-33	6	42-216	27	2,960	2,030
TR-102	03S45E08DCB 01	Montco 3458-3C	3	15-79	9	1,960	1,270
TR-103	05S45E12BDB 01	DH76-101 (Dam Creek)	9	0-50	4	2,745	1,870
TR-104	04S45E26BDCD01	DH76-101	7	0-62 157-212	5	2,050	1,340
TR-105	05S45E04BADD01	DH77-101 (Chromo 4)	8	0-50	4	7,375	5,400
TR-106	04S45E28BDDD02	DH78-101 (Newell 28)	8	0-113	7	2,085	1,370
TR-107	04S45E06DBDA01	DH78-101 (Shy 6)	4	0-121	6	3,050	2,100
TR-108	03S45E09CDDA01	State 30	3	0-245	46	2,250	1,490
TR-109	03S44E25BDCC01	State 55	2	0-170	34	1,510	930
TR-110	03S44E36DBCD01	State 31	2	0-245	49	2,860	1,960
TR-111	03S45E26DBCC01	State 140 (A-1)	3	0-145	22	4,570	3,260
TR-112	03S45E34DBDC01	State 141	3	0-205	40	2,710	1,840
TR-113	04S45E03BDBD01	State 142	5	0-170	33	1,970	1,280
TR-114	04S45E26CCAD01	State 62	7	0-65	10	560	205
TR-115	05S45E04BBDC01	State 61	8	0-135	26	1,600	997
TR-116	05S45E12ACCC01	State 60	9	0-95	19	2,740	1,860
TR-117	05S45E16ACDA01	State 36	10	0-125	22	2,580	1,740

[1]Saturated-paste extract data from Montana Department of State Lands, Montana Bureau of Mines and Geology, and U.S. Geological Survey.

[2]All specific-conductance values are weighted means (by thickness of overburden sample).

[3]Dissolved solids calculated by equation: Dissolved solids = 0.762 (specific conductance) -222. The regression equation was derived from 15 samples of overburden leachate water from the Otter Creek area. Coefficient of determination for the equation is 0.998.

Table 21.--*Annual post-mining dissolved-solids loads from mine spoils*

Sub-area No.	Width of mined area (percent of total width)	Annual discharge from mine spoils (acre-feet)	Additional post-mining concentration[1] of dissolved solids from mine spoils (milligrams per liter)		Additional post-mining annual load[2] from mine spoils (tons)	
			Minimum	Maximum	Minimum	Maximum
1	66	40	840	1,970	46	107
2	36	22	840	1,970	25	59
3	58	57	840	1,970	65	153
4	100	144	840	1,970	164	386
5	100	144	840	1,970	164	386
6	100	134	840	1,970	153	359
7	100	160	840	1,970	183	428
8	100	110	840	1,970	126	294
9	100	185	840	1,970	211	495
10	100	77	840	1,970	88	206
				Totals	1,225	2,873

[1]Post-mining concentrations: minimum values from batch-mixing data and maximum values from saturated-paste-extract data.

[2]The factor for converting the product of acre-feet and milligrams per liter to tons is 0.001359.

Table 22.--*Specific-conductance and dissolved-solids data from batch-mixing tests* [1]

[mg/L, milligrams per liter; microsiemens, microsiemens per centimeter at 25° Celsius]

Well No.	Location No.	Other identification No.	Sample interval (feet below land surface)	Specific conductance (microsiemens)	Dissolved solids concentration (mg/L)[2]
TR-3[3]	03S44E36DACA01	OC83-1	0-60	5,990 [5]5,025	4,360 [5]3,610
TR-53[3]	04S45E14CDCC01	OC83-4	0-60 60-150	3,375 2,050 [5]1,375	2,360 1,300 [5]642
TR-91[4]	05S45E16ADDD01	OC83-7	0-60 60-115 115-175	2,480 1,820 1,460 [5]935	1,630 1,240 894 [5]559

[1]Mixing ratio for samples was 2:1 by weight (water:material).

[2]Dissolved-solids concentrations of water from the batch-mixing tests were greater than those from the aquifer water. Weighted-mean concentrations increased by: 750 milligrams per liter for TR-3, 1,080 milligrams per liter for TR-53, and 700 milligrams per liter for TR-91 (average increase 840 milligrams per liter).

[3]Water from Knobloch coal aquifer.

[4]Water from sandstone aquifer.

[5]Denotes values from aquifer water.

Table 23.--*Annual and monthly post-mining dissolved-solids loads in Otter Creek at Ashland (station 06307740)*

[mg/L, milligrams per liter]

Month	Median discharge[1] (acre-feet)	Mean dissolved solids concentration[2] (mg/L)	Mean load (tons)	Additional load from mining (tons)		Mean post-mining load (tons)[3]		Post-mining dissolved-solids concentration at median flow (milligrams per liter)		Percent increase in dissolved solids load at median flow	
				Minimum	Maximum	Minimum[4]	Maximum[4]	Minimum	Maximum	Minimum	Maximum
Jan.	262	2,130	758	104.0	244.0	862	1,002	2,420	2,810	14	32
Feb.	550	1,940	1,450	94.0	220.4	1,544	1,670	2,060	2,230	6	15
Mar.	546	1,640	1,217	104.0	244.0	1,321	1,461	1,780	1,970	9	20
Apr.	440	2,200	1,316	100.7	236.1	1,417	1,552	2,370	2,600	8	18
May	337	2,220	1,017	104.0	244.0	1,121	1,261	2,450	2,750	10	24
June	298	2,300	931	100.7	236.1	1,032	1,167	2,550	2,880	11	25
July	136	2,230	412	104.0	244.0	516	656	2,790	3,550	25	59
Aug.	41	2,110	118	104.0	244.0	222	362	3,980	6,500	89	208
Sept.	48	2,040	133	100.7	236.1	234	369	3,590	5,660	76	177
Oct.	133	1,990	360	104.0	244.0	464	604	2,570	3,340	29	68
Nov.	195	2,130	564	100.7	236.1	665	800	2,510	3,020	18	42
Dec.	212	2,460	709	104.0	244.0	813	953	2,820	3,310	15	35
Totals	3,198		8,985	1,225	2,873	10,210	11,858				

[1]Period of record for discharge values is Oct. 1975 through Feb. 1984.

[2]Calculated from mean monthly specific conductance, in microsiemens per centimeter at 25° Celsius; period of record for specific-conductance values is Oct. 1975 through July 1984 (regression equation in table 15).

[3]The factor for converting the product of acre-feet and milligrams per liter to tons is 0.001359.

[4]Values do not exactly sum to total because of rounding.

UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT

powder river

DRAFT ENVIRONMENTAL IMPACT STATEMENT

coal 1984

United States Department of the Interior
Bureau of Land Management

DRAFT
ENVIRONMENTAL IMPACT STATEMENT
for
ROUND II COAL LEASE SALE
in the
POWDER RIVER REGION

Hillary A. Oden
WYOMING STATE DIRECTOR

January 1984

DRAFT EIS FOR 1984 COAL LEASE SALE
POWDER RIVER REGION

Lead Agency: Bureau of Land Management, U.S. Department of the Interior

Cooperating Agency: Forest Service, U.S. Department of Agriculture

Type of Action: Administrative

Abstract:

This statement assesses the environmental consequences of five alternatives for new leasing of coal. The new leasing alternatives range from leasing 9 tracts (0.997 billion tons) to leasing 22 tracts (4.515 billion tons). A sixth alternative, the "no action" alternative, also is included. The "no action" alternative includes seven coal exchanges: I-90 exchanges for Big Horn Coal, Gulf, Belco, and Kerr-McGee; an alluvial valley floor exchange for Whitney Benefits/Peter Kiewit Sons; and exchanges from Northern Cheyenne legislation for Peabody Coal Company and Consolidation Coal Company. The "no action" alternative also includes 67 preference right lease applications totaling 15 mine units and the existing mining operations listed in appendix B.

The statement assesses impacts that would result from additional federal coal leasing and development and cumulative impacts from the exchanges and preference right lease applications. The counties for which impacts are assessed are Campbell, Converse, Crook, Johnson, Natrona, Sheridan, and Weston in Wyoming and Big Horn, Powder River, and Rosebud in Montana.

Further information regarding this statement or the alternatives may be obtained from the address below. Comments, which will be accepted until April 30, 1984, should be addressed to:

Mr. Charles Wilkie, Team Leader
Bureau of Land Management
951 Rancho Road
Casper, Wyoming 82601

This draft environmental impact statement will be available to the EPA and the public February 29, 1984.

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SUMMARY

INTRODUCTION

This draft environmental impact statement analyzes the environmental impacts of the proposed competitive leasing of 22 federal surface minable coal lease tracts in the Powder River Coal Region. This is the second round of federal coal leasing in this region.

The Department of the Interior, through the Bureau of Land Management, periodically conducts competitive coal lease sales to ensure that adequate coal supplies are available to meet national long-term energy requirements and that adequate reserves are available to continue existing production. The Secretary of the Interior established a leasing level range of 1.2 to 4.85 billion tons of recoverable coal for this round of leasing in the Powder River Coal Region on April 29, 1983.

The Powder River Coal Region includes parts or all of Natrona, Converse, Johnson, Campbell, Sheridan, Crook, and Weston counties in Wyoming and Rosebud, Big Horn, and Powder River counties in Montana. Proposed federal coal leasing would occur primarily in Campbell County, Wyoming, and in Rosebud and Big Horn counties in Montana.

RECOMMENDATION

The Bureau of Land Management recommends that Alternative 5 be selected as the preferred alternative. Analysis of the 17 tracts in this alternative indicates that 8 of the 17 would be maintenance tracts for the perpetuation of existing coal mining operations. Total recoverable tonnage from this alternative equals about 2.6 billion tons. That amount is well within the recommended leasing level range of 1.2 to 4.85 billion tons. With this alternative, impacts such as high population increase, water consumption, and air pollution associated with the proposed coal-fired generator in the Mud Springs tract would be avoided.

ISSUES

Issues and alternatives were discussed and formulated by the Powder River Regional Coal Team in June 1983. No new alternatives or issues within the scope of this environmental impact statement (EIS) were indentified during the public scoping process, but existing issues were expanded, with concerns about specific areas or resource conflicts being raised. Major areas of concern or controversy raised during the public scoping period were reclamation and revegetation, air quality, water quality and quantity, population increases, socioeconomic impacts to Indian reservations, land use, and impacts to ranch operations, economics, and social values.

ALTERNATIVES

Six alternatives are addressed in this EIS: the "no action" alternative and five alternatives with different leasing levels in which from 9 to 22 tracts would be offered in a proposed 1984 lease sale.

The leasing alternatives include various mitigation requirements, which are considered parts of the proposed federal actions under all alternatives.

The "no action" alternative would not offer federal coal for competitive leasing. Both coal-related activities and activities not related to coal would continue to occur within the region without new federal leasing. These activities include natural population growth, maintenance of existing industrial operations, and development of new operations where resources were previously committed. Taken together, these activities constitute the "baseline," which is a projection of overall development trends until the year 2000 without additional federal coal leasing.

Current energy-related industrial developments included in the baseline are listed in appendix B.

Alternative 2 proposes the leasing of 9 tracts, 3 in Wyoming and 6 maintenance tracts in Montana. A total of 997 million tons of recoverable coal reserves would be offered for sale.

Under Alternative 3, a total of 11 tracts would be offered for leasing—3 in Wyoming and 8 in Montana. The 11 tracts contain 1.384 billion tons of recoverable coal reserves. This alternative proposes leasing the Wyoming tracts included in Alternative 2, the Montana maintenance tracts, and 2 competitive tracts in Montana.

Alternative 4 proposes leasing 15 tracts, 6 in Wyoming and 9 in Montana. A total of 2.297 billion tons of recoverable coal reserves would be offered for sale.

Alternative 5 would offer 17 tracts for competitive leasing, 8 in Wyoming and 9 in Montana. The 17 tracts contain a total of 2.605 billion tons of recoverable coal. The same number of Montana tracts would be offered as in Alternative 4; however, the Mud Springs tract in Alternative 4 was replaced in Alternative 5 by the Hanging Woman tract.

Alternative 6, the maximum alternative, proposes leasing 22 tracts, 11 in Wyoming and 11 in Montana. A total of 4.515 billion tons of recoverable coal would be offered for sale under this alternative.

MAJOR CONCLUSIONS

Overall Impacts

Analysis of the region indicates that new federal coal leasing would cause no significant impacts to the following resources under any alternative: climate, physiographic provinces, geologic structure, floodplains, threatened or endangered plant species, prime farmland, wilderness or wilderness study areas, recreation, areas of critical environmental concern, or wild and scenic rivers.

Resources that would incur one or more significant impacts are air quality; geology; topography, and minerals, water; vegetation; wildlife; visual; land use; economics; social values; and transportation facilities.

Impacts in Wyoming would be centered in the urbanized communities of Sheridan in Sheridan County and Gillette in Campbell County. Sheridan has been experiencing energy-related impacts due to coal mine development principally in Montana for the past 10 to 15 years. Similar impacts in Gillette have stemmed from coal and from oil and gas exploration and production in Campbell County and surrounding areas.

Impacts in Montana would be continued in the communities of Colstrip and Ashland. Additional impacts would occur on either side of the rural Decker area. Unlike Wyoming communities, the Montana communities, with the exception of Colstrip, have experienced very little growth over the past decade. Therefore, social and economic impacts caused by increased population would affect this subregion heavily. The Northern Cheyenne and Crow Indian reservations also could experience impacts.

All the alternatives, including the "no action" alternative, would further diversify the economic base within the region. The trend is well established in Wyoming but would create a shift in economic base in Montana, where agriculture has contributed a significant part of the economic base.

Coal leasing in Sheridan County would help relieve the impact to Sheridan caused by miners working in Montana and living in Sheridan. Development of new coal mines in Sheridan County would provide a source of revenue to offset coal-related impacts from out-of-state mining.

Geology and Other Minerals

Coal, oil and gas, and uranium exist in economic quantities within the region. Uranium activities have declined since 1980 and have presented very few conflicts to coal development. Coal production generally does not interfere with extraction of oil and gas. However, as exploration and development of the two resources expand, individual conflicts do occur. These conflicts are lessened by thorough land use planning constraints that minimize chances for the conflict to occur. The BLM's strategy has been not to develop regulations on this issue but to maintain sufficient flexibility in administration to allow industry representatives to resolve the conflicts themselves.

Water Resources

The impacts on water resources resulting from new federal leasing would be very small regionally. The loss of shallow aquifers would extend over more than 400,000 acres by 1990 under Alternative 5. Water from shallow aquifers generally is of poor quality, with dissolved solids ranging from 3,000 to 5,000 milligrams per liter, although water more suitable for human use is available. Increased costs for new well construction and greater pumping lifts are associated with the loss of shallow aquifers.

Air Quality

Air pollution from mining and indirect development would be local and would not significantly affect air quality except in the vicinity of coal lease tracts. No federal air quality standards would be violated under any of the alternatives. State standards might be violated or marginally

violated on or near the Thunder Basin National Grassland in Wyoming and in the Decker area of Montana. Significant impact to the Class I air quality area on the Northern Cheyenne Indian Reservation has not been forecast.

Soils, Vegetation, and Reclamation

Soils in the area are often shallow, although slopes are generally gradual on a rolling type terrain. Reclamation potential is good, and reclamation would be successful, although it might require intense and costly management on particular areas.

Wildlife

Leasing and development of federal coal would create major impacts on local populations of wildlife, but minor effects on regional populations. Antelope would be affected most heavily in the area around Gillette, Wyoming, where existing mining operations are restricting animal movement and disturbing habitat. Impacts to mule deer would not be significant regionally. Populations of sharp-tailed grouse and sage grouse would be affected locally.

Cultural Resources

Federal and state regulations protect cultural resources. Historic and architectural resources on private land might not be protected unless steps are taken by local governments or private citizens.

Land Use

Lands within this region are administered and controlled by a variety of governmental jurisidctions, each of which exercises a different level of land use planning, development, and control of the use of resources. About 85% of the region's ownership is "split estate"; that is, private surface ownership with federally controlled minerals.

Land use patterns are expected to shift from agriculture toward mining and urbanization, without new federal coal leasing, and implementation of the preferred alltternative would influence this very little. Thirty-seven landowners not related to energy who operate within the boundaries of tracts would be affected. Documented analysis (Moore 1983) suggests that land values of farms and ranches have been enhanced by coal mines in the vicinity.

Transportation Facilities

Wyoming has adequate highway capacity to handle the increas in traffic volume that would result from the alternatives. Required maintenance would be expected to fall behind because of increased use by maximum weight vehicles.

Montana's highway system is adequate in the Colstrip area but would require major upgrading in the Ashland and Decker areas. Highways of major concern include U.S. Highway 212 from Crow Agency to Ashland, and Montana secondary road 314 from U.S. 212 to Decker.

Railroad traffic would increase by 50 unit trains per day on the main line leaving the region. This traffic would be divided among the three rail lines. Forty-five miles of new rail spur line would be constructed.

Sociology and Economics

Increases in population are expected with or without new federal coal leasing. The fiscal impact to communities in Wyoming would be be significant but could be beneficial in Sheridan's case. Impacts to Montana communities would be significant, and increases in Northern Cheyenne and Crow Indian reservation populations would be expected. Most of these impacts could be mitigated, but only through strong committment and assistance from both federal and state governments.

UNAVOIDABLE COMMITMENTS

Coal included in Alternatives 2 through 6 (up to 4.5 billion tons) would be consumed if developed; therefore, it would not be available for later use.

Existing soil profiles and natural plant communities would be destroyed on between 20,000 and more than 100,000 acres, depending on which leasing alternative was selected. Mining would impair or destroy 275 to 425 wells and 25 to 49 springs, and shallow aquifers would be impaired

at the magnitude of 20,000 to 100,000 acres, depending on the alternative selected.

Construction of 5 to 65 miles of new rail spur would be required under the leasing alternatives. Mining under the leasing alternatives would destroy 20,000 to 100,000 acres of wildlife habitat in the short term; wildlife habitat diversity would be lost at the same rate for the short term; and loss of topographic divesity would cause irreversible loss of cover for wildlife.

If one of the leasing alternatives was selected, mining would bring about the salvage of identified cultural sites; however, these sites, once mined, would not be available for future study, when advanced techniques might be developed. Visual resources would be unavoidably altered by dominance of the landscape by mining activities and structures. Irreversible impacts to the landscape character would be the rounding and smoothing of rugged topographic areas.

Air quality would be unavoidably impaired by the generation of fugitive dust produced by surface mining if a leasing alternative was selected, and increased rail traffic would cause an increased delay for automobile traffic at at-grade crossings.

Increases in regional population would be unavoidable under the leasing alternatives, with the amount of increase dependent on the alternative selected. Impacts due to population increases would increase proportionately.

Adverse effects on social structure such as transience, impersonalization, social fragmentation, and conflicts between new and longtime residents would occur at a level dependent on the population change related to the leasing alternative selected.

ABBREVIATIONS

AVF	Alluvial valley floor
BIA	Bureau of Indian Affairs, U.S. Department of the Interior
BLM	Bureau of Land Management, U.S. Department of the Interior
Btu	British thermal unit
CFR	Code of Federal Regulations. Numbers refer to title and part; that is, 43 CFR 4100 refers to title 43, part 4100.
cfsm	Cubic feet per second per square mile
CONSOL	Consolidation Coal Company
dBA	"A" weighted decibels
DEQ	Department of Environmental Quality, Wyoming
DSL	Department of State Lands, Montana
EA	Environmental assessment. A record of the environmental factors involved in a land management action.
EIS	Environmental impact statement. A written analysis of the impacts of a proposed project and alternatives.
EPA	U.S. Environmental Protection Agency
ETSI	Energy Transportation Systems, Inc.
FCLAA	Federal Coal Leasing Amendments Act of 1976
FLPMA	Federal Land Policy and Management Act of 1976
FS	Forest Service, U.S. Department of Agriculture
gpm	Gallons per minute
GS	Geological Survey, U.S. Department of the Interior
MFP	Management framework plan. A BLM land use planning document.
mg/l	Milligrams per liter
NAAQS	National ambient air quality standards
NEPA	National Environmental Policy Act of 1969
NPRC	Northern Plains Resource Council
OSM	Office of Surface Mining Reclamation and Enforcement, U.S. Department of the Interior
ppm	Parts per million
PRLA	Preference right lease application (defined in chapter 1)
PSD	Prevention of significant deterioration
SCS	Soil Conservation Service, U.S. Department of Agriculture
SMCRA	Surface Mining Control and Reclamation Act of 1977
TDS	Total dissolved solids
Tract Profile	See beginning of the Reference section
TSP	Total suspended particulates
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFWS	U.S. Fish and Wildlife Service, Department of the Interior
VQO	Visual Quality Objective. A classification used by the Forest Service in its visual management system.
VRM	Visual resource management. A BLM program to protect scenic values and reduce the impact of development activities.

CHAPTER 1: PURPOSE OF AND NEED FOR THE ACTION

COAL LEASE SALES

Purpose

The federal coal management program is administered by the Department of the Interior through the Bureau of Land Management (BLM). The program provides for competitve leasing of federal coal to ensure that adequate coal supplies are available to meet national long-term energy requirements and that sufficient reserves are available to continue existing production.

The Secretary of the Interior on April 29, 1983, established a leasing level range of 1.2 to 4.85 billion tons of recoverable reserves for proposed secound round of coal leasing in the Powder River Region. Only federal coal is included in that leasing level.

The leasing level was established after analysis of potential production from planned and existing coal mines in the region and the projected demand for coal. This level was selected to ensure that sufficient coal resources would be offered to enhance industry competition. The selection of this level was based in part on new expressions of interest from industry totaling 3.1 billion tons, plus expressions totaling 3.4 billion tons "recycled" from the first round (1982) coal lease sale. To meet the leasing level established for the Powder River Region, the alternatives described in this document propose offering between 9 and 22 tracts for competitive leasing in 1984.

Need

The need for additional federal coal leasing is discussed in depth in the *Final Environmental Statement: Federal Coal Management Program* (USDI, BLM 1979a). Benefits of coal leasing defined in that study include greater assurance of meeting national energy objectives, significant legal and administrative advantages, and improvement of the state of competition in the Western coal industry. Another benefit mentioned is the promotion of more desirable patterns of coal development with the potential to reduce production costs and environmental impacts.

Overall guidance for the leasing process is provided by the Powder River Regional Coal Team, which is chaired by the BLM state director from Oregon. Other members of the team are the BLM state directors from Montana and Wyoming and representatives of the governors of Montana and Wyoming.

A detailed discussion of methodologies for determining coal leasing levels may be found in the leasing level paper attached to the regional coal team's leasing level recommendation of February 14, 1983. The paper is included in the minutes of the Powder River Regional Coal Team's meeting, which are available at the BLM's Wyoming State Office, 2515 Warren Avenue, Cheyenne, Wyoming 82001.

Factors considered in establishing the leasing level are productive capacity, inventory, contracting rate, expressions of interest, past sales, and minimum leasing. The inventory method yielded a leasing level of 1.4 to 3.8 billion tons; the contracting rate method indicated a range of 0.65 to 1.65 billion tons. Expression of interest methodology indicated a range of 2.5 to 3.1 billion tons, and a mimimum leasing methodology indicated a range of 1.4 to 2.4 billion tons.

Although there are some indications of a decrease in the market demand for reserves, industry has continued to express a significant level of interest in leasing federal coal in this region. A memorandum from the director of the Bureau of Land Management dated March 17, 1983, expresses the opinion that a leasing level of 1.2 to 4.85 billion tons of recoverable reserves will satisfy the demand, increase competition within the region, address the nation's energy needs, and provide for an inventory of leased reserves to accommodate any unforseen needs.

Background

The federal coal management program establishes coal production regions in the United States and provides for sales of coal leases in those regions to help meet the nation's projected energy demands. The area dealt with in this EIS is the Powder River Coal Region, which comprises all or parts of Natrona, Converse, Johnson, Campbell, Sheridan, Crook, and Weston counties in northeastern Wyoming and Rosebud, Big Horn, and Powder River counties in southeastern Montana. The coal region is portrayed on the Location map in the front of this document and the Regional Activity map in the back pocket.

Purpose and Need

The EIS for the first round of Powder River Coal Region leasing, the *Final Powder River Regional Coal Environmental Impact Statement* (USDI, BLM 1981b), was released in December 1981. Twelve tracts were sold in 1982, and leases have been issued for all of them. However, litigation was filed by the National Wildlife Federation and the Northern Cheyenne Indian Tribe against the leasing action. The complaints contended that land use planning had not been adequate and that effects on the Northern Cheyenne Indian Tribe had not been considered. A ruling is still pending on that litigation.

The Northern Plains Resource Council, in affiliation with the Tongue River Agricultural Protection Association, the Rosebud Protection Association, and the Tri-County Ranchers' Association, filed a petition alleging that certain lands in Rosebud and Powder River counties, Montana, were unsuitable for surface coal mining. That petition (Tongue River Petition, December 1980) was filed under section 522 of the Surface Mining Control and Reclamation Act of 1977. A petition evaluation document releasing in January 1982 by the Office of Surface Mining Reclamation and Enforcement (OSM), U.S. Department of the Interior, denied the petition.

In preparation for the second round of federal coal leasing in this region, the Powder River Regional Coal Team has held public meetings to consider the various phases of the process that has led to the publication of this EIS.

The federal coal leasing program is fully described in the *Federal Coal Management Regulations* (43 CFR 3400) and in the following publications by the Bureau of Land Management: *Final Environmental Statement: Federal Coal Management Program* (1979), *Secretarial Issue Document: Federal Coal Management Program* (n.d.), and *The Federal Coal Management Program: A Narrative Description.* File copies of these documents are available for inspection at the Bureau of Land Management, Office of Public Affairs, 18th and C Streets, NW, Washington, D.C. 20240.

Procedure

Land Use Planning

The first step in the coal leasing process is land use planning, through which areas are identified that are suitable to be considered for coal leasing. The potential coal lease tracts analyzed in this EIS have been delineated from the acceptable areas identified in the land use plans.

In identifying acceptable areas, the BLM applies the following four "screens."

Only areas with high or moderate potential for coal development area considered.

The unsuitability criteria of the federal coal management program are applied (43 CFR 3460), and areas found unsuitable for mining are excluded from consideration for leasing.

Multiple use decisions in land use planning may preclude coal development in certain areas.

Surface owner consultation permits owners to express preference for or against leasing. Some areas may be precluded from development if there is significant opposition.

The land use plans that have been completed are consistent with local and state land use plans. As a result of the unsuitability assessment, some areas have been dropped from further consideration for leasing. In addition, tract-specific mitigative measures have been developed to protect threatened or endangered wildlife species, alluvial valley floors, and other special features (see appendix C). Documentation of the land use planning process is on file at the BLM District Offices in Miles City, Montana, and Casper, Wyoming.

Expressions of Interest

After land use planning was completed, the BLM called for expressions of interest in leasing from industry. The expression of interest included information on the area of interest, desired tonnages, and whether surface or subsurface mining was proposed. The information is on file at the district offices in Casper and Miles City.

Tract Delineation and Tract Profiles

After receiving the expressions of interest, the BLM delineated tracts of high to moderate coal potential that might be offered for leasing. A "tract profile" was then prepared for each tract. Each profile combined a tract delineation report, which focused on the coal resource facts, and a site-specific analysis, which considered environmental, social, and economic factors. Tracts selected for further study are shown on the Regional Activity map at the back of this document.

Tract profiles are a concise presentation of tract-specific facts. They serve as the foundation for analysis of impacts associated with the proposed action: to lease coal in the Powder River Region and are integral to the regional cumulative analysis documented in this EIS, which is prepared for compliance with the Nation Environmental Policy Act of 1969.

The BLM also prepared a summary brochure, *Powder River Coal Region Tract Summaries* (USDI, BLM 1983), which served as a concise source of pertinent facts about the tracts. The tract profiles and the summary brochure are available upon request from the Casper BLM District Office, 951 Rancho Road, Casper, Wyoming 82601.

Tract Ranking and Selection

At a public meeting on June 21, 1983, the Powder River Regional Coal Team (1) ranked the tracts as having high, moderate, or low desirability for coal development, (2) selected tracts for consideration in the EIS, and (3) formulated leasing alternatives. Factors considered in ranking the tracts fall into three general categories: coal data, environmental data, and socioeconomic data. Table 1-1 contains information on the acreage and tonnage of each tract selected; table 1-2 contains more information on the ranking factors; table 1-3 shows the ranking of selected tracts. A detailed discussion of the ranking and selection process appears in the minutes of the coal team's meeting.

Formulation of Alternatives

The Powder River Regional Coal Team grouped the tracts into six alternatives, a "no leasing" alternative and five leasing alternatives. Table 1-4 shows the tracts included in each alternative. Alternative 2 contains only the highly desirable tracts, with successively higher leasing alternatives adding the tracts ranked "moderate" and "low." A "maintenance" tract, as listed on table 1-4, has a small quantity of reserves and could logically be mined as part of an existing operation. In contrast, a "competitive" tract contains sufficient reserves to open a new mine.

Alternative 1, the "no leasing" alternative, assumes that the current regional industrial development would continue but that no new competitive federal coal leases would be offered. Existing industrial developments, the "baseline" for this EIS, are listed in appendix B and are shown on the Regional Activitiy map.

Leasing alternatives as shown on table 1-4 cover a range of coal reserves from 0.997 billion tons to 4.515 billion tons. This range is only slightly lower than the recommended coal leasing level for the region. A 900-megawatt coal-fired generator has been proposed in the development of the Mud Springs tract. That tract is included in Alternatives 3, 4, and 6.

On the basis of the analysis of alternatives in this EIS, the BLM recommends that Alternative 5 be selected as the preferred alternative. This recommendation of the BLM does not reflect the desires or wishes of the Powder River Regional Coal Team or the Governors of Wyoming or Montana. It was selected for purposes of analysis only, and the recommendation is subject to change.

Public Involvement

Meetings

After the release of the coal leasing level decision and selection of tracts, the Powder River Regional Coal Team held scoping meetings in May and July 1983 to identify public conerns and to allow the public to review and comment on the issues and alternatives. The meetings were held as follows: Gillette, Wyoming, May 24; Sheridan, Wyoming, May 25; Ashland, Montana, May 26; Hardin, Montana, July 12; and Sheridan, Wyoming, July 13. Written comments were accepted for a 15-day period after each round of meetings. Comments received did not result in identification of any totally new issues within the scope of the EIS, but the preliminary issues were elaborated on, and concerns were expressed about specific areas or conflicts.

Issues

Issues identified through the BLM's land use planning system and through the scoping process, and determined to be within the scope of the EIS, are as follows:

General

The effectiveness of mitigation

Impacts on agriculture from mining

The effect of not maintaining a coal industry

TABLE 1-1
COAL DATA BY TRACT

Tract	Coal Ownership (acres)					Recoverable Reserves (millions of tons)					Companies Expressing Interest
	Federal Uncommitted	Federal Committed	State	Private	Total	Federal Uncommitted	Federal Committed	State	Private	Total	
Wyoming											
Youngs Creek	3,310		640	635	4,585	388		53	94	535	Coastal States Energy; Ash Creek; Shell; Basin Elec.; Central & Southwest Fuels; Western Fuels
Hidden Water	6,285		640	1,960	8,885	163		100	19	282	Peter Kiewit & Sons
Calf Creek	6,010	360	640	40	7,050	694	16	28	3	753	Shell; U.S. Steel; Old Ben; Texaco; Mobil
Hay Creek	5,250		120		5,370	447		16		463	Old Ben; Texaco; Mobil; Peter Kiewit & Sons
*Donkey Creek	600	700	640		1,940	49	75	4		128	Wyodak Rsces. Devel. Co.
Timber Creek	3,350			400	3,750	165			9	174	Bridgeview Coal Co.
Mount Logan	6,165		640		6,805	410		42		452	U.S. Steel; Exxon; Gulf
Kintz Creek	4,080			120	4,200	282				284	Wymo; NERCO, Inc.; Exxon; Gulf; U.S. Steel; Shell
Thundercloud	3,845		640	40	4,525	445		78	5	528	Anaconda Mining Co.
*Porcupine	560	160			720	26	13			39	North Antelope Coal Co.; Rochelle Coal Co.
Ridgerunner	4,610		720		5,330	415		25		440	NERCO, Inc.
Wyoming total	44,065				53,160	3,484				4,078	
Montana											
*Colstrip Maintenance	240				240	2				2	Western Energy
*Colstrip Area C	1,481	842	76	2,737	5,136	34	21		40	95	Western Energy
*Spring Creek	280	2,365	640		3,285	11	232	16		259	NERCO, Inc.
*North Decker I[a]	510	2,361			2,871	14				14	Decker Coal Company
*North Decker II[a]	921	2,361			3,281	13				13	Decker Coal Company
*Wolf Mountain Maintenance	598	524		249	1,371	31	34		18	83	Peter Kiewit & Sons
Downey Coulee	4,709		640	6,506	11,855	77		6	116	199	Peabody Coal; Meridian Land and Mineral
Ashland (Decker-Birney)	1,949		640	2,939	5,528	110		51	186	347	Cities Service Company; Meridian Land and Mineral
Northwest Otter Creek	1,350		640	3,484	5,475	89		56	173	318	Cities Service; Chevron; Meridian
Hanging Woman	9,144		720		9,864	373		27		400	Kendrich Cattle Co.; Lee Techni-Coal for Cyprus Coal Co.
Mud Springs	7,720		480		8,200	277		23		300	Utah International
Montana total	28,902				57,106	1,031				2,030	
Region total	72,967				110,266	4,515				6,108	

* Maintenance tracts. a. Committed coal is the same for North Decker I and North Decker II.

TABLE 1-2
TRACT RANKING FACTORS

Coal Resource Data	Effects on the Natural Environment
Economic viability	Wildlife habitat
Ratio of recovered BTUs per acre of surface disturbance	Reclamation potential
Energy production potential: to what extent is development of the tract economically feasible? How likely is development? (Economy of scale is included.)	Effects on quality and quantity of surface water and groundwater
Transportation: Proximity of mine to expected use or transportation facility. (Requirements for new construction are taken into account.)	Effects on air quality
Bypass potential if tract is not mined at this time.	**Socioeconomic Effects**
Potential for later delineation. (This relates to tracts carried over from the first round. Would deferring sale of tract make possible a more viable tract for a later sale?)	Disruption of family farms/ranches
Expansion of existing mines	Reduction of economic viability of each farm/ranch unit.
Inclusion of state lands (tracts that contain state lands are ranked higher than those without state lands)	Loss of family farm concept
	Changes in agricultural productivity
	Temporary loss of land to mining
	Changes in rural quality of life
	Changes in communities, Indian reservations, local community services
	Conflict with other plans or policies (state and local) for development

Minerals

The relationship of preference right lease applications to the coal leasing program and the EIS

The need for new leasing

Soils

Impacts on stabilization of soils

Vegetation

Questions about types of vegetation used for reclamation

Loss of riparian vegetation

Water Resources

Impacts on water quality from the contamination, aquifer destruction, and increased population

Impacts on water quantity, including water availability for other users, increased populations, and maintenance of existing operations.

Land Use

No contact with adjacent landowners by mining interests

Impacts of living next door to a coal mine

Wildlife

Impacts on wildlife habitat

Cultural Resources

Impacts on cultural resource values and religious sites

Noise

Impacts of increased noise levels

TABLE 1-3
RANKING OF SELECTED TRACTS

Tract	Recoverable Reserves (in millions of tons) Federal	Total	Coal Factors	Environmental Factors	Socioeconomic Factors	Overall Ranking
Wyoming						
Youngs Creek	388	535	H	H	H	H
Hidden Water	163	282	L	H	H	M
Calf Creek	694	753	H	M	M	M
Hay Creek	447	463	M	H	H	H
Donkey Creek	49	128	H	H	H	H
Timber Creek	165	174	H	H	H	H
Mount Logan	410	452	M	M	M	M
Kintz Creek	282	284	H	H	H	H
Thundercloud	445	528	H	H	H	H
Porcupine	26	39	H	H	H	H
Ridgerunner	415	440	H	H	H	H
Montana						
Colstrip Maintenance	2	2	H	H	H	H
Colstrip Area C	34	95	H	H	H	H
Spring Creek	11	259	H	H	H	H
North Decker I	14	14	H	H	H	H
North Decker II	13	13	H	H	H	H
Wolf Mountain Maintenance	31	83	H	H	H	H
Downey Coulee	77	199	M	L	L	L
Ashland (Decker-Birney)	110	347	M	L	L	L
Northwest Otter Creek	89	318	M	L	L	L
Hanging Woman	373	400	M	M	L	M
Mud Springs	277	300	M	M	L	M

NOTE: "H" indicates high desirability for leasing, not high impact to the factor considered. "M" indicates medium desirability for leasing; "L", low desirability.

TABLE 1-4
ALTERNATIVES FOR PROPOSED 1984 COAL LEASE SALE
POWDER RIVER REGION
(federal uncommited recoverable reserves in billions of tons)

ALTERNATIVE 1

No Leasing

ALTERNATIVE 2

Wyoming Tracts	Reserves	Totals
Thundercloud[a](H)	0.445	
Timber Creek(H)	0.165	
Kintz Creek(H)	0.282	
Wyoming total		0.892
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Montana total		0.105
ALTERNATIVE 2 TOTAL		0.997

ALTERNATIVE 3

Wyoming Tracts	Reserves	Totals
Thundercloud(H)	0.445	
Timber Creek(H)	0.165	
Kintz Creek(H)	0.282	
Wyoming Total		0.892
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Ashland (Decker-Birney)(L)	0.110	
Mud Springs(M)	0.277	
Montana total		0.492
ALTERNATIVE 3 TOTAL		1.384

ALTERNATIVE 4

Wyoming Tracts	Reserves	Totals
Thundercloud(H)	0.445	
Timber Creek(H)	0.165	
Kintz Creek(H)	0.282	
Porcupine (mtce.)(H)	0.026	
Mount Logan(M)	0.410	
Youngs Creek(H)	0.388	
Wyoming total		1.716
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Ashland (Decker-Birney)(L)	0.110	
Mud Springs(M)	0.277	
Northwest Otter Creek(L)	0.089	
Montana total		0.581
ALTERNATIVE 4 TOTAL		2.297

ALTERNATIVE 5

Wyoming Tracts	Reserves	Totals
Thundercloud(H)	0.445	
Timber Creek(H)	0.165	
Kintz Creek(H)	0.282	
Porcupine (mtce.)(H)	0.026	
Mount Logan(M)	0.410	
Youngs Creek(H)	0.388	
Donkey Creek (mtce.)(H)	0.049	
Hidden Water(M)	0.163	
Wyoming total		1.928
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Ashland (Decker-Birney)(L)	0.110	
Northwest Otter Creek(L)	0.089	
Hanging Woman(M)	0.373	
Montana total		0.677

ALTERNATIVE 6

Wyoming Tracts	Reserves	Totals
Thundercloud(H)	0.445	
Timber Creek (H)	0.165	
Kintz Creek(H)	0.282	
Porcupine (mtce.)(H)	0.026	
Mount Logan(M)	0.410	
Youngs Creek(H)	0.388	
Donkey Creek (mtce.)(H)	0.049	
Hidden Water(M)	0.163	
Calf Creek(M)	0.694	
Hay Creek(H)	0.447	
Ridgerunner(H)	0.415	
Wyoming total		3.484
Montana Tracts		
Maintenance tracts[b](H)	0.105	
Ashland (Decker-Birney)(L)	0.110	
Mud Springs(M)	0.277	
Northwest Otter Creek(L)	0.089	
Hanging Woman(M)	0.373	
Downey Coulee(L)	0.077	
Montana total		1.031
ALTERNATIVE 6 TOTAL		4.515

a. Letters in parentheses indicate ranking of the tract's desirability for leasing as high, moderate, or low.

b. Maintenance tracts in Montana are as follows (billions of tons in parentheses): North Decker I (0.014), Colstrip C (0.034), Wolf Mountain Maintenance (0.031), Spring Creek (0.011), Colstrip Maintenance (0.002), and North Decker II (0.013).

Air Quality

Impacts on air quality

The total number of air quality permits in the region

Visibility standards and impacts on Class I areas in the region

Transportation

Impacts on transportation systems (highways and railroads)

Economics and Social Values

Impacts on local governments

Impacts on community facilities such as housing, roads, schools, water and sewer facilities, police and fire protection, and health care

Impacts to Indian reservations

Impacts on lifestyles

Impacts on local labor forces—unemployment from imported labor forces and population increases

Issues Not Addressed

Some of the issues identified before and during the scoping process are beyond the scope of the EIS, have been covered by prior environmental review, or are not considered to have a significant effect on human environment within the area of study. Those issues are listed below.

Whether it is advisable to lease additional coal while the current coal market is soft; the possibility of selling public resources in a manner that maximizes, through competition, the monies returned to the federal, state, and local treasuries

The ability of surface owners to manipulate the sale of lease tracts

Impacts associated with construction of the coal slurry pipeline by Energy Transportation Systems, Inc.

OTHER TYPES OF COAL LEASING

In certain circumstances federal coal leases may be granted by other means than in competitive lease sales. Other methods of coal leasing in the Powder River Region are described below.

I-90 Exchanges

Public Law 95-554, dated October 30, 1978, authorized the Secretary of the Interior to consider the exchange of specific coal leases that are crossed by Interstate Highway 90 for leases on other federal coal. Six leaseholders were affected by this law. Carter Mining Company received an exchange in 1982. The proposals for exchange of three applicants, Carter, Gulf, and Wyodak, were analyzed in the EIS for the 1982 coal lease sale (USDI, BLM 1981b). Three other proposals for exchange, from Big Horn, Kerr-McGee, and Belco, are assessed in this document as part of the baseline. Site-specific environmental assessments (EAs) will be prepared at a later date.

Preference Right Lease Applications

Under the Mineral Leasing Act of 1920, the Secretary of the Interior was authorized to issue exploration permits for land where the existence or workability of coal resources was unknown. A permittee who could demonstrate, during the term of the permit, the existence of commercial quantities of coal was entitled to a "preference right lease"—that is, a noncompetitive lease. Provisions for prospecting permits were repealed in 1976, but current federal coal regulations (43 CFR 3430) provide for processing of pending preference right lease applications (PRLAs).

There are 67 PRLAs in the Powder River Region. Seven PRLAs have been rejected; all are under appeal. The cumulative impacts of development of these PRLAs, as depicted in the initial showings submitted by the applicants, are assessed as part of the baseline in this document. Site-specific EAs have been done for all of these PRLAs.

Northern Cheyenne Coal Exchanges

Under Public Law 96-401, the Secretary of the Interior is authorized and directed to negotiate a cancellation agreement between the Northern Cheyenne Indian Tribe and parties holding leases or permits on tribal land. Such an agreement would provide for issuance of a noncompetitive lease for lands adjacent to existing operations and/or for issuance of a certificate of a coal lease bidding right for an amount equal to the investment made by each party.

The deadline for an agreement on leases was November 1, 1980, and permits had to be agreed upon by January 1, 1982. Peabody Coal Company, with six leases and three permits, made a settlement agreement with the Northern Cheyennes on October 30, 1980, for a noncompetitive lease on lands in Rosebud County, Montana. This agreement, which covered the Greenleaf-Miller project, is included as part of the baseline of this EIS.

Eight other permits were held by five other parties. AMAX negotiated successfully for lands adjacent to the Belle Ayr Mine in Campbell County, Wyoming. Consolidation Coal Company (CONSOL), with one permit, is seeking lands adjacent to its CX Ranch property in Big Horn County, Montana. Chevron Oil Company, with one permit, is negotiating with CONSOL for a percentage of CX Ranch and is seeking land adjacent to that lease. Negotiations with the remaining permit holders were not concluded before the statutory deadline. Any pending claims for compensation will now have to be submitted to the U.S. Court of Claims for resolution.

Substantial amounts of economic coal reserves are available for leasing on the Crow and Northern Cheyenne Indian reservations, at each tribe's discretion.

Energy Transportation System, Incorporated (ETSI) is scheduled to complete its coal slurry pipeline in 1985. Coal for the pipeline will be supplied by the North Rawhide, North Antelope, and Jacobs Ranch mines, which are under construction or in production. A full analysis of the ETSI proposal, including water use, may be found in the *Draft Environmental Impact Statement on the Energy Transportation Systems, Inc., Coal Slurry Pipeline Transportation Project* (USDI, BLM and Woodward-Clyde 1980).

LEGISLATION AND REGULATIONS

The development of federal coal resources is controlled by a number of federal and state laws and regulations. The most important federal laws are the Federal Coal Leasing Amendments Act of 1976 (FCLAA), the Federal Land Policy and Management Act of 1976 (FLPMA), and the Surface Mining Control and Reclmation Act of 1977 (SMCRA), and the National Environmental Policy Act of 1969 (NEPA). The federal coal EIS contains a detailed discussion of the related legislation and regulations (USDI, BLM 1979a).

FCLAA provides a more orderly procedure for the leasing and development of federal coal than was set forth in its parent document, the Mineral Leasing Act of 1920. In particular, the FCLAA specifies that land use planning must be completed before federal coal is leased, that coal must be leased only through competition, and that the government must receive fair market value.

FLPMA provides the BLM with a statutory framework for land use planning on public lands. It requires that the BLM use the principles of multiple use and sustained yield, give priority to the protection of areas of critical environmental concern, consider present uses of public land as well as future uses, and coordinate planning activities with those of state and other federal agencies.

SMCRA regulates mining and reclamation on state and private land. It permits state regulation of these activities on federal lands, provided the state has a program approved by the Office of Surface Mining and has entered into an agreement with the Secretary of the Interior for regulation of surface coal mining activities on federal lands. Montana's and Wyoming's programs for implementing these provisions have been approved by the Secretary of the Interior, and both states have entered into cooperative agreements with the Department of the Interior. Thus, both states have primary responsibility for ensuring that the environment is adequately protected and that standards are maintained in surface mining and reclamation on federal, state, and private lands. However, specific federal responsibilities, such as protection of threatened or endangered species, have not been delegated to the states.

Each lease operator is required to submit a permit application package that complies with the appropriate state/federal cooperative agreement and regulations incorporated therein, and with 43 CFR 3480. The application must demonstrate that economic coal recovery has been evaluated and that resources other than coal will be protected. The permit application package must be approved by the state regulatory authority. The Assistant Secretary for Energy and Minerals, Department of the Interior, must approve the resource recovery and protection plan, which is part of the permit application package.

SCHEDULE OF FURTHER ACTIVITY

Upon release of the final EIS in March of 1984, the regional coal team will make recommendations to the director of the BLM as to (1) which specific tracts of the 22 analyzed should be offered for lease sale and (2) if appropriate, a schedule for the lease sale. The director will forward these recommendations, along with his own, to the Secretary of the Interior, who will make the final decision on which tracts and how many are to be offered. The Secretary of the Interior has discretion to select for leasing any combination of tracts analyzed in the EIS. The Secretary of the Interior also will determine the schedule of tract sales.

The second round of competitive coal lease sales in the Powder River Region is tentatively scheduled to begin in August 1984.

CHAPTER 2: ALTERNATIVES, INCLUDING THE PROPOSED ACTION

INTRODUCTION

This chapter provides a narrative description of the six alternatives analyzed in this document and a series of tables summarizing relevant data such as recoverable reserves by tract and alternative, population changes, and acreage disturbances for each alternative. Also provided is a list of the types of mitigating measures applied. Table 2-1 gives a comparative analysis of impacts associated with the six alternatives.

The major consequences of each alternative are summarized in this chapter. The individual tract profiles contain site-specific analysis of the impacts of development of each tract included in the alternatives. That analysis includes consideration of agricultural economics.

Because documented evidence of damage to the agricultural production of farms and ranches in the vicinity of a coal mine has not been demonstrated, and because documented analysis has suggested that land values of farms and ranches have been enhanced by coal mines in the vicinity (Moore 1983), we have decided that the analysis of agicultural economics contained in the 1981 coal EIS (USDI, BLM 1981b, appendix G) and in the individual tract profiles prepared for the tracts being studies for sale is adequate. Therefore, further analysis of agricultural economics will not be undertaken.

THE ALTERNATIVES

The alternatives are directed toward leasing various combinations of tracts to make specific tonnages of coal available for production. Table 1-4 in chapter 1 lists the tracts that would be offered for leasing under each alternative and the tonnage of federal uncommitted recoverable reserves in each tract.

For analytical purposes it is assumed that all tracts offered under each alternative will be leased and, further, that they will be mined in the period covered by this analysis. The impact analysis for Alternative 6 represents the maximum development possible. Figure 2-1 shows the annual production capacity for each alternative in selected years.

TRACTS OF SPECIAL INTEREST

Mud Springs

In its expression of interest in the Mud Springs tract, Utah International indicated it would use coal from the tract on the site for generation of electricity. The facility would include two 450-megawatt generating plants that would employ a permanent work force of approximately 200. The workforce for construction of the power plant and associated facilities would peak at 2,800 employees.

The Mud Springs tract is included in Alternatives 3, 4, and 6. Wherever the effects from development of this tract are discussed, we have assumed that if this tract was leased, the coal-fired generators would be built on the site.

If the generating plant were built as described, cooling water probably would be obtained from the Powder River in the amount of 13,000 acre-feet per year.

The most restrictive air quality regulation is the 24-hour maximum allowable increase in sulfur dioxide of 5 micrograms per cubic meter. This is the federal, Wyoming, and Montana standard for prevention of significant deterioration in a Class I area. The maximum predicted increment in sulfur dioxide due to the generating plants would be 2.1 micrograms per cubic meter at the boundary of the Northern Cheyenne Indian Reservation (PEDCo 1983)—well below the standard.

Bitter Creek

The Bitter Creek tract was among those described in an individual tract profile and summarized in the tract summary report (USDI, BLM 1983). However, the tract was not selected for inclusion in any alternative because its overall desirability for leasing was low. Economic development of this isolated tract's coal would be hampered by a high stripping ratio and a low British thermal unit (Btu) content, and at least 35 miles of railroad spur would be required. Steep terrain and a probable alluvial valley floor are other concerns.

TABLE 2-1
COMPARISON OF ALTERNATIVES
CUMULATIVE ENVIRONMENTAL IMPACTS

Resource	Alternative 1 (baseline)	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
GEOLOGY AND MINERALS						
Potential annual coal production resulting from new federal leasing (million tons)	98 + (sig)	128.5 + (sig)	144.6 + (sig)	177.6 + (sig)	197.1 + (sig)	256.8 + (sig)
Net energy analysis (Btus produced to Btus consumed)	230 to 1 + (sig)	232 to 1 + (sig)	230 to 1 + (sig)	231 to 1 + (sig)	231 to 1 + (sig)	225 to 1 - (sig)
SOILS AND RECLAMATION						
Total acreage to be reclaimed*	333,700 - (sig)	355,700 - (sig)	372,000 - (sig)	391,300 - (sig)	402,800 - (sig)	444,800 - (sig)
Coal acreage to be reclaimed	293,900 - (sig)	314,060 (non)	327,790 - (sig)	345,380 - (sig)	356,270 - (sig)	394,070 - (sig)
WATER RESOURCES						
Groundwater						
Maximum number of wells destroyed or affected through mine life	275 - (sig)	333 - (sig)	368 - (sig)	384 - (sig)	375 - (sig)	425 - (sig)
Number of springs destroyed	25 - (sig)	29 - (sig)	35 - (sig)	35 - (sig)	28 - (sig)	49 - (sig)
Acre-feet of water needed for coal mining in 1990	9,340 - (sig)	9,950 (non)	10,270 (non)	11,000 - (sig)	11,240 - (sig)	12,590 - (sig)
Acre-feet of municipal water needed by 1990 population	38,000 - (sig)	38,990 (non)	40,556 (non)	41,844 (non)	41,205 (non)	43,900 - (sig)
Surface Water						
Reduction in surface outflow (maximum through mine life)						
Cheyenne River	2.20% (non)	3.10% (non)	3.10% (non)	3.10% (non)	3.10% (non)	3.80% (non)
Tongue River	0.09% (non)	0.09% (non)	0.12% (non)	0.13% (non)	0.16% (non)	0.44% (non)
Maximum number of point watering sources lost through mine life	108 - (sig)	164 - (sig)	183 - (sig)	204 - (sig)	220 - (sig)	287 - (sig)

* These figures apply to all energy-related actions on and off the sites of the developments.

Symbols: "+" = positive; "-" = negative; "sig" = significant; "non" = nonsignificant.

(continued on next page)

COMPARISON OF ALTERNATIVES--CUMULATIVE ENVIRONMENTAL IMPACTS (continued)

Resource	Alternative 1 (baseline)	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
WATER RESOURCES (continued)						
Surface Water (continued)						
Increase in dissolved solids concentration						
Cheyenne River	5.6% - (sig)	6.3% - (sig)	6.3% - (sig)	6.3% - (sig)	6.3% - (sig)	6.9% - (sig)
Tongue River	1.4% (non)	1.7% (non)	3.5% (non)	4.1% - (sig)	4.3% - (sig)	7.2% - (sig)
AIR QUALITY						
Predicted violations in 1990	a (non)	a,b (non)	a,b (non)	a,b (non)	a,b (non)	a,c (non)
TRANSPORTATION FACILITIES						
Total number of unit coal trains per day	210 - (sig)	227 (non)	234 - (sig)	255 - (sig)	261 - (sig)	289 - (sig)
Average hours and minutes per day that at-grade crossings would be occupied (at 20 m.p.h.)	5:51 - (sig)	6:00 (non)	6:06 - (sig)	6:33 - (sig)	7:03 - (sig)	8:06 - (sig)
Probable number of car-train accidents at at-grade crosings per 1,000 vehicles per day per 100 years	13 - (sig)	14 (non)	14 (non)	16 - (sig)	17 - (sig)	19 - (sig)
SOCIOLOGY AND ECONOMICS						
Population in 1990						
Wyoming						
Campbell County	45,600	48,400	48,400	50,000	50,100	54,700
Converse County	16,700	16,900	16,900	17,200	17,200	18,100
Crook County	5,800	5,900	5,900	5,900	5,900	6,000
Goshen County	14,600	14,800	14,800	15,000	15,100	15,500
Johnson County	8,100	8,200	8,200	8,200	8,300	8,400
Natrona County	83,800	84,900	84,900	85,900	87,400	88,300
Niobrara County	3,200	3,220	3,220	3,240	3,250	3,300
Platte County	9,200	9,400	9,400	9,500	9,500	9,800
Sheridan County	32,600	33,000	35,700	37,600	36,900	40,300
Weston County	9,900	10,000	10,000	10,100	10,100	10,300

a. No violation of federal standards is predicted.

b. Wyoming standards would be violated on Thundercloud, and Kintz Creek tracts; Montana standards would be violated on North Decker I and North Decker II tracts.

c. Wyoming standards would be violated on Thundercloud, Kintz Creek, and Calf Creek tracts; Montana standards would be violated on North Decker I, North Decker II, and Downey Coulee tracts.

(continued next page)

COMPARISON OF ALTERNATIVES--CUMULATIVE ENVIRONMENTAL IMPACTS (continued)

Resource	Alternative 1 (baseline)	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
SOCIOLOGY AND ECONOMICS (continued)						
Population in 1990 (continued)						
Montana						
Big Horn County	15,600	15,600	16,600	16,700	17,200	17,900
Powder River County	4,640	4,640	7,500	8,200	6,100	8,200
Rosebud County	14,500	14,500	16,200	16,900	16,200	18,000
Crow Indian Reservation	8,200	8,200	8,700	8,700	9,000	9,400
Northern Cheyenne Indian Reservation	5,300	5,300	5,700	5,800	5,600	6,200
Total Population	264,240 - (sig)	269,460 (non)	277,720 (non)	284,440 - (sig)	283,250 - (sig)	298,800 - (sig)

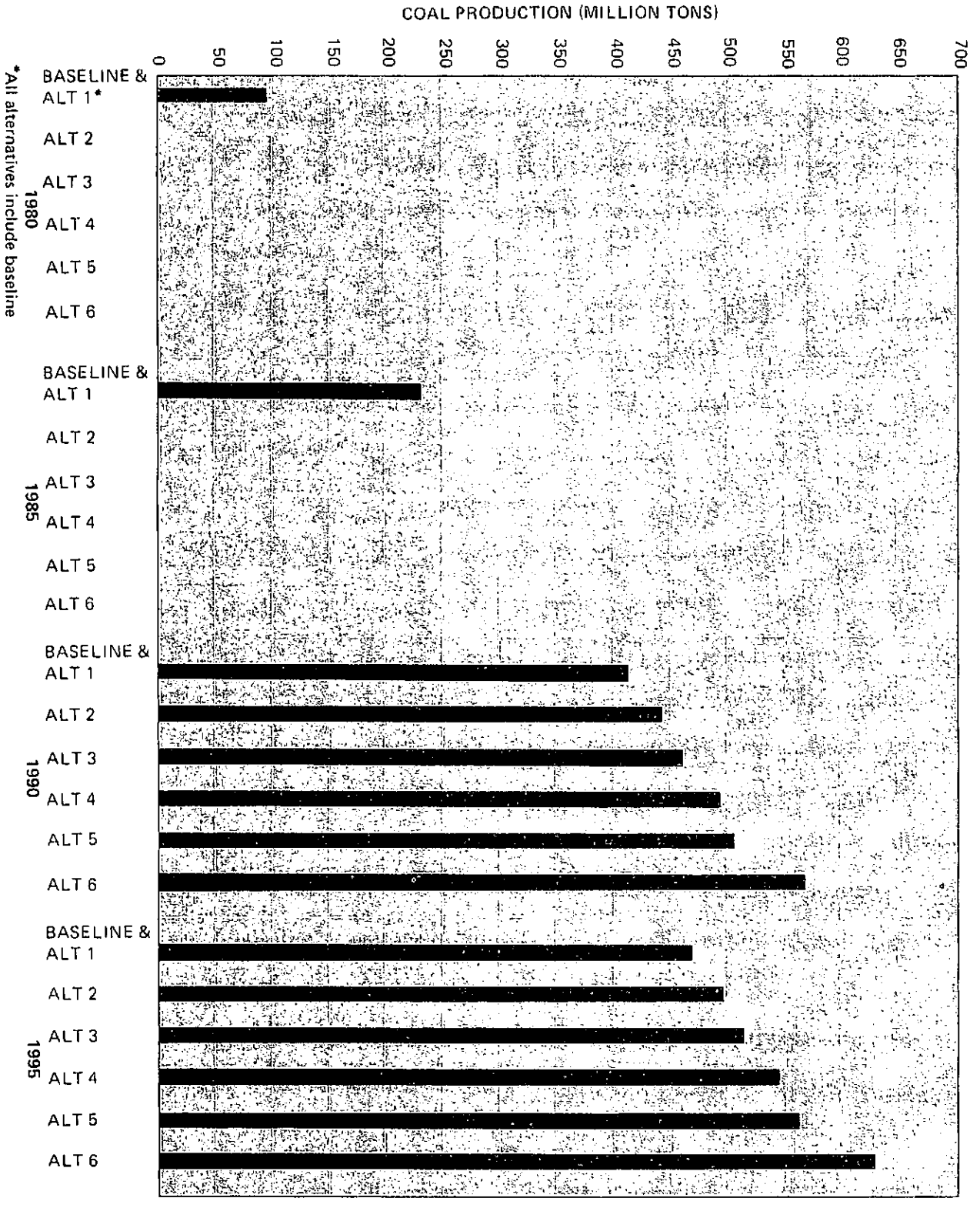


Figure 2-1
POWDER RIVER REGIONAL
ANNUAL COAL PRODUCTION CAPACITY
TO 1995

The Bitter Creek tract's diverse wildlife includes a large prairie dog population that makes the area potential habitat for black-footed ferret. The needed railroad spur would interfere with a primary winter migration route for antelope. Although socioeconomic impacts from development of the tract would not be significant, benefits in that category were not sufficient to increase its desirability for leasing.

SPECIAL ACTIONS

The Donkey Creek, Hay Creek, and Thundercloud tracts have been subject to actions of note. The Donkey Creek tract, as described in the tract profile, was originally delineated as a competitive coal tract; however, in an effort to prevent the tract from encroaching upon Gillette's buffer area around the city, the tract was redelineated with the western half eliminated. The redelineation reduced the acreage and tonnage of the tract to maintenance status.

Portions of the Hay Creek and Thundercloud tracts have been applied for under I-90 exchange procedures. Public Law 95-554 of 1978 amended the Minerals Leasing Act of 1920 to authorize the exchange of certain specified coal leases that are crossed by Interstate 90 for leases on other federal coal. Under these exchange provisions, Belco Petroleum Corporation has applied for a portion of the Hay Creek tract. The Powder River Regional Coal Team agreed with Belco's proposal in 1982.

Kerr-McGee Coal Corportion, using I-90 exchange procedures, has applied for about 1,100 acres in the Thundercloud tract containing an estimated total of 120 million tons of coal. The regional coal team has recommended against redelineation of the Thundercloud tract until Kerr-McGee's exchange proposal has been thoroughly evaluated and a determination has been made of what would best serve the public interest.

ASSUMPTIONS

The following assumptions have been made in analyzing the environmental impacts of mining and coal-related development considered in this EIS:

All relevant state and federal laws and regulations pertaining to coal mining and related activities will be followed and enforced. The most important of these are the regulations of the Office of Surface Mining Reclamation and Enforcement (OSM), 30 CFR, chapter 7; Environmental Protection Agency (EPA) regulations, 40 CFR 1500-1508; Coal Management Program regulations of the Department of the Interior, 43 CFR 3400 and 43 CFR 3480; the National Historic Preservation Act, 36 CFR 800; the Threatened and Endangered Species Act of 1973; the Clean Air Act of 1970 and 1977; and regulations of the Montana Department of State Lands and the Wyoming Department of Environmental Quality (DEQ). While observance and enforcement of laws are fundamental, it is recognized that there may be emergency situations or cases of enforcement failure. Mitigation requirements are discussed in the next section.

The majority of impacts would occur in Campbell and Sheridan counties in Wyoming and in Big Horn, Powder River, and Rosebud counties in Montana.

The maintenance tracts would add to the mine life of the adjacent existing mines rather than increase annual production.

State and privately owned coal included in federal lease tracts or adjoining those tracts would be developed simultaneously with federal coal.

Coal produced would be strip-mined and transported from the region by railroad and possibly by coal slurry pipeline. A possible exception to this is the Mud Springs tract, where a proposal for mine-mouth consumption would be considered.

Figures for recoverable reserves are based on a 90% recovery rate.

Active mine life could cover a range of 35 to 40 years, depending on reserves and markets.

Following issuance of each lease, development and approval of a permit application package would take three years (1984 through 1986). During that time, the operator would collect further information on cultural resources and obtain a permit for surface mining. Construction of facilities would require two years (1987 and 1988). Mines resulting from this lease sale would have capacity for full production by 1990, except the Mud Springs tract, which would have capacity for full production in 1992.

Reclamation would proceed concurrently with mining operations. After a six-year reclamation period, the reclaimed land would be stabilized and available for its previous use. Full restoration of the land and its vegetation to the premining condition would require a longer time (30 to 50 years).

Lands used for housing or public facilities would not be reclaimed.

Land use after mining would be the same as that before mining except for housing, public facilities, transportation rights-of-way, and permanent changes due to development.

Coal reserves included in the PRLAs covered under Alternative 1 will all be developed.

MITIGATION REQUIREMENTS

Federal coal leases will be developed in compliance with all applicable federal, state, and local laws and regulations. Existing laws and regulations form the basis of the federal coal leasing program. Therefore, enforceable statutes, performance standards, and other license requirements are considered part of proposed federal actions under all alternatives and are applicable to all coal tracts.

Additional site-specific mitigating measures have been developed through the BLM's land use and activity planning processes. Cooperating agencies and members of the public have made significant contributions to the development of these measures, which are detailed in appendix C. The mitigating measures are considered to be real, committed, and legally enforceable. The general types of mitigating measures are as follows.

Cultural Resources: Field inventories and procedures for protection of cultural resources

Paleontological Resources: Survey and resource recovery

Existing Rights: Negotiation procedures

Soils: Separation of "B" horizon material from underlying material

Survey Markers: Protection from damage; provision for replacement

Raptors: Buffer zones around nesting areas and restrictions as necessary on surface mining

Black-Footed Ferret Habitat: Monitoring and inventory in accordance with prescribed guidelines

Migratory Birds of High Federal Interest: Habitat recovery and replacement

Buffer Zones and Rights-of-Way: Buffer zones unsuitable for surface mining for existing public facilities

Alluvial Valley Floors: Mitigation or designation of unsuitability pending final determinations by authorized agencies

SUMMARY OF MAJOR CONSEQUENCES

In the interest of presenting a clear comparison of alternatives, we have limited the discussions of resource disciplines in this chapter to soils, vegetation, and reclamation; water resources; land use; air quality; transportation facilities; and economic and social conditions. Through the scoping process, these components were identified as the ones of major interest to the public. Chapter 4 contains detailed analyses of impacts on all affected resoures. Cumulative environmental impacts are summarized in table 2-1, and the significance is indicated.

Alternative 1 (No Action)

Soils, Vegetation, and Reclamation

A total of 333,700 acres will be disturbed if no new leasing occurs.

Water Resources

Water use would be about 600,000 acre-feet per year by 1990. Major uses would be for irrigation, 420,000; power plants, 46,000; municipal use, 38,000; uranium milling and mining, 7,000; and coal mining 9,340 acre-feet per year.

Groundwater

Approximately 275 existing wells and 25 springs on mine sites would be destroyed, but wells usually could be replaced by tapping deeper aquifers or by using wells in spoils aquifers. Springs might eventually reappear, but they would be in different locations.

Impacts of coal mining on groundwater are restricted to an area within a few miles of the mine site. Water levels in wells near a mine would be lowered during mining but would return to near premining levels after the site was restored.

Recharge would probably increase in many areas because the postmining slope of the land surface would be less steep and because reclamation practices to retain moisture and prevent erosion would increase infiltration. Shale layers that may have caused springs and seeps would be destroyed; however, the increased infiltration might cause increased groundwater inflow to streams or the creation of new springs and seeps near the mine site. Population increase associated with the "no new leasing" alternative would require 11,275 acre-feet of additional supplies by 1990.

Surface Water

The interception and use of water in mining operations and water consumption by the increased population would reduce surface outflow from the region by about 3,113 acre-feet per year (0.5%) during mining. The greatest reductions in flow would occur in the Little Powder and Cheyenne rivers, where flows might decrease more than 2%.

The total dissolved solids (TDS) concentrations of streams might increase as a result of leaching from coal spoils and increased sewage effluent. The maximum increase in TDS would range from 0.4% in the Powder River to 5.6% in the Cheyenne River. The increase in TDS would be long-term but would have no significant impact on current uses of the water or on aquatic biology downstream. The TDS of the Yellowstone and North Platte rivers would not be increased measurably.

Land Use

Under Alternative 1, no new mining properties would be added. The baseline impacts would be those caused by the regional industrial developments listed in appendix B.

Air Quality

Under Alternative 1, in which no new federal leasing would occur, regional changes in air quality resulting from new lease development, coal exchanges, PRLA development, and population increases would be insignificant. However, impacts near the Belle Ayr, Black Thunder, and Jacobs Ranch mines would violate standards on some occasions. Estimated emissions of total suspended particulates (TSP) from all mining sources under this alternative would be 34,044 tons in 1995.

Transportation Facilities

There would be no change from the baseline under Alternative 1. Table 4-10 and figure 4-1 in chapter 4 show the number of trains per day for selected towns. Table 4-10 also shows the at-grade interruptions and accident rates for each alternative. The figures for all alternatives are based on production potential; the actual number of trains would depend upon contracts and coal demand.

Economic and Social Conditions

Because the brunt of negative socioeconomic impacts due to coal development arises from population changes, this section will summarize the incremental changes in population under each alternative (see table 2-2). It is estimated that peak increases in population will occur by 1990.

In general, each succeeding alternative that contains additional leasing proposals would present an increasing change in peak population, except in Sheridan County, Powder River County, Rosebud County, and the Northern Cheyenne Indian Reservation. For the exceptions, Alternative 5 clearly would present a smaller change in peak population than the other leasing alternatives; thus, it has the potential for a more favorable ratio of benefits (from jobs and revenues) to costs (from population and expenditures).

TABLE 2-2
INCREMENTAL POPULATION CHANGES RESULTING FROM EACH NEW LEASING ALTERNATIVE
IN THE POWDER RIVER REGION

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Eastern and Western Powder River Region[a]						
Campbell County						
1988	0	510	510	740	760	1,430
1990	0	2,830	2,830	4,400	4,500	9,100
1995	0	2,830	2,830	4,400	4,500	9,100
Converse County						
1988	0	30	30	60	70	120
1990	0	240	240	450	510	1,420
1995	0	240	240	450	510	1,420
Crook County						
1988	0	10	10	10	10	30
1990	0	50	50	100	110	210
1995	0	50	50	100	110	210
Goshen County						
1988	0	30	30	60	60	110
1990	0	220	220	410	470	850
1995	0	220	220	410	470	850
Johnson County						
1988	0	10	10	20	20	40
1990	0	80	80	140	160	290
1995	0	80	80	140	160	290
Natrona County						
1988	0	170	170	290	340	570
1990	0	1,140	1,140	2,140	3,600	4,500
1995	0	1,140	1,140	2,140	3,600	4,500
Niobrara County						
1988	0	0	0	0	0	10
1990	0	20	20	40	50	100
1995	0	20	20	40	50	100
Platte County						
1988	0	20	20	40	50	80
1990	0	160	160	290	340	610
1995	0	160	160	290	340	610
Sheridan County[b]						
1988	0	60	880	1,150	920	1,760
1990	0	370	3,100	5,000	4,300	7,700
1995	0	370	1,430	3,300	4,300	6,000
Weston County						
1988	0	20	20	20	20	50
1990	0	100	100	180	160	370
1995	0	100	100	180	160	370

a. See footnotes to table 4-14 for derivation (except for Sheridan County).

b. See footnotes to table 4-15 for derivation.

(continued on next page)

INCREMENTAL POPULATION CHANGES (continued)

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6
Northern Powder River Region[c]						
Big Horn County						
1988	0	0	320	420	810	1,050
1990	0	0	940	1,110	1,600	2,340
1995	0	0	420	570	1,600	1,890
Powder River County						
1988	0	0	840	1,110	510	1,190
1990	0	0	2,870	3,500	1,480	3,600
1995	0	0	1,920	2,580	1,480	2,620
Rosebud County						
1988	0	0	680	1,030	880	1,540
1990	0	0	1,780	2,470	1,680	3,500
1995	0	0	1,070	1,760	1,680	2,750
The Crow Reservation[d]						
1988	0	0	160	210	410	530
1990	0	0	480	560	810	1,190
1995	0	0	210	290	810	960
The Northern Cheyenne Reservation[d]						
1988	0	0	150	190	180	380
1990	0	0	430	500	330	870
1995	0	0	220	260	330	640

c. See footnotes to table 4-16 for derivation.

d. See footnotes to table 4-17A for derivation.

Alternative 2

Soils, Vegetation, and Reclamation

A total of 355,700 acres would be disturbed under Alternative 2. This is 22,000 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Coal mining under Alternative 2 would consume 610 acre-feet of water per year more than that consumed under Alternative 1; however, most of this water could be supplied by rainfall on the mined areas and seepage into the pits. Under this alternative, 58 wells would be impaired or destroyed in addition to those impaired or destroyed under Alternative 1, and at least four additional springs would be impaired or destroyed. The destroyed wells could be replaced at approximately their original depth in the spoils aquifer after reclamation, but the quality of water would be poorer in most cases, with TDS typically 3,000 to 5,000 milligrams per liter (mg/l). This TDS range is unsuitable for human use and only marginally suitable for livestock use. Better quality water could be obtained at greater depth in most areas, but the static water levels in the deeper wells would be lower and pumping lifts would be greater.

Population increases associated with this alternative would require 990 acre-feet of water more than that required under Alternative 1. The impact of this requirement would be felt primarily by the communities of Wright and Gillette.

Surface Water

Under Alternative 2, surface outflow from the region would be reduced during mining by about 200 acre-feet per year (0.03%) in addition to the reduction under Alternative 1. The greatest effect

would be in the Cheyenne River watershed, where flow would be reduced 0.9%.

About 55 livestock ponds and small reservoirs would be destroyed during mining. The quantity of water lost would not be significant, but the loss of point-watering sources would be a temporary deterrent to the use of the areas by wildlife and livestock.

The maximum potential increase in TDS concentrations in streams would range from 0.3% in the Tongue River to 2.3% in Armells Creek. However, these increases would have no significant impact on current uses of the water or on aquatic biology downstream and no measurable effect on the salinity of the Yellowstone River.

Land Use

New mine properties covering 20,200 acres would be added under Alternative 2. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

Nine landowners operate ranches within the boundaries of tracts included in this alternative. Two of them have voiced concern that development of the Kintz Creek tract would adversely affect air quality. They also expressed concern about noise impacts and access. Kintz Creek is also among the tracts selected for Alternatives 3, 4, 5, and 6.

Air Quality

Under Alternative 2, the Wyoming 24-hour standard would be violated around the Thundercloud and Kintz Creek tracts. (The Wyoming DEQ does not recognize the validity of the 24-hour prediction process.) Montana's 24-hour standards would be marginally violated near the North Decker I, North Decker II, and Spring Creek tracts. No federal air quality standards would be violated under any of the alternatives. The estimated increase in TSP emissions under Alternative 2 would be 5,227 tons per year more than under Alternative 1.

Transportation Facilities

Alternative 2 would add 5 miles of new rail spur lines to serve new facilities. Full production from these tracts would add 16 unit trains per day to the main lines leaving the region. The number of trains per day is shown on table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interruptions and accident rates. Most of the tracts in this alternative are maintenance tracts that would not add any new rail spur lines or additional trains.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

TABLE 2-3
ACREAGE OF LAND DISTURBED BY COAL MINING UNDER EACH ALTERNATIVE

	Total Acreage Disturbed[a]	Cropland Disturbed	Rangeland Disturbed	Acreage Disturbed Offsite[b]	Acreage Disturbed per Year	Total Acreage Disturbed at Any One Time[c]
Alternative 1 (Baseline)	293,900	No additional mining properties added.				
Alternative 2	20,160	3,040	17,120	1,900	740	6,300
Alternative 3	33,890	4,080	29,810	4,400	920	10,600
Alternative 4	51,480	5,040	46,440	6,100	1,540	15,400
Alternative 5	63,270	5,630	57,640	5,800	1,930	17,400
Alternative 6	101,070	8,410	92,660	10,100	2,850	27,100

NOTE: Figures are not cumulative.

a. Totals do not include off-site impacts.

b. Includes facilities, access roads, rail spurs, and urban growth.

c. Includes land mined and not yet reclaimed, facilities, off-site disturbance, and urban growth.

Alternative 3

Soils, Vegetation, and Reclamation

A total of 372,000 acres would be disturbed under Alternative 3. This is 38,300 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Annual water use for coal mining under Alternative 3 would be about 930 acre-feet greater than it would be under the "no action" alternative; however, most of the additional water could be supplied by rainfall on the mined areas and seepage into the pits. Municipal use would require 2,556 additional acre-feet per year.

About 93 more wells would be impaired or destroyed than under Alternative 1, and about 10 additional springs would be destroyed.

Surface Water

During peak production, surface outflow from the region would be reduced by 310 acre-feet per year more than under Alternative 1. Flow reductions would range from about 0.03% more in the Tongue River watershed to about 0.9% more in the Cheyenne River.

About 75 livestock ponds and small reservoirs would be destroyed during mining, causing a temporary deterrent to the use of the areas by wildlife and livestock.

The maximum potential increase in TDS concentrations above those under the "no action" alternative would range from 0.6% in the Belle Fourche River to 2.1% in the Tongue River and 2.3% in Armells Creek. These increases would have no significant impact.

Land Use

New mine properties covering 33,900 acres would be developed under Alternative 3. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

There are 19 landowners (non energy-related operations) who operate within the boundaries of tracts included in this alternative. One landowner whose property adjoins the Mud Springs tract has expressed concern about impacts that development of this tract would have on the air quality of his operation. He also is concerned about noise and social impacts. The Mud Springs tract is also included in Alternatives 4 and 6. Also see the discussion of Kintz Creek under Alternative 2.

Air Quality

As under Alternative 2, the Wyoming 24-hour standard would be violated around the Thundercloud and Kintz Creek tracts, and marginal violations of Montana's 24-hour standards would be expected near the North Decker I, North Decker II, and Spring Creek tracts. The estimated increase in TSP emissions under Alternative 3 would be 7,427 tons per year more than under Alternative 1.

Interest has been expressed in a coal-fired power plant on the Mud Springs tract, which is included in Alternatives 3, 4, and 6. If the power plant was built on this tract, sulfur dioxide would be emitted at a constant rate of 10,381 tons per year and nitrogen dioxide at 20,696 tons per year through 2000.

The most restrictive regulation on sulfur dioxide is the prevention of significant deterioration (PSD) increment for the Northern Cheyenne Indian Reservation, a Class I area. The 24-hour allowable increment consumption for sulfur dioxide in a Class I area is 5 micrograms per cubic meter. The maximum increment consumption for sulfur dioxide is projected to be 2.1 micrograms per cubic meter at the reservation boundary.

Transportation Facilities

Alternative 3 would add 10 miles of rail spur to serve new facilities. Full production from these tracts would add 25 unit trains per day to the main lines leaving the region. The number of trains per day is shown in table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interruptions and accident rates.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

Alternative 4

Soils, Vegetation, and Reclamation

A total of 391,300 acres would be disturbed under Alternative 4. This is 57,600 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Coal mining under Alternative 4 would require 1,660 acre-feet of water per year more than that required by the "no action" alternative; however, most of the additional water would be supplied by rainfall on the mined areas and seepage into the pits. Associated population growth would require 3,844 acre-feet per year more than Alternative 1.

Approximately 109 more wells would be impaired or destroyed than under Alternative 1, and at least 10 additional springs would be destroyed.

Surface Water

Surface outflow from the region would be reduced by 555 acre-feet per year more than under Alternative 1. The flow reductions would range from about 0.04% more than Alternative 1 in the Tongue River watershed to about 1.0% more in the Belle Fourche River.

About 96 livestock ponds and small reservoirs would be destroyed during mining, causing a temporary deterrent to use of the areas by wildlife and livestock.

Maximum TDS increases over those under the "no new leasing" alternative would range from 0.76% in the Cheyenne River to 2.7% in the Tongue River.

Land Use

New mine properties covering 51,500 acres would be developed under Alternative 4. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

There are 28 landowners (non-energy related operations) who operate within the boundaries of tracts included in this alternative. Landowners who have expressed concerns are discussed under Alternatives 2 and 3.

Air Quality

Wyoming 24-hour standards would be violated under Alternative 4 around the Thundercloud, Kintz Creek, and Mount Logan tracts. Marginal violations of Montana's 24-hour standards would occur near the North Decker I, North Decker II, and Spring Creek tracts. Power plant emissions from the projected plant on the Mud Springs tract would be the same as those described for Alternative 3. The estimated increase in TSP emissions under Alternative 4 would be 10,305 tons per year more than under Alternative 1.

Transportation Facilities

Alternative 4 would add 10 miles of new rail spur lines to serve new facilities. Full production from these tracts would add 44 unit trains per day to main lines leaving the region. The number of trains per day is shown on table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interruptions and accident rates.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

Alternative 5

Soils, Vegetation, and Reclamation

A total of 402,800 acres would be disturbed under Alternative 5. This is 69,100 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Coal mining under Alternative 5 would consume about 1,900 acre-feet of water per year more than would be required if there were no new leasing. Most of the additional water could be supplied by rainfall on the mined areas and seepage into the pits. Associated population growth would require 3,205 more acre-feet per year.

About 100 more wells would be impaired or

destroyed by mining under this alternative than under Alternative 1, and at least 3 more springs would be destroyed.

Surface Water

Surface outflow from the region would be reduced by 635 acre-feet per year more than under Alternative 1. Flow reductions would range from 0.07% more than Alternative 1 in the Tongue River to about 1.0% more in the Belle Fourche River.

About 112 livestock ponds and small reservoirs would be destroyed during mining.

The maximum additional TDS increases caused by mining in Alternative 5 would range from 0.8% in the Cheyenne River to 2.9% in the Tongue River.

Land Use

New mine properties covering 63,300 acres would be developed under Alternative 5. The acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

There are 37 landowners (non-energy related operations) who operate within the boundaries of tracts included in this alternative. Landowners who have expressed concerns are discussed under Alternative 2.

Air Quality

Violations of 24-hour air quality standards under Alternative 5 would be the same as those described for Alternative 4. The Mud Springs tract is not included in this alternative, so impacts described for the proposed power plant on that tract would not occur. The estimated increase in TSP emissions under Alternative 5 would be 12,489 tons per year more than under Alternative 1.

Transportation Facilities

Alternative 5 would add 45 miles of new rail spur lines to serve new facilities. Full production from these tracts would add 50 unit trains per day to main lines leaving the region. The number of trains per day is shown in table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interrruptions and accident rates.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

Alternative 6

Soils, Vegetation, and Reclamation

A total of 444,800 acres would be disturbed under Alternative 6. This is 111,100 acres more than would be disturbed under Alternative 1.

Water Resources

Groundwater

Coal mining for this alternative would consume 3,250 acre-feet per year more than the "no new leasing" alternative. However, most of this water could be supplied by rainfall on the mine areas and seepage into the mine pits.

About 150 wells would be impaired or destroyed in addition to those impacted by projected mining under Alternative 1, and at least 24 more springs would be destroyed.

Population growth associated with the coal development would require an additional 5,900 acre-feet per year for municipal supplies.

Surface Water

It is estimated that the reduction in regional surface outflow would exceed that of the "no action" alternative by 1,085 acre-feet per year. The greatest flow reductions would be in the Little Powder River watershed, which would have a decrease in flow of about 1.6%.

About 179 livestock ponds and small reservoirs would be destroyed during mining. The loss of these point-watering sources would be a temporary deterrent to use of the areas by wildlife and livestock until the water sources were replaced after reclamation.

The estimated maximum additional increases in TDS concentrations would range from 1.3% in the Cheyenne River to 5.8% in the Tongue River.

Land Use

New mine properties covering 101,100 acres would be developed under Alternative 6. The

acreage of cropland and rangeland that would be affected is shown on table 2-3, which also shows the number of acres disturbed off-site, the acreage disturbed per year, and the maximum number of acres disturbed at any one time.

There are 52 landowners (non-energy related operations) who operate within the boundaries of tracts included in this alternative. Landowners who have expressed concerns are discussed under Alternatives 2 and 3.

Air Quality

Under Alternative 6, the Calf Creek tract in Wyoming and the Downey Coulee tract in Montana would be added to the list of tracts that would violate the 24-hour standards, as described under Alternative 4. Impacts from the proposed coal-fired generator on the Mud Springs tract would be as described under Alternative 3. The estimated increase in TSP emissions under Alternative 6 would be 19,275 tons per year more than under Alternative 1.

Transportation Facilities

Alternative 6 would add 65 miles of new rail spur lines to serve new facilities. Full production from these tracts would add 85 unit trains per day to main lines leaving the region. The number of trains per day is shown in table 4-10 and figure 4-1 in chapter 4. Table 4-10 also shows at-grade interruptions and accident rates.

Economic and Social Conditions

See the narrative under Alternative 1, and table 2-2.

CHAPTER 3: THE AFFECTED ENVIRONMENT

INTRODUCTION

Components of the environment described in this chapter are those that would be affected by one or more of the alternatives. Climate, physiographic provinces, geologic structure, floodplains, threatened and endangered plant species, prime farmlands, wilderness or wilderness study areas, recreation, areas of critical environmental concern, and wild and scenic rivers are not discussed either because they do not occur in the region or because they would not be significantly affected by any of the alternatives.

Certain areas in some Wyoming and Montana tracts have been preliminarily identified as alluvial valley floors (AVFs), and one area in Montana has been definitely identified as an AVF. The possible AVFs have been excluded from consideration for leasing; however, before approval of a mining permit for a tract, the OSM or the appropriate state agency would make a final determination as to their existence and as to whether mining would be permitted in that part of the tract. The location and status of each possible AVF is detailed in appendix C.

GEOLOGY AND MINERALS

Coal

The economic coal beds of the region are found principally in the Tongue River Member of the Paleocene Fort Union Formation and in the Eocene Wasatch Formation. These coal beds generally are 30 to 70 feet thick and cover a wide area (more than 2,700 square miles).

The quality of coal is good, with the Btu content ranging from 8,000 to 9,300 Btus per pound and sulfur content less than 0.5% (see appendix A). Quantities of strippable reserves are estimated to exceed 100 billion tons. The coal seams of greatest significance are the Wyodak, Anderson, Dietz, Knobloch, and Canyon.

Detailed discussions concerning the quality, quantity, correlation, and locations of the coal beds appear in the individual tract profiles, and in *Draft Environmental Statement: Regional Analysis: Northern Powder River Basin Coal, Montana* (USDI, GS & Mont. DSL 1979) and *Final Environmental Statement: Proposed Development of Coal Resources in Eastern Powder River, Wyoming* (USDI, BLM 1979b). This information also is available in *Wyoming Geological Association 28th Annual Field Conference Guidebook* (Glass 1976), *Quality and Reserves of Strippable Coal, Selected Deposits: Southeastern Montana* (Mon. Bur. Mines & Geol. 1973), *Montana Coal: A Guide to Coal Geology, Resources, and Production* (Mont. Bur. Mines & Geol. 1980), and *Geology of the Tongue River Member, Fort Union Formation, Eastern Montana* (Matson and Pinchock 1977).

Coal areas in the Powder River Basin generally have suffered little structural deformation. Significant faults and folds are rare; they are confined mostly to the west flank of the basin along the Big Horn Mountains. This region is classified as aseismic; that is, having no tendency for earthquakes (Simon 1972).

Abundant plant and invertebrate fossils are found in the Tertiary coal-bearing rocks. Vertebrates and other significant fossils are rare; few have been found. The fossils known to be in the region have no exceptional scientific interest or value (USDI, BLM 1979b; USDI, GS & Mont. DSL 1979).

Other Minerals

Other minerals of economic importance in the region are oil and gas, uranium, and bentonite. The primary mineral resource in the region is oil and gas. Oil production in 1980 exceeded 45 million barrels. The uranium industry was very prominent in the southern part of the region before the Three-Mile Island incident. It is now dormant, with most mines closed or producing only small amounts of ore. Bentonite production in the region has declined with the recession and the decline of oil and gas exploration.

Further information is available in the publications cited under "Coal," above.

SOILS AND RECLAMATION

Soils in the region can be grouped into three general types. The first, and most extensive, are the recent soils, which are classified in the Entisol soil order. They occur mostly on sloping topography where geologic erosion is too high to

permit profile development or accumulation of organic matter. The physical and chemical properties of these soils are reliant upon those of the parent materials from which they are derived. These soils are relatively low in plant nutrients and commonly have textures that are too high in clay to be highly suitable for reclamation.

The region also has extensive areas of upland soils on flatter, more stable topography. They are classified in the Aridisol soil order. They commonly have low to moderate accumulations of organic matter and plant nutrients in the surface layer. They also have moderate to strong structural development within the solum (topsoil, subsoil, and soil-like parent material), which is important for good moisture intake and gas exchange within the soil. Stronger profile development also means that carbonates and salts present in the parent material have been leached by water to depths of 1 or 2 feet, or more. This produces a more fertile rooting zone. These soils are the most extensive (in terms of acreage) source of surface material suitable for plant growth when the textures are loamy; that is, not too clayey or sandy. Clayey soils tend to be impermeable to water and therefore droughty. Aridisols are less suitable than mollisols for surface reclamation.

The third major soil type is the Mollisols, which are the most fertile upland soils. These soils are of minor extent in the Wyoming part of the region, but they comprise significant acreage in Montana. They have surface layers high in organic matter and nutrients, and they are the best source of surface soil for rehabilitating the disturbed landscape.

There are minor amounts of fluvial soil types, which are found in flat to gently sloping drainage bottoms. Fluvial soils vary considerably in fertility, depending on the source of the alluvium; however, where salt concentrations are low these soils tend to be very fertile and are the most productive in the region. Riparian areas associated with these soils are especially important because they are a crucial source of biological diversity.

Riparian areas with their specific soils are scarce in the Powder River Region (USDI, GS & Mont. DSL 1979). Minor amounts of other soils are found in the region, including soils with some profile development that are found mainly in recent alluvial landscapes. The fertility of these soils is similar to that of the Entisols.

Detailed descriptions of the soils by tract are included in the individual tract profiles for the Montana tracts. Soil information for the Montana tracts in Big Horn County has a high reliability, since it comes from an Order II soil survey by the Soil Conservation Service, U.S. Department of Agriculture (SCS). According to the Miles City District of the BLM, the soil information for tracts in Powder River County is estimated to have a 30% reliability. A new survey publication for this county is planned.

Soil information for the Wyoming tracts is based on the *Wyoming General Soil Map* (U. of Wy. Ag. Exp. Sta. 1977). This map consists of large delineations of soil associations, some larger than the tracts themselves, so there is no way to determine from the map what percentage of each component is present in a tract or whether any given component occurs within the tract. Therefore, the *General Soil Map* has no utility for making predictions about the fertility of the soils on the Wyoming tracts or their reclamation potential. More site-specific information on soils may be available for Wyoming tracts in the near future.

Reclamation efforts at mines in the region indicate that most soils in the region have a fairly good reclamation potential. "Fairly good" means that these soils rate 7 on a scale of 1 to 10. Reclamation potential is assessed further in the individual tract profiles, in a Forest Service publication (USDA, FS 1974b), and in table 4-1 in chapter 4.

VEGETATION

The major vegetation type in the Wyoming part of the region is the sagebrush-herbaceous, which may also be called sagebrush-grassland. Sagebrush cover of this type generally varies from 20% to 60%. The major grasses are western wheatgrass, needle-and-thread grass, bluegrass, and prairie junegrass. Also of major extent in the Wyoming part of the region is the grassland-mixed shrub type, in which the major overstory species are snowberry, skunkbush sumac, wild currant, and big sagebrush. The major understory species are bluebunch wheatgrass, little bluestem, and Indian ricegrass. The Eastern Powder River coal EIS (USDI, BLM 1979b) contains a more detailed description of the major vegetative types in the Wyoming portion of the Powder River Coal Region.

There are lesser acreages of the juniper-mixed shrub type, in which the major species are Rocky Mountain juniper, big sagebrush, skunkbush sumac, snowberry, and bluebunch wheatgrass. The riparian type, although it constitutes only a small percentage of the total acreage, is of major importance for wildlife habitat. The major species in this type are cottonwood, boxelder, willow, big

sagebrush, western wheatgrass, and bluegrass. More detailed descriptions of the vegetation are included in the individual tract profiles.

The major vegetation types in Montana are the ponderosa pine-grass type, the sagebrush-grass type, the native grassland, and the riparian type. The ponderosa pine type generally is found on shallow, rocky soils. Sagebrush-grass and native grassland types are found on sites that vary from steep slopes to flat areas and have sandy to clayey texture. The fertility of the soils on these sites also can vary considerably. The riparian type, which is found in flat drainage bottoms, produces the most vegetation, but it accounts for only a small part of the total acreage. The 1979 Northern Powder River EIS (USDI, GS & Mont. DSL 1979) contains a more detailed description of the major vegetation types. Table 3A shows the acreage of vegetation types in the coal tracts proposed for leasing.

WATER RESOURCES

Surface Water

The region is drained to the north by Rosebud Creek, the Tongue River, and the Powder River and to the east by the Belle Fourche and Cheyenne rivers. Tributaries of these streams are generally ephemeral or intermittent.

There are two peak runoff periods during the year, corresponding to late winter snowmelt and spring rainfall. The lowest streamflow occurs from October through January. The streamflow regime is modified by numerous small reservoirs (mostly less than 20 acre-feet) and spreader systems. These structures result in appreciable depletion of runoff through increased seepage and evapotranspiration. Very high peak flows (floods with a return interval of 50 years or more) are not noticeably reduced by these structures (USDI, BLM 1979b).

Yields from the nonmountainous drainage basins (the Belle Fourche, Cheyenne, and south and east parts of the Powder River watershed) are generally less than 0.05 cubic feet per second per square mile (cfsm). Streams draining the Big Horn Mountains in the western part of the area generally yield more than 0.3 cfsm (USDI, GS 1973). Volumes of runoff vary considerably from year to year.

Erosion is quite high during peak flows in the ephemeral streams of the region. Sediment yields typically range from 0.13 to 1.3 acre-feet per

TABLE 3A
ACREAGE OF VEGETATIVE TYPES IN COAL LEASE AREA
BY ALTERNATIVE

Alternative	Total	Sage/Grass	Grassland	Ponderosa Pine	Other[a]
1	293,900	(data breakdown is not available for baseline acreage)			
2	14,128	8,626	3,670	0	1,832
3	26,888	10,436	7,729	2,788	5,935
4	40,445	20,613	9,008	3,292	7,532
5	60,234	34,825	12,398	3,482	9,529
6	87,064	50,905	19,806	3,482	12,871

NOTE: This table lists only the acreage of vegetative types on the proposed coal tracts. Off-site acreage is shown in table 2-3.

a. One or more of the following types: saline upland, saline lowland, mixed shrub-herbaceous, riparian deciduous.

square mile per year (USDI, BLM 1979b).

The chemical quality of water in the streams of the region changes continually with varying amounts and sources of water. In streams in the central and eastern parts of the Powder River basin, calcium, sodium, and sulfate are the dominant ions. TDS concentrations frequently are higher than 2,000 mg/l. Streams originating in the Big Horn Mountains, including the Tongue River and Rosebud Creek, typically have much better water quality. Water generally is of the calcium-bicarbonate type, and TDS concentrations often are less than 500 mg/l.

The largest use of surface water is for irrigation along stream valleys. Because stream discharge is small during the irrigation season, small reservoirs are often used for storage of irrigation supplies. Perennial streams and small reservoirs are also important sources of livestock water. Surface waters are used as municipal supplies for Sheridan, Buffalo, Dayton, Ranchester and Kaycee.

Groundwater

Aquifers in the Powder River Basin are contained in formations with a total thickness of more than 9,000 feet. The deepest aquifer of major importance is the Madison aquifer, which is found in the Big Horn Dolomite and Madison Limestone. These formations consist of dense Mississippian carbonate with low primary permeability. High secondary permeability exists locally in areas where there has been fracturing or solution. Yields of more than 1,000 gallons per minute (gpm) are possible where cavernous or fractured zones are present. Transmissivities are typically from 0.010 to 0.025 square feet per day. Recharge into the Madison occurs in the Big Horn Mountains, the Black Hills, the north end of the Laramie Mountains, and the Hartville Uplift. TDS concentrations usually are less than 1,000 mg/l. The major ions are calcium, magnesium, carbonate, and sulfate. The best quality water is found near outcrop areas, where TDS is typically less than 300 mg/l and sulfate less than 10 mg/l.

Most wells in the Madison aquifer are near outcrop areas. In the Black Hills, production exceeds 10,000 acre-feet per year. Bell Creek, Montana, Osage and Newcastle, Wyoming, and Edgemont, South Dakota, obtain water from Madison wells. Douglas, Wyoming, obtains Madison water from a spring. In the Midwest oil fields in Wyoming, wells about 5,000 feet deep supply water for water-flood secondary recovery operations.

The shallow aquifers are separated from the underlying Madison group by a sequence of Cretaceous shales up to 5,500 feet thick.

The Fox Hills-Lance aquifer (referred to as the Lower Hell Creek-Fox Hills in Montana) underlies the strippable coal in much of theregion. It is nearest the surface and most continuous in the northern part of the Powder River basin. The aquifer consists of Upper Cretaceous sands interbedded with sandy shale and claystone. The thickness of water-bearing zones ranges up to about 750 feet. Yields of 100 to 200 gpm are possible in the northern part of the basin. TDS concentrations range from 200 to 2,000 mg/l. No dominant water type is prevalent (Koch et al. 1982).

The Tullock aquifer consists of a section of the Tullock Member of the Fort Union Formation up to 600 feet thick plus the upper 10 to 80 feet of the Lance Formation. It is fine-grained sand, jointed coal, and clinker interbedded with shale. Yields are typically 15 to 40 gpm.

The Lebo Shale overlies the Tullock member and separates it from the Tongue River Member of the Fort Union Formation. In the Tongue River Member, thick coals and thick sandstone lenses beneath the coals are the principal water producers.

The Wasatch Formation, which overlies the Fort Union Formation, yields water sufficient for livestock consumption and domestic purposes from wells completed in lenticular sandstones, and to a lesser extent in jointed coal and clinker beds. Wells in the northern part of the basin may produce 10 to 50 gpm; wells in the southern part produce more. TDS concentrations range from 200 to 8,000 mg/l, but typically they are from 500 to 1,500 mg/l. Better quality water is found in the southern part of the basin. Sodium sulfate and sodium bicarbonate are the dominant water types.

Recharge to the shallow aquifer system is mainly in upland areas through sandy zones of the Fort Union Formation, coarse-grained alluvium, and clinker.

Quaternary alluvium contains the shallowest aquifers in unconsolidated silt, sand, and gravel deposits underlying floodplains and alluvial terraces. The thickness of the alluvial deposits is generally less than 50 feet, but it may be more than 100 feet in some valleys near mountains.

Yields range from a few gallons per minute to several hundred gpm in coarse-grained material along perennial rivers. TDS concentrations range from about 100 to more than 4,000 mg/l, but typically they are between 500 and 1,500 mg/l. Water in alluvium near the Big Horn Mountains and the Black Hills is usually better than that in the central part of the basin. No dominant water type is prevalent.

LAND USE

Agriculture is the primary land use in the region, occupying 87% of the land (Mont. Crop & Lvst. 1980; Wyo. Crop & Lvst. 1981). Most of the agricultural land is used for cattle and sheep. Most farming is dryland production of grain or hay. There is some flood-irrigated farming along stream bottoms.

There are no prime farmlands or wetlands in the region (USDA, SCS 1981). Land uses related to energy development accounted for 23,500 acres in the Montana portion of this region and 76,500 acres in the Wyoming portion of the region in 1980.

Land use in the region has previously been described in the 1979 Northern Powder River EIS, the 1979 Eastern Powder River EIS, and the 1981 Wyoming Coal EIS (USDI, GS & Mont. DSL 1979; USDI, BLM 1979b, 1981b). Refer to table 2-3 and the individual tract profiles for tabulations of affected land by type.

WILDLIFE

Wyoming

The area in the Powder River Basin most affected by coal mining is the Highlight antelope herd unit (hunt areas 24 and 101). Most of the factors that affect this herd unit remain unchanged from those described in the final coal EIS prepared in 1981 (USDI, BLM 1981b). Table 3-1 shows the harvest figures for recent years in antelope and mule deer hunt areas. Table 3-2 shows the acreage that probably would be disturbed by coal mining projects underway or planned. The antelope hunt district/area map shows the locations of hunt areas.

The antelope population in the Highlight herd unit has greatly increased since 1980 to its present level of approximately 12,800 animals, or 10.9 per square mile. Three main factors have contributed to this population explosion: First, all of Campbell County is a favored area for out-of-state hunters; however, the nonresident hunting license fee was drastically increased in 1980, and the number of licenses sold since then has declined sharply. Second, high trespass fees charged for hunting on private land also have discouraged hunters who have already paid a substantial sum for a hunting license. Third, three consecutive mild winters have greatly reduced antelope deaths from winter stress. In addition to these factors, most land that is now leased for coal development—about 7.6% of this herd unit—is closed to sport hunting.

There currently are two mines in antelope hunt area 17 (Gillette herd unit). There is some seasonal movement of antelope in the portion of the herd unit north of Spotted Horse west to the Powder River. A large portion of this herd moves southeast in the late fall into the sagebrush grasslands between Rawhide Creek on the south and Horse Creek on the north. Antelope are common only in the benches and bottomlands along Wild Horse Creek.

Investigations conducted by the Wyoming Game and Fish Department in northern Campbell County showed no significant winter mule deer concentration areas in deer hunt areas 17 and 18. High use areas are described in the 1981 Coal EIS (USDI, BLM 1981b).

Sage grouse are the most common upland game bird in Campbell County, where 51 leks are known to exist. Sixteen of these leks are in the area southeast of Gillette (antelope hunt areas 24 and 101). Five leks have been abandoned and two others destroyed by coal mining activities since 1975 (Wyo. Game & Fish 1979). These are active sage grouse leks on the Mount Logan and Hay Creek tracts.

Sharp-tailed grouse are common in the northern half of Campbell County, with eight leks known. Data are not available for the rest of the county.

There are several migratory bird species of high federal interest in the Powder River Region. These species receive special attention under federal coal leasing regulations. The species in the Wyoming part of the region most likely to be affected by development are golden eagle, prairie falcon, ferruginous hawk, merlin, burrowing owl, mountain plover, and Lewis' woodpecker. Less likely to occur in the Wyoming portion are the

TABLE 3-1
ANTELOPE AND DEER HARVEST IN WYOMING

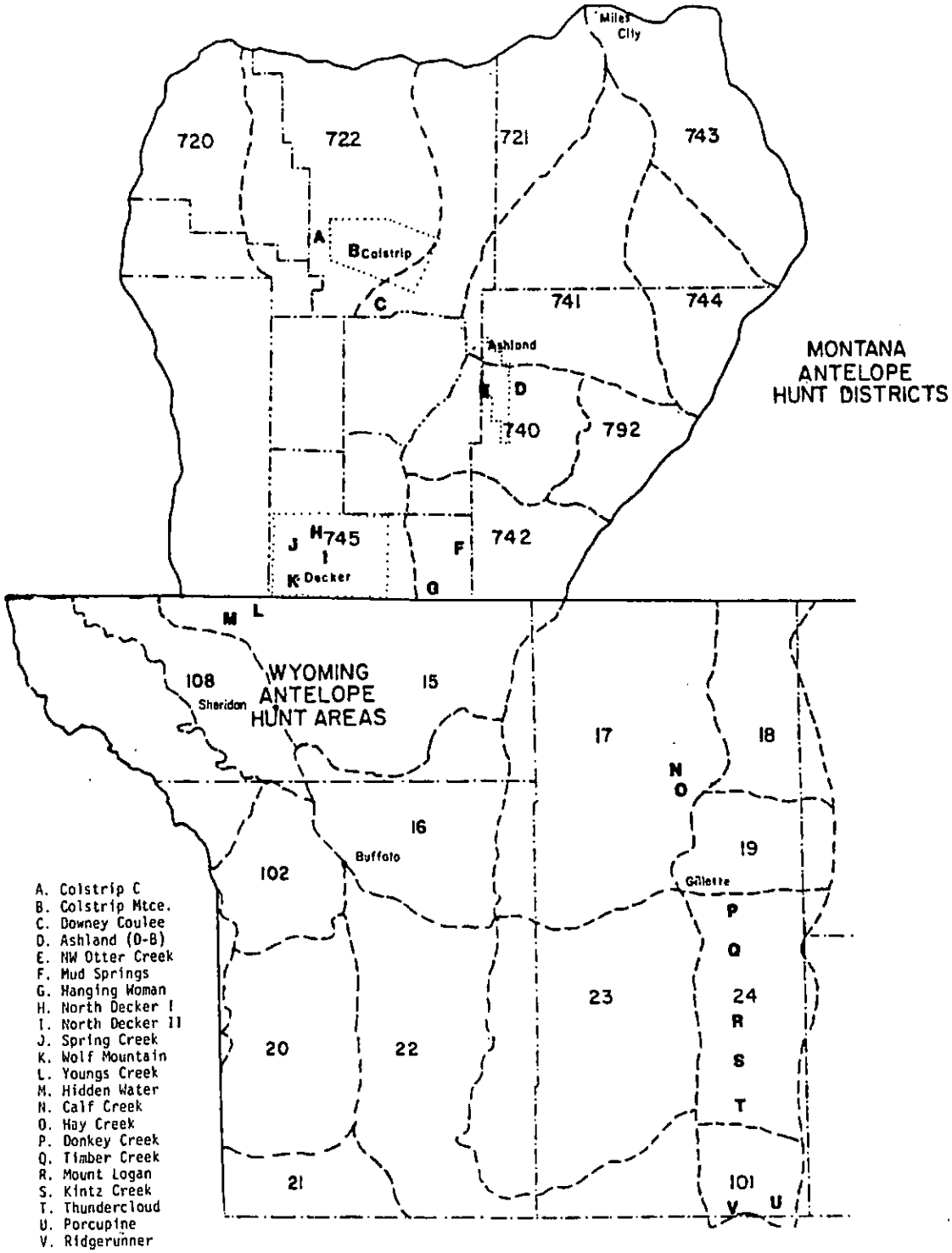
Year	Harvest and Percentage of Change from Previous Year					
	Antelope Hunt Area			Mule Deer Hunt Area		
	24[a]	17	15	21	18	24
1976	2,545	2,983	562	878	2,178	714
1977	1,937 - 23.9%	1,176 - 43.5%	515 - 8.4%	736 - 16.2%	1,876 - 13.9%	1,654 + 131.6%
1978	1,893 - 2.37%	1,627 - 5.2%	575 + 11.6%	498 - 22.3%	1,069 - 43.1%	1,008 - 39.1%
1979	1,226 - 35.3%	1,071 - 34.2%	610 + 6.1%	316 - 36.6%	749 - 30.0%	1,007 0
1980	501 - 59.2%	470 - 56.2%	516 - 15.5%	361 + 14.2%	1,017 + 35.8%	984 - 2.3%
1981	887 + 77.0%	638 + 35.7%	832 + 61.2%	414 + 14.7%	897 - 11.8%	1,180 + 19.9%
1982	1,244 + 40.2%	815 + 27.7%	532 - 36.1%	409 - 1.2%	1,301 + 45.0%	1,363 + 15.5%

a. Area 24 was divided into areas 24 and 101 in 1979. The figures given here for area 24 for 1979 through 1982 are the combined figures for both areas.

TABLE 3-2
ACREAGE DISTURBED BY COAL MINING IN HUNT AREAS

	1983		1985		1990		1995	
Antelope Hunt Area	Acreage Disturbed	Percentage of Herd Unit	Acreage Disturbed	Percentage of Herd Unit	Acreage Disturbed	Percentage of Herd Unit	Acreage Disturbed	Percentage of Herd Unit
24[a]	8,933	1.2%	12,333	1.6%	22,444	3.0%	31,946	4.2%
17	3,142	0.3%	4,264	0.4%	10,152	0.9%	23,297	2.1%
15	746	0.1%	822	0.1%	2,572	0.3%	8,512	1.1%
Mule Deer Hunt Area	Acreage Disturbed	Percentage of Hunt Area	Acreage Disturbed	Percentage of Hunt Area	Acreage Disturbed	Percentage of Hunt Area	Acreage Disturbed	Percentage of Hunt Area
21	8,933	1.2%	12,333	1.6%	22,444	3.0%	31,946	4.2%
18	3,142	0.3%	4,264	0.4%	8,394	0.8%	13,767	1.4%
24	746	0.2%	822	0.2%	1,440	0.4%	2,184	0.6%
17	-0-	-0-	-0-	-0-	1,758	0.2%	9,530	1.2%

a. Area 24 includes area 101. Both make up the Highlight Herd Unit.


MONTANA
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HUNT DISTRICTS
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722
721
743
A
B Colstrip
C
741
744
Ashland
E
D
740
792
J
H
745
I
K Decker
F
742
G
WYOMING
ANTELOPE
HUNT AREAS
M
L
108
Sheridan
15
17
18
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O
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Buffalo
102
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Gillette
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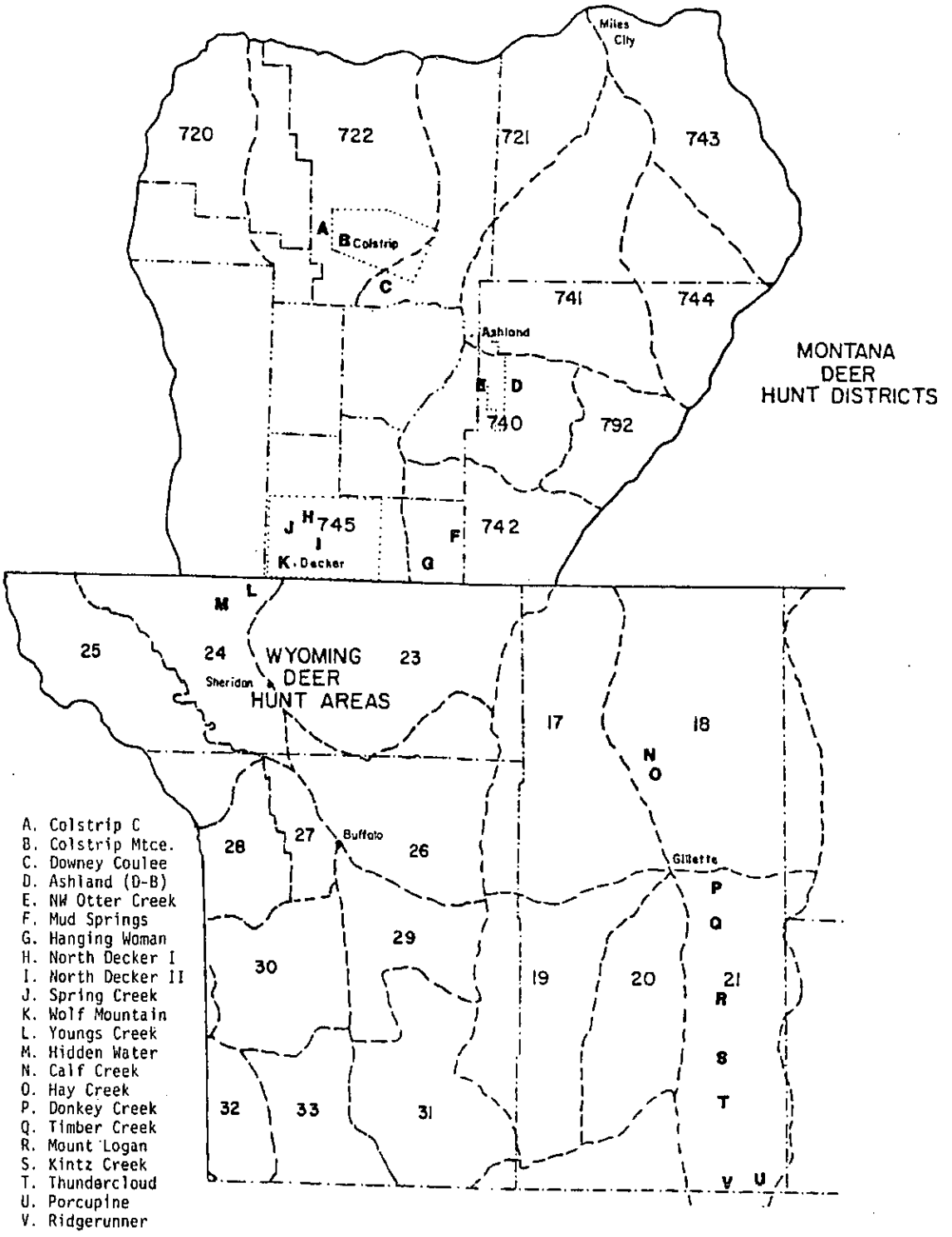
22
21
101
V
U
A. Colstrip C
B. Colstrip Mtce.
C. Downey Coulee
D. Ashland (D-B)
E. NW Otter Creek
F. Mud Springs
G. Hanging Woman
H. North Decker I
I. North Decker II
J. Spring Creek
K. Wolf Mountain
L. Youngs Creek
M. Hidden Water
N. Calf Creek
O. Hay Creek
P. Donkey Creek
Q. Timber Creek
R. Mount Logan
S. Kintz Creek
T. Thundercloud
U. Porcupine
V. Ridgerunner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C. Downey Coulee
D. Ashland (D-B)
E. NW Otter Creek
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T. Thundercloud
U. Porcupine
V. Ridgerunner

dickcissel and the long-billed curlew.

Golden eagles, red-tailed hawks, ferruginous hawks, and great horned owls are the most common raptors that nest in Campbell County. Available data indicate that there are at least 155 pairs of nesting golden eagles, 21 pairs of red-tailed hawks, 21 pairs of great horned owls, and 79 pairs of ferruginous hawks. There are 13 pairs of golden eagles nesting on or within ½ mile of active mines or areas leased for further development. One pair of prairie falcons nests on the Youngs Creek tract.

The bald eagle, the peregrine falcon, and the black-footed ferret are listed as endangered species by the Fish and Wildlife Service, U. S. Department of the Interior (USFWS). The bald eagle is a common winter resident of Campbell County. The peregrine falcon is a migrant through the region in spring and fall. The black-footed ferret is considered rare in this area since there have been few reported sightings. No habitat in the region has been designated as critical for any of these endangered species, and no other threatened or endangered animal species are known to occur in this area.

The Ash Creek-Youngs Creek area of Sheridan County contains the most diverse habitat of all the coal areas in Wyoming. A population of Lewis' woodpeckers nests in this area. It is one of only two populations of this species known to exist in Wyoming. The burrowing owl lives among the prairie dog towns in this area. The area also contains three sharp-tailed grouse leks and two sage grouse leks, as well as several small black-tailed prairie dog towns. Mule deer and antelope populations in this area have been relatively stable since 1976.

The Tongue River, which runs south and east of the Youngs Creek and Hidden Water tracts and forms the eastern boundary of the Youngs Creek tract, is a Class III fishery of regional importance. The woody riparian habitats along Ash Creek, Youngs Creek, and Little Youngs Creek contain a variety of nongame mammals and bird species several times greater than the number of species found in neighboring sagebrush grasslands.

There are two golden eagle nests on or near the Hidden Water tract. Both of the nests and protective buffer zones around them have been declared unsuitable for surface mining.

A bald eagle nest was discovered in 1983 approximately 1 mile from the Youngs Creek tract, and two young were fledged from the nest in that year. Surface mining was excluded from 120 acres of the Youngs Creek tract to protect bald eagle foraging habitat next to the Tongue River.

Consultation according to section 7 of the Endangered Species Act has been initiated between the BLM and the U.S. Fish and Wildlife Service for all tracts in Wyoming.

Montana

Descriptions of wildlife resources in the Otter Creek, Colstrip, and Decker BLM planning areas appear in the 1981 Coal EIS (USDI, BLM 1981b). No new published data are available for these areas.

BLM personnel surveyed the Mud Springs tract area in 1979 and 1980 to determine the habitat areas used by species of high interest to federal and state governments. The area is most important as mule deer and antelope yearlong habitat. Ponderosa pine and sagebrush grasslands are the two most important habitats for mule deer. Antelope use the sagebrush-grasslands on the tract infrequently. Several raptor species are common in the vicinity, but the tract contains no nests of raptor species of high interest to federal or state government.

The Downey Coulee tract area is characterized by large sandstone bluffs and buttes and by ponderosa pine vegetation. It is primarily mule deer habitat; they use the riparian bottomlands along Rosebud Creek heavily during summer and the ponderosa pine habitat year-round, especially during winter. The tract's suitability for antelope habitat is limited, so most antelope use occurs in late spring and early summer.

A sharp-tailed grouse lek in in the Downey Coulee tract was active in 1980 but inactive in 1981. Another lek was discovered just north of the tract in 1981. The portion of the buffer zone inside the tract was determined to be suitable for mining provided the state of Montana agrees to a mitigation plan. One golden eagle nest is present on the tract, but it overlies private minerals, so no unsuitablility exclusion was made for the nest.

The Hanging Woman Creek area supports large herds of antelope and mule deer. The largest concentration of deer in all seasons occurs in the hills between the East Fork of Trail Creek and Horse Creek (Martin 1980). Antelope also tend to concentrate on the mid-slope areas north

of Trail Creek, especially in winter (Martin 1980).

Three sharp-tailed grouse leks are known in the area. One lek is approximately 600 yards west of the Hanging Woman tract. An area surrounding this lek on the Hanging Woman Creek bottom has been declared unsuitable for mining. The tract also contains two sage grouse leks, and one other sage grouse lek is less than ½ mile from the boundary. The corporation that owns deeded lands on and around the tract and the Montana Department of Fish, Wildlife, and Parks have agreed to a mitigation plan setting aside areas of sagebrush habitat outside the tract for use by grouse.

Several small black-tailed prairie dog towns are on the Hanging Woman Creek tract. The towns were searched for black-footed ferrets in 1980, but no sign of this endangered species was found. Several raptor species of high federal interest nest near the tract, but none are known to nest on the tract.

Consultation according to section 7 of the Endangered Species Act has been initiated between the BLM and the U.S. Fish and Wildlife Service for all tracts in Montana.

CULTURAL RESOURCES

Background

The Powder River region of the Great Plains has witnessed human activity for the past 12,000 years. As a result of this occupation, approximately 8,000 prehistoric and historic sites are known to exist. These cultural resourcesrange from prehistoric hunters' camps to bison kill sites, stone circles, quarries, petroglyphs and pictographs, burials, pottery sites, rock shelters, lithic scatters, and stratified sites caused by continued reuse of a certain area.

In addition, the district also contains ethnohistoric and historic cultural resources. The Indian utilization of a region subsequent to European contact represents the ethnohistorical period; the historic period is the period during which Euorpean-American exploration and settlement occurred. Site types from these periods include trails, battlefields, homesteads, historic mines, and native American religious sites.

In recent years cultural resource inventories have been conducted as a response to increasing energy development. These inventories are undertaken in compliance with Section 106 of the National Historic Preservation Act and Section 2(b) of Executive Order 11593.

However, at present only approximately 4% of the Powder River Basin region has been surveyed for cultural resources at a Class III level. Although two major Class II projects have been completed, "The Western Powder River Basin Survey" (Reher n.d.) and "The Eastern Powder River Basin Survey" (Metcalf-Zier 1981), neither of these two complies with current mine permit stipulations requiring intensive inventory for cultural sites. A Class II study is a 10% sample survey of a selected area. Consequently, though large areas have been surveyed at a Class I literature search level and a Class II sample survey level, these inventories are not of sufficient intensity to "clear" areas for coal mining purposes.

Prehistory

The prehistoric chronology for this region is based largely upon studies completed in neighboring areas. The first chronology for the Powder River Region was developed by Mulloy in 1958 and later revised by Frison in 1978. According to thses studies, the Paleo-Indian period extends from 11,200 to 7,500 years ago; the Early Plains archaic from 7,500 to 5,000 B.P.; the Middle Plains Archaic from 5,000 to 3,000 B.P.; Late Plains Archaic from 3,000 to 1,700 B.P., and the Late Prehistoric from 1,700 to 300 years ago.

Until more research is conducted, the actual significance of sites falling into these different periods is difficult to evaluate. Though archeological investigations have provided enough fundamental information to venture a few suggestions concerning settlement pattern and subsistence strategies, these assumptions are based on limited data. However, generally the greatest site density should occur in areas of highest topographic diversity. Such areas gave prehistoric peoples the ability to exploit the variety of wildlife and plant species that occurred in different ecological zones. The lowest site density, then, should be in large, flat open areas.

Because the number of extensive excavations in the Powder River Region has been small, no particular site type or time period can be evaluated as more significant than another. Any site that

has the ability to contribute new information to our understanding of prehistoric lifeways is significant.

Ethnohistory and History

Ethnography and ethnohistory allow some delineation of tribal movements from about A.D. 1400 to the present. Tribal demography can be seen as a series of population relocations. Between 1400 and 1850 A.D. the Powder River Basin was shared by the Crow, Plains Apache, Shoshoni, Comanche, Cheyenne, Teton Dakota, and Arapahoe.

The first known historic travelers to reach this region were members of Francois Antoine Larocque's Northwest Company. Then in 1811 and 1812 the Astorians from the American Fur Company crossed the divide between the Powder River and the Little Missouri River. Various groups of trappers, traders, missionaries and military men traversed the basin between 1820 and 1860. Emigrant traffic began in 1863 to proceed up the Powder River trail pioneered by John Bozeman and John Jacobs. Because this route violated the last sacred hunting grounds of the regional Native Americans, the trail was the scene of numerous Indian-military and Indian-emigrant conflicts. By 1864 the route was known as the "Bloody Bozeman."

With the end of the Civil War, the government began concentrating its military efforts on subduing the hostile Plains tribes. Notable events occurred along the Bozeman Trail at Crazy Woman Creek, at Fort Phil Kearny, and the Little Big Horn. Both the Fetterman Massacre in 1866 and the Custer Massacre in 1876 were desperate attempts on the part of Powder River tribes to fight off the growing encroachment of whites in their treaty-assured lands. All efforts failed. By the end of the 1870s, the Plains Indian peoples were confined on reservations.

After 1880 homesteaders began settling the region, forming small farms and ranches. Later large cattle companies started competing with the small operations, and conflicts over who had right to the use of open public land resulted in the Johnson County War of 1892.

The railroad reached Gillette, Campbell County, in 1891, and homesteading efforts were stepped up accordingly. Sheep were introduced and energy production pursuits began.

Early coal mines and oil and gas activities were initiated as early as 1882. Large scale oil development began in the 1950s and coal development in the 1970s.

Physical evidence of early homesteading and energy production is present throughout the region.

The Northern Cheyenne Tribe has indicated that there are two religious sites on the Downey Coulee tract. The tribe has been asked to identify the location of the sites, but to date the BLM has received no further information.

Specific numbers of sites in each tract are reported in the individual tract profiles. More extensive discussion of prehistoric and historic activities in the region is included in the 1979 Eastern Powder River coal EIS (USDI, BLM 1979b) and the 1979 Northern Powder River Coal EIS (USDI, GS & Mont. DSL 1979).

VISUAL RESOURCES

The landscape in areas that would be affected in the Montana portion of the region is mostly rolling uplands dissected by steep-sided valleys. Areas of rugged hills and badlands also would be affected. The affected landscape in the Wyoming portion is largely low rolling hills and flat plains. There are rough hills and breaks along the Powder River. The dominant visual element in both the Montana and Wyoming portions of the region is the Big Horn Mountains in the west.

The scenic quality of most of the lands is rated Class B or Class C according to the BLM's visual resource management (VRM) system (USDI, BLM 1980c). These quality ratings, when combined with sensitivity levels and distance zones, form visual management classes. Scenic quality B and C, combined with medium sensitivity and foreground/middleground and background zones, result in management classes of III and IV.

The landscape character of Forest Service lands in the region is generally rated Subtype 6. Variety classes generally are C, with some Class B or Class A areas. Visual quality objectives for these lands range from partial retention through modification to maximum modification. The land classification systems of the Forest Service and the BLM are described in appendix D.

More detailed descriptions of the region's visual resources are available in the Eastern Powder River EIS, the 1981 coal EIS, and the Montana coal EIS (USDI, BLM 1979b, 1981b; USDI, GS & Mont. DSL 1979).

NOISE

Noise levels in rural areas of the region are low (30 to 50 dBA), with most noise sources related to agriculture. The major noise impacts from energy development are related to transportation. Increased vehicular and train traffic has increased noise impact zones along major transportation routes. The major receptors of noise effects are the residents of Miles City, Colstrip, and Forsyth, Montana, and Gillette, Newcastle, Torrington, and Lusk, Wyoming. Noise dissipates rapidly in wide-open rural areas; thus, the effects of mines on rural areas are not as great as those on residential areas within 1 mile of a mine. However, surveys have shown that residents in subdivisions within 1 mile of existing mines in this region have few problems with noise from coal mining (Paul Nelson Asso. 1981).

AIR QUALITY

Background

The basic regulatory framework of the Clean Air Act of 1977 involves national ambient air quality standards (NAAQS) and allowable increments for the prevention of significant deterioration of air quality.

NAAQS are absolute, nationwide limits on the amount of certain pollutants that may be present in the air. No part of the country may exceed these levels. The federal government has set primary standards to protect public health and secondary standards to protect the general public welfare. The states of Wyoming and Montana have set their own ambient standards for the same pollutants, which are at least as stringent as the federal standards (see table 3-3).

The PSD program is designed to protect the air quality from significant deterioration in areas already meeting the NAAQS. In other words, in cleaner areas a specific increase, or "increment," in pollution is allowed above the existing air quality "baseline" pollution levels. In no event, however, may pollution increases exceed the NAAQS.

The size of the increment allowable under the PSD program depends on the area's designation as a Class I, II, or III area, with Class I areas allowed the smallest pollution increment and Class III the largest. In the Clean Air Act of 1977, the Congress designated certain national parks and other such areas as Class I areas. All other areas were designated as Class II. However, Congress provided a procedure for state and tribal governments to redesignate areas under their jurisdiction as Class II or III.

Wyoming's and Montana's PSD standards are identical to the federal standards (see table 3-4). Air quality regulations are discussed further in appendix E.

Air Quality in This Region

A report prepared for the BLM by PEDCo Environmental, Inc. (1983) contains a detailed description of the air quality in the region. Most of the region is federal Class II for PSD. However, the Northern Cheyenne Indian Reservation, which is a Class I PSD area, is within 15 miles of tracts north of Decker.

The maximum allowable increases and the federal, Wyoming, and Montana ambient air quality standards are shown on tables 3-3 and 3-4. State standards for ambient TSP generally are more restrictive than the federal standards, with 24-hour standards being a greater restraint than annual standards.

The background rural TSP annual geometric mean concentration for the region is about 15 micrograms per cubic meter. In and near populated areas and mining activities, particulate levels are significantly higher than background levels (see table 3-5).

No monitored violations of federal ambient TSP standards have occurred in Wyoming in recent years. However, the more restrictive Wyoming annual standard has been violated in Sheridan, and the 24-hour state standard has been marginally violated near several mining locations. Monitoring of gaseous pollutants indicated that concentrations are well within state and federal standards.

Air quality monitoring data show that rural background concentrations of sulfur oxide and nitrogen oxide are as follows:

TABLE 3-3
AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	Federal Primary Standards (mcg/m³)	Federal Primary Standards (ppm)	Wyoming State Standards (mcg/m³)	Wyoming State Standards (ppm)	Montana State Standards (mcg/m³)	Montana State Standards (ppm)
Sulfur dioxide	Annual (arithmetic)	80	0.03	80	0.02		0.02
	24-hour	365	0.14	260	0.10		0.10
	3-hour			1,300	0.50		0.50
Total suspended particulates	Annual (geometric)	75		60		75	
	24-hour	260		150		200	
Carbon monoxide	8-hour	10,000	9.00	10,000	9.00		9.00
	1-hour	40,000	35.00	40,000	35.00		22.00
Photochemical oxidant	1-hour	240	0.12	160	0.08		0.08
Nitrogen dioxide	Annual	100	0.05	100	0.05		0.05

SOURCES: National Ambient Air Quality Standards 1970; Wyoming Department of Environmental Quality 1975; Montana State Department of Health and Environmental Sciences 1983.

mcg/m³ = micrograms per cubic meter. ppm = parts per million

TABLE 3-4
MAXIMUM ALLOWABLE INCREASES
FOR PREVENTION OF SIGNIFICANT DETERIORATION OF AIR QUALITY

Pollutant	Averaging Time	Maximum Allowable Air Quality Increases (micrograms per cubic meter) Class I	Class II	Class III
Sulfur dioxide	Annual mean	2	20	40
	24-hour[a]	5	91	182
	3-hour[a]	25	512	700
Total suspended particulates (TSP)	Annual mean	5	19	37
	24-hour[a]	10	37	75

NOTE: These are federal, Wyoming, and Montana ambient air quality standards.

a. The increments for these averaging times are not to be exceeded more than once per year.

Annual arithemtic mean: sulfur oxide, 1 microgram per cubic meter; nitrogen oxide, 2 micrograms per cubic meter.

Maximum 24-hour: sulfur oxide and nitrogen oxide, 9 micrograms per cubic meter.

The only significant sources of sulfur oxide and nitrogen oxide in Wyoming are three power plant units near Gillette.

In Montana, both federal and state ambient annual and 24-hour TSP standards have been violated in the Colstrip area. Colstrip has been designated nonattainment for particulate. Elsewhere, federal and state 24-hour standards are violated near mining areas. No monitoring data for gaseous pollutants were found.

The rural background concentrations measured in Wyoming were assumed to be representative for the Montana portion of the study area. The principal sources of sulfur oxide and nitrogen oxide in Montana are the Colstrip power plant units 1 through 4.

Visibility greater than 60 miles is common. Significant reductions in visibility are generally weather related.

The only mining operations included in the air quality modeling were those that either were in production or had indicated an intention to start the permitting process. The Cook Mountain tract was inadvertently omitted, but it will be analyzed in another computer run to be made before the final EIS is released. The site-specific analysis of the Cook Mountain tract by PEDCo in 1980 did not forecast violations of air quality standards.

TABLE 3-5
AMBIENT BACKGROUND CONCENTRATIONS OF POLLUTANTS
IN THE POWDER RIVER REGION

Pollutant	Concentration in micrograms per cubic meter
Sulfur dioxide	
Maximum annual arithmetic mean	1
24-hour maximum	9
3-hour maximum[a]	27
1-hour maximum	82
Total suspended particulates	
Maximum annual geometric mean	15
24-hour maximum	61.5
Nitrogen dioxide	
Maximum annual arithmetic mean	2
24-hour maximum	9

SOURCE: Figures for background concentrations supplied by the state of Wyoming.

a. Estimate based on rough interpolation between 1-hour and 24-hour maxima; no monitoring data are available for the 3-hour maximum.

TRANSPORTATION FACILITIES

Burlington Northern Railroad operates three main rail lines within the Powder River region. Most coal is carried east on these lines. The Chicago and North Western/Union Pacific line to be constructed in southeastern Wyoming is expected to begin moving coal when construction is completed, reaching a plateau in the amount hauled by 1991 (US, Dept. of Trans. 1980).

Major highways and trafficways are shown on the Regional Activity map, as are rail routes. Outlying areas in the region are connected by a system of county roads, private roads, Forest Service roads, and in Montana, Indian reservation roads.

Resurfacing is planned during the next six years on the section of U.S. Highway 212 from Crow Agency to Busby and from Lame Deer to Ashland. General maintenance along these sections currently costs approximately $3,000 per mile. The section from Lame Deer to Ashland is a heavy snowfall area. The Montana State Highway Department is attempting to implement a pavement management program, which would involve installing a seal coat every 10 years and an overlay every 20 years on highways in this area (Braut 1983).

Wyoming Highway 59 from Gillette to Reno Junction is being reconstructed and should keep up with development in that area. However, Wyoming 59 north of Gillette and U.S 14-16 north of Gillette do not have the structural design or alignment to handle large volumes of traffic from increased development.

There are no current plans to reconstruct either of these roads. An overlay is planned for 18 miles of Wyoming 59 in 1984. Four miles of Wyoming 338 north of Sheridan are to be reconstructed in 1984, and the section of thathighway from the new section around the Big Horn Mine north to the Montana state line is to be reconstructed in 1987 (Hanlin 1983).

Highway and rail systems are discussed further in previously published documents (USDI, BLM 1979b, 1981b; USDI, GS, & Mont. DSL 1979).

A coal slurry pipeline operated by Energy Transportation Systems, Inc., (ETSI) is expected to begin transporting coal by 1990. Slurry preparation plants are planned for the North Rawhide, North Antelope, and Jacobs Ranch areas in Campbell County. The pipeline would compete with railroads hauling coal out of the Powder River Region. More information on the pipeline is available in the ETSI pipeline EIS (USDI, BLM & Woodward-Clyde 1980).

EMPLOYMENT AND SALARIES AND WAGES

This section presents projections of ongoing trends in employment and in salaries and wages for benchmark years in the Powder River Region. All employment projections are based on the regional industrial development that is presented in appendix B. It should be noted that plans that had been formulated for the construction of power plants and generating units in the latter part of the 1980s have been postponed indefinitely. After the completion of Colstrip units 3 and 4, no power plant construction is projected in the region. This is apparently due to forecasts for less demand for electricity than heretofore expected.

The Eastern and Western Powder River Region

General

Soft markets for uranium and coal, the recent recession, and a depressed oil and gas industry have served to lower employment forecasts in many Wyoming counties through 1985. A 12% decline is expected in employment in Converse County by 1985 (see table 3-6). In addition, the closing of the CF&I iron mine and the completion of new railroad facilities in Platte County provide the basis for a 29% decline in Platte County employment by 1985. Firming coal and uranium markets and an improved oil and gas outlook in the last half of the 1980s will increase employment levels substantially by 1990 in all counties except Platte County, which will remain at 80% of the 1980 employment level.

Sheridan County

Employment levels in Sheridan county are unique in that they contain secondary employment induced by development in Montana as well as development in Wyoming. Table 3-7 presents an estimate of the secondary employment induced in Sheridan County by Montana development and estimates of the number of persons employed

TABLE 3-6
PROJECTED TRENDS FOR COVERED EMPLOYMENT[a]
AND SALARIES AND WAGES IN BENCHMARK YEARS
FOR THE EASTERN AND WESTERN POWDER RIVER REGION

(salaries and wages are in millions of dollars)

County/Sector	1980[b]		1985[c]		1987[c]		1988[c]		1990[c]		1995[c]	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Campbell County												
Coal employment	2,022	54.3	6,200	166.6	7,900	212.1	8,800	236.2	10,500	281.3	12,500	335.6
Construction employment	2,331	49.4	880	18.7	4,400	93.3	4,500	95.4	2,100	44.5	1,200	25.4
All other employment	9,053	151.1	9,920	165.6	10,900	181.9	11,200	186.9	11,900	198.6	12,900	215.3
All covered employment	13,406	254.8	17,000	350.9	23,200	487.3	24,500	518.5	24,500	524.4	26,600	576.3
Converse County												
Coal employment	162	4.0	230	5.6	530	13.2	690	17.2	990	24.7	1,100	27.0
Construction employment	598	12.0	590	11.7	1,600	32.1	1,600	32.1	610	12.2	620	12.4
All other employment	5,171	91.2	4,380	77.2	4,970	87.7	5,110	90.1	5,400	95.2	5,780	101.9
All covered employment	5,931	107.2	5,200	94.5	7,100	133.0	7,400	139.4	7,000	132.1	7,500	141.3
Crook County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	166	2.8	170	2.9	170	2.9	170	2.9	170	2.9	170	2.9
All other employment	1,279	16.2	1,330	16.8	1,330	16.8	1,430	18.1	1,430	18.1	1,430	18.1
All covered employment	1,445	19.0	1,500	19.7	1,500	19.7	1,600	21.0	1,600	21.0	1,600	21.0
Goshen County												
Mining and construction[d]	300	4.1	300	4.1	300	4.1	300	4.1	310	4.2	310	4.2
All other employment	3,120	31.1	3,300	32.9	3,600	35.9	3,600	35.9	3,690	36.8	3,790	37.8
All covered employment	3,420	35.2	3,600	37.0	3,900	40.0	3,900	40.0	4,000	41.0	4,100	42.0
Johnson County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	245	3.5	240	3.4	250	3.6	250	3.6	250	3.6	250	3.6
All other employment	2,040	23.7	2,160	25.1	2,350	27.3	2,450	28.5	2,550	29.6	2,550	29.6
All covered employment	2,285	27.2	2,400	28.5	2,600	30.9	2,700	32.7	2,800	33.2	2,800	33.2
Natrona County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	3,677	69.0	3,600	67.6	3,700	69.4	3,700	69.4	3,800	71.3	3,800	71.3
All other employment	33,925	590.3	35,900	624.7	38,300	666.4	38,900	676.9	39,300	683.8	40,700	708.2
All covered employment	37,602	659.3	39,500	692.3	42,000	735.8	42,600	746.3	43,100	755.1	44,500	779.5

Niobrara County												
Mining and construction[d]	114	1.7	120	1.8	120	1.8	120	1.8	120	1.8	130	1.9
All other employment	619	5.8	660	6.2	690	6.5	700	6.6	710	6.7	730	6.8
All covered employment	733	7.5	780	8.0	810	8.3	820	8.4	830	8.5	860	8.7
Platte County												
Mining and construction[d]	1,366	34.0	10	0.2	10	0.2	10	0.2	10	0.2	10	0.2
All other employment	2,296	24.9	2,590	28.1	2,890	31.3	2,890	31.3	2,990	32.4	3,090	33.5
All covered employment	3,662	58.9	2,600	28.3	2,900	31.5	2,900	31.5	3,000	32.6	3,100	33.7
Sheridan County												
A separate table has been prepared for Sheridan County because some impacts to that county will come from mining in the Northern Powder River Region. See table 3-4.												
Weston County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	257	4.0	250	3.9	260	4.0	260	4.0	260	4.0	270	4.2
All other employment	2,291	33.3	2,950	42.9	3,040	44.2	3,040	44.2	3,140	45.6	3,130	45.5
All covered employment	2,548	37.3	3,200	46.8	3,300	48.2	3,300	48.2	3,400	49.6	3,400	49.7

NOTE: Figures may not add due to rounding.

a. "Covered employment" is employment that is covered by unemployment insurance, as reported for the county of employment by the Wyoming Employment Security Commission (WESC).

b. Except for coal employment, all 1980 employment shown herein is actual covered employment as published by WESC. Coal employment for 1980 is an estimate based on industrial planning or the relative weight of coal activity compared to all mining in the county. All 1980 salaries and wages are actual salaries and wages paid to covered employment in 1980, as published by the WESC.

c. All employment projections are derived from the Casper District input-output model. All salary and wage projections are based on 1980 average weekly wages as published by the WESC.

d. Mining and construction have been combined for Goshen, Niobrara, and Platte counties so that individual operations will not be disclosed.

in Big Horn and Powder River counties who will reside in Sheridan County. The secondary employment will reach an interim peak in 1987 as a result of cumulative construction projects in Montana at that time.

The Northern Powder River Region

Table 3-8 presents estimates of employment and salaries and wages for benchmark years in the Northern Powder River region. All counties in this section will experience an interim peak in employment in 1987 because of the cumulative effects of the construction of coal mines and the Tongue River railroad. Employment levels will decline somewhat between 1987 and 1990. Regional coal mines will reach the capacity for full production in 1990, and employment levels should arrive at a plateau between 1990 and 1995.

The Crow and Northern Cheyenne Tribes

Table 3-9 presents estimates of labor force, employment, and unemployment among the Crow and Northern Cheyenne Indians for benchmark years. Figures for 1980 from the Bureau of Indian Affairs, U.S. Department of the Interior (BIA), indicate high unemployment rates for both tribes: 43% for the Crow and 48% for the Northern Cheyenne. Preferential hiring agreements would help to lower these rates.

The Crow Tribe has leased coal on the reservation and as part of that action required preferential hiring of Crow Indians to produce the coal.

Data on wages and salaries among the Indians are not available, but low incomes can readily be assumed in light of the high unemployment rates. In this regard, the assumption can also be easily made that increased employment would raise income levels among the Indians.

POPULATION AND HOUSING

This section presents projections of ongoing trends in population and housing requirements for benchmark years in the Powder River Region. Figures 3-1, 3-2, and 3-3 depict these trends graphically for the counties that will be directly affected by federal coal leasing in 1984. Tables 3-10 through 3-13 present the population projections and housing requirements for the entire region.

The Eastern and Western Powder River Region

General

As with employment trends, Converse and Platte counties will experience a decline in population through 1985, after which Converse County will experience a substantial increase in population (see table 3-10). Platte County will remain at 80% of the 1980 population level, or less, through 1995.

Sheridan County

It is estimated that about 6% of the population in Sheridan County in 1980 was the result, both directly and indirectly, of Montana development. The portion of Sheridan County population that is attributable to Montana developments is expected to grow to about 12½% by 1990 (see table 3-11).

The Northern Powder River Region

Unlike employment trends in the Northern Powder River Region, the only discernable interim peak in population will occur in Big Horn County in 1987 (see table 3-12). This is due to the lower population effects resulting from construction projects, to which the pronounced peak in employment is attributable. Even with the interim peak, 1990 population in Big Horn County is expected to be about 11% greater than that of 1987.

The Crow and Northern Cheyenne Indian Reservations

Table 3-13 presents population projections for the Crow and Northern Cheyenne reservations for benchmark years. In general, population trends on the reservation will follow the population trends of the counties in which the reservations are situated.

TABLE 3-7
PROJECTED TRENDS FOR COVERED EMPLOYMENT[a]
AND SALARIES AND WAGES IN BENCHMARK YEARS
FOR SHERIDAN COUNTY

(salaries and wages are in millions of dollars)

	1980[b]		1985[c]		1987[c]		1988[c]		1990[c]		1995[c]	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Coal employment	300	7.5	440	11.0	660	16.6	770	19.3	990	24.9	990	24.9
Construction employment	1,127	18.6	1,100	18.3	1,500	24.8	1,500	24.8	1,150	18.9	1,200	19.8
All other employment	6,726	76.4	7,260	82.5	7,810	88.7	7,830	88.9	8,060	91.6	8,210	93.3
All covered employment	8,153	102.5	8,800	111.8	9,900	130.1	10,100	133.0	10,200	135.4	10,400	138.0
Secondary employment induced in Sheridan County by Montana employment[d]	70	0.8	100	1.2	230	2.7	100	1.2	300	3.6	300	3.6
Montana workers residing in Sheridan County[e]	490	13.8	750	21.1	750	21.1	890	25.0	1,140	32.0	1,140	32.0

NOTE: Except as noted, 1980 figures are actual data as reported by the Wyoming Employment Security Commission (WESC).

a. "Covered employment" is employment that is covered by unemployment insurance, as reported for the county of employment by the WESC.

b. Employment projections are derived from the Casper District input-output model. Salary and wage projections are based on 1980 average weekly wages published by the WESC.

c. Coal employment for 1980 is an estimate based on industrial planning and the relative weight of coal activity compared to all mining in the county.

d. Estimate of employment induced in Sheridan County by primary employment in neighboring Montana counties. See footnote "c" to table 3-8 for the methodology used in projecting induced employment. Because covered employment is reported by county of employment, these numbers are included in Sheridan County employment.

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

TABLE 3-8
PROJECTED TRENDS FOR COVERED EMPLOYMENT
AND SALARIES AND WAGES IN BENCHMARK YEARS
FOR THE NORTHERN POWDER RIVER REGION
(salaries and wages are in millions of dollars)

County/Sector	1980[a]		1985		1987		1988		1990		1995	
	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages	Employment	Salaries and Wages
Big Horn County												
Coal employment[b]	954	26.8	1,480	41.6	1,480	41.6	1,750	49.4	2,240	63.1	2,240	63.1
Construction employment[c,d]	589	17.3	320	9.5	1,250	36.8	320	9.5	420	12.3	420	12.4
All other employment[c]	2,351	25.4	2,420	26.1	2,520	27.2	2,400	26.0	2,570	27.8	2,580	27.8
All covered employment	3,894	69.6	4,200	77.2	5,200	105.6	4,500	85.9	5,200	103.2	5,200	103.3
Powder River County												
Coal employment[b]	15	0.3	---	---	---	---	150	3.3	440	9.5	440	9.5
Construction employment[c,d]	33	0.5	30	0.5	550	8.0	30	0.5	40	0.5	40	0.5
All other employment[c]	529	5.8	540	5.9	560	6.1	560	6.1	580	6.3	590	6.4
All covered employment	577	6.6	580	6.4	1,100	14.1	750	9.9	1,100	16.3	1,100	16.4
Rosebud County												
Coal employment[b]	432	12.1	880	24.8	1,040	29.2	1,240	34.7	1,340	37.5	1,410	39.7
Construction employment[c,d]	707	14.9	840	17.8	1,130	23.9	940	19.8	820	17.3	810	17.1
All other employment[c]	2,337	23.3	2,450	24.5	2,620	26.2	2,450	24.5	2,690	26.8	2,700	26.9
All covered employment	3,476	50.3	4,200	67.1	4,800	79.3	4,600	79.0	4,800	81.6	4,900	83.7

NOTE: Figures may not add due to rounding.

a. The 1980 employment is the annual average of monthly employment covered by unemployment insurance, as reported for the county of employment. The 1980 salaries and wages are a summation of covered quarterly salaries and wages. Monthly and quarterly data for 1980 were furnished by the Employment Security Division of the Montana Department of Labor and Industry.

b. The 1980 coal employment is an estimate derived from covered mining employment on the basis of the amount of coal activity compared to other mining activity in the county. Projections of coal employment are based on the relationship of one additional employee for each additional 25,300 tons of projected coal capacity (relationship derived from the Casper District input-output model). Salaries and wages for coal are based on the 1980 weekly average wage for mining.

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

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

TABLE 3-9
LABOR FORCE, EMPLOYMENT, AND UNEMPLOYMENT
AMONG THE CROW AND NORTHERN CHEYENNE INDIANS IN 1980
WITH PROJECTIONS FOR BENCHMARK YEARS

	1980	1985	1987	1988	1990	1995
Crow Indians						
Labor force	2,019	2,250	2,550	2,400	2,760	2,810
Employment	1,147	1,280	1,450	1,360	1,570	1,600
Unemployment	872	970	1,100	1,040	1,190	1,210
Northern Cheyenne Indians						
Labor force	1,703	2,030	2,250	2,250	2,470	2,530
Employment	886	1,060	1,170	1,170	1,290	1,310
Unemployment	817	970	1,080	1,080	1,190	1,210

NOTE: Data for 1980 are from the Bureau of Indian Affairs, U.S. Department of the Interior. Projections are based on the 1980 ratios of labor force, employment, and unemployment to the population of Indians on the reservation. Figures may not add due to rounding.

REVENUES AND EXPENDITURES

Expenditure Levels

This section presents projections of local expenditure levels for benchmark years in the Powder River Region. The projections are based on per capita spending in the base year, 1979-1980. This was done to maintain the spending standards of the base year. For that reason, debt servicing was included in the base year expenditures. For purposes of this section, it is assumed that projected expenditures will be supported by taxation, user fees, grants, or deficit spending. In instances where localities cannot utilize any of these measures, it must be assumed that requirements for new or additional facilities or services will not be met. In localities where services and facilities are already considered inadequate, it must be further assumed that additional needs will further aggravate an already bad situation.

Projected expenditures follow the trend in employment and population throughout the region (see tables 3-14 through 3-16).

Funding

This section is intended only to indicate the primary sources of funds for local entities in the region. It is not a detailed analysis of the tax structure.

The Eastern and Western Powder River Region

Primary sources of funding for counties in the Eastern and Western Powder River Region include property taxes, sales and use taxes, and bonded indebtedness. Primary sources for communities include sales and use taxes, grants, and bonded indebtedness. Funding for schools is primarily from property taxes, mineral royalty payments, and bonded indebtedness. Funding for water, sewer, highway, road, and street projects in areas either directly or indirectly affected by the production of coal is allocated by the Wyoming Farm Board from the coal severance tax.

It should be noted that there is no mechanism to allocate funds to Sheridan County from Montana coal developments. All severance taxes from Montana coal development accrue to the state of Montana, but a substantial portion of the population impacts occur in Sheridan County. For this reason, some Sheridan County residents would welcome coal development in Sheridan County if only to broaden the tax base.

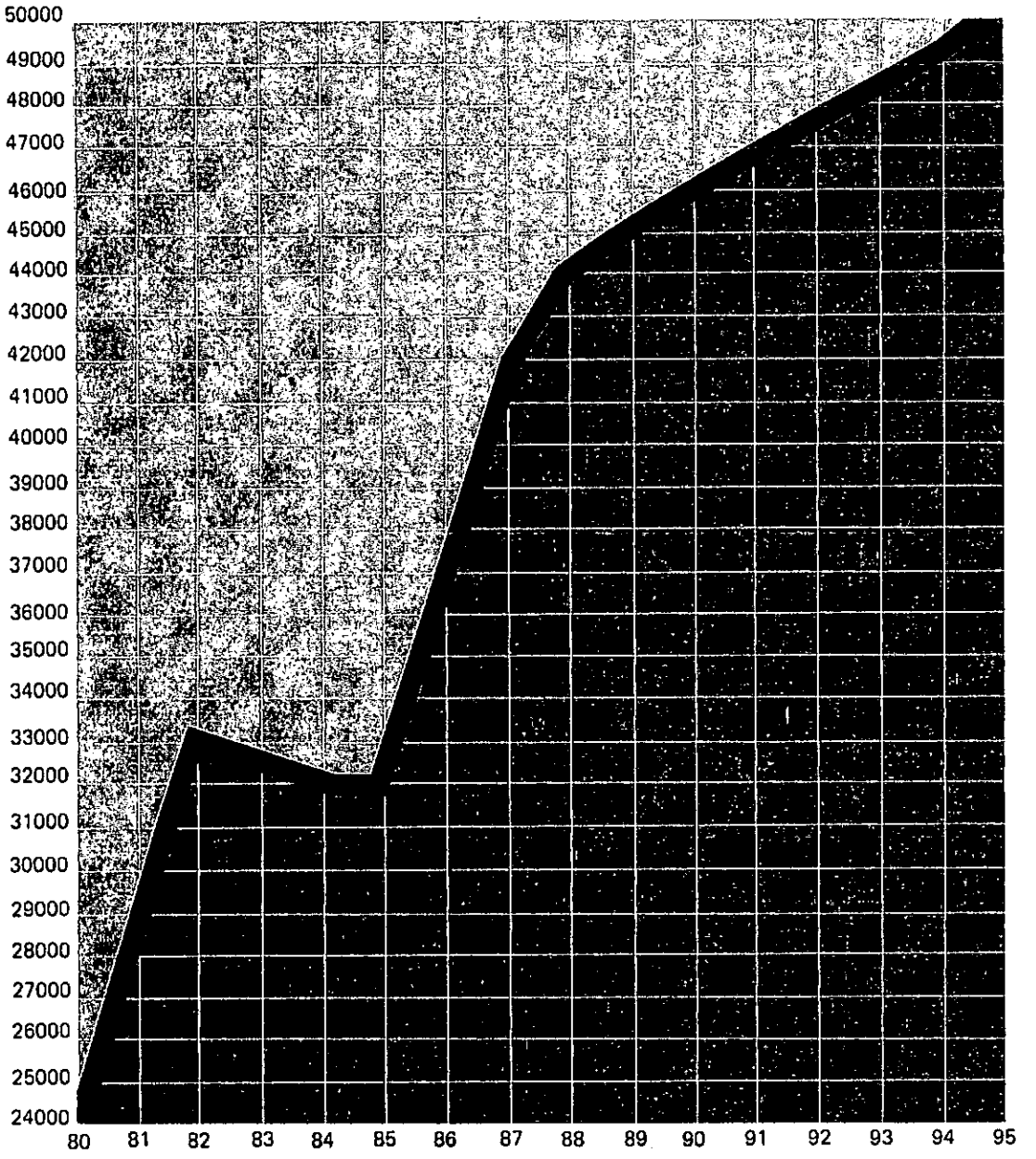


Figure 3-1
POPULATION TRENDS
EASTERN POWDER RIVER – CAMPBELL COUNTY

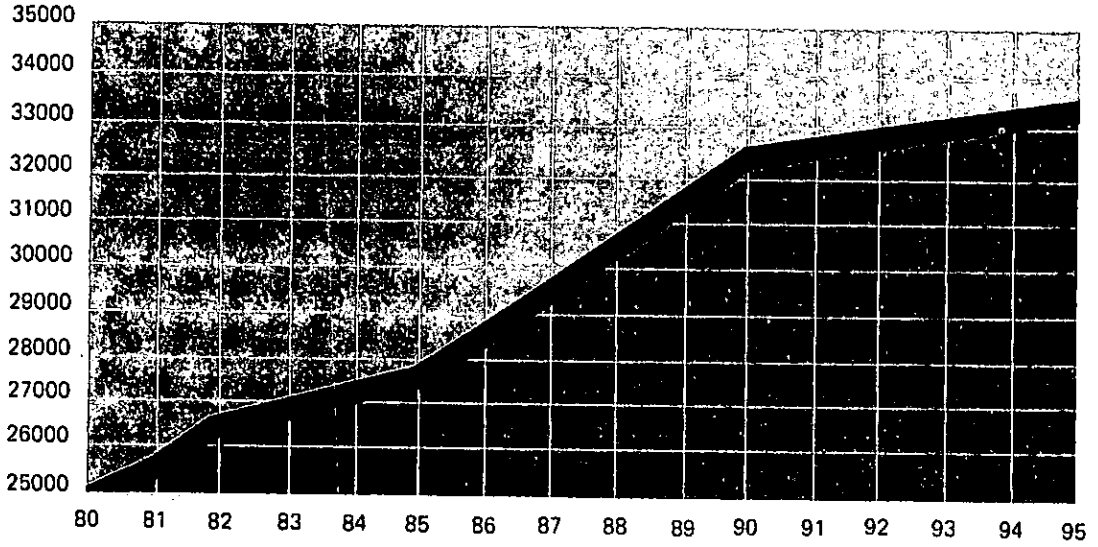
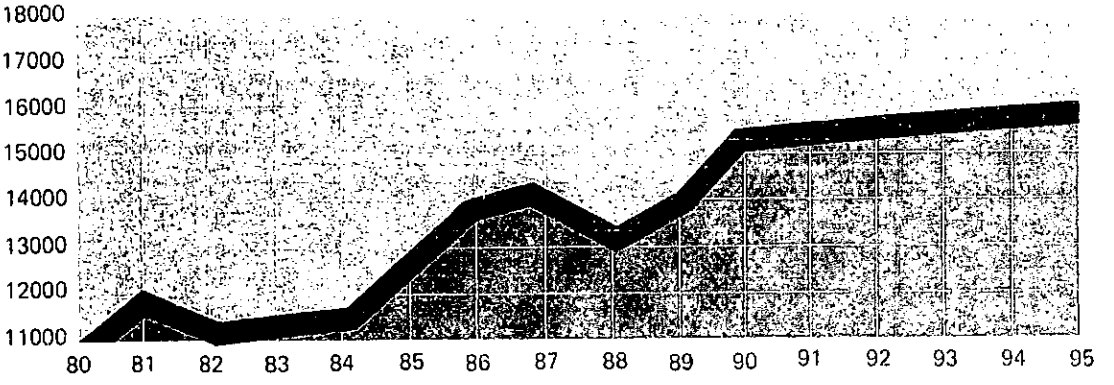
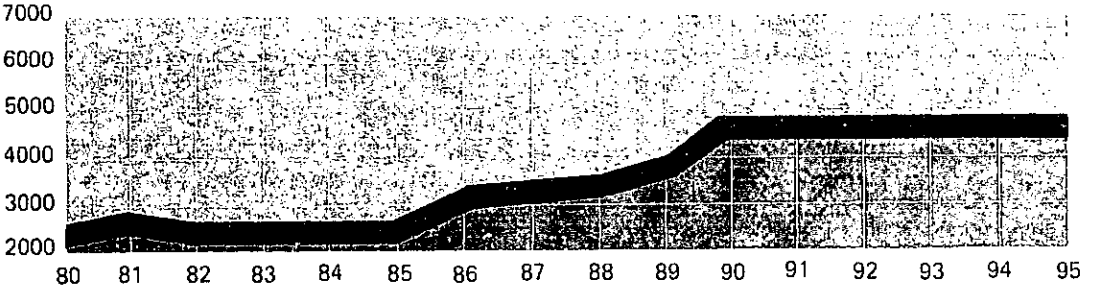


Figure 3-2
POPULATION TRENDS
WESTERN POWDER RIVER – SHERIDAN COUNTY

BIGHORN COUNTY



POWDER RIVER COUNTY



ROSEBUD COUNTY

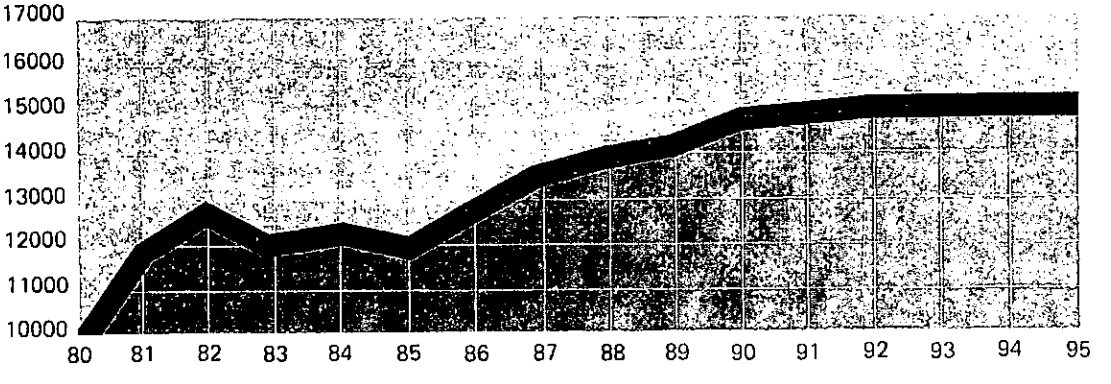


Figure 3-3
POPULATION TRENDS
NORTHERN POWDER RIVER

TABLE 3-10
ESTIMATED POPULATION TRENDS AND HOUSING NEEDS FOR BENCHMARK YEARS
IN THE EASTERN AND WESTERN POWDER RIVER REGION

	1980[a]		1985[a]		1987[a]		1988[a]		1990[a]		1995[a]	
County/Community	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Campbell[b]	24,367	9,505	31,900	12,400	41,500	16,200	43,900	17,100	45,600	17,800	50,000	19,500
Gillette	12,134	4,857	15,900	6,400	20,700	8,300	21,900	8,800	22,700	9,100	24,900	10,000
Converse[c]	14,069	5,350	12,400	4,700	15,700	6,000	16,400	6,200	16,700	6,400	17,500	6,700
Douglas	6,030	2,338	5,300	2,100	6,700	2,600	7,000	2,700	7,100	2,800	7,500	2,900
Glenrock	2,736	1,044	2,410	920	3,050	1,160	3,190	1,220	3,250	1,240	3,400	1,300
Crook[d]	5,308	2,434	5,400	2,500	5,600	2,580	5,700	2,630	5,800	2,660	5,900	2,700
Sundance	1,087	479	1,120	490	1,150	510	1,180	520	1,190	520	1,200	530
Moorcroft	1,014	442	1,040	450	1,080	470	1,100	480	1,110	480	1,120	490
Goshen[d]	12,040	5,017	13,200	5,500	14,100	5,900	14,300	6,000	14,600	6,100	15,000	6,300
Torrington	5,441	2,231	6,000	2,460	6,400	2,600	6,500	2,670	6,600	2,700	6,800	2,790
Johnson[d]	6,700	3,029	7,000	3,200	7,600	3,400	7,900	3,600	8,100	3,700	8,300	3,800
Buffalo	3,799	1,673	3,950	1,740	4,300	1,890	4,500	1,980	4,600	2,020	4,700	2,070
Natrona[d]	71,856	28,493	76,800	30,500	81,500	32,300	82,800	32,800	83,800	33,200	86,500	34,300
Casper	51,016	20,259	54,500	21,600	57,900	23,000	58,800	23,400	59,500	23,600	61,400	24,400
Niobrara[d]	2,924	1,434	3,020	1,480	3,130	1,540	3,170	1,550	3,200	1,570	3,250	1,590
Lusk	1,650	777	1,710	810	1,760	830	1,790	840	1,800	850	1,830	860
Platte[d]	11,975	5,053	8,300	3,500	8,900	3,800	9,100	3,800	9,200	3,900	9,500	4,000
Guernsey	1,991	871	1,380	600	1,480	650	1,510	660	1,530	670	1,580	690
Wheatland	5,816	2,516	4,000	1,730	4,300	1,860	4,400	1,900	4,500	1,950	4,600	1,990
Sheridan: A separate table has been prepared for Sheridan County because some impacts to that county will come from mining in the Northern Powder River Region. See table 3-11.												
Weston[d]	7,106	2,900	9,400	3,800	9,700	4,000	9,800	4,000	9,900	4,000	10,100	4,100
Newcastle	3,596	1,443	4,800	1,920	4,900	1,970	5,000	2,010	5,000	2,010	5,100	2,050
Upton	1,193	525	1,590	700	1,630	720	1,650	730	1,660	730	1,690	740

a. Figures for 1980 are from the actual census count. Trends were derived by applying 1980 population-to-employment ratios to projected employment. Housing requirements are based on the number of persons per house in 1980.

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

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

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

TABLE 3-11
ESTIMATED POPULATION TRENDS AND HOUSING NEEDS IN BENCHMARK YEARS
FOR SHERIDAN COUNTY

	1980		1985		1987		1988		1990		1995	
	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]	Population[a]	Housing[b]
Primary impact of Montana employment	1,410	620	2,180	950	2,180	950	2,590	1,130	3,300	1,440	3,300	1,440
Secondary impact of Montana employment	190	80	280	120	670	290	290	130	800	350	820	360
Base without Montana impacts[c]	23,500	10,300	25,000	10,900	27,100	11,800	28,000	12,200	28,500	12,400	29,300	12,800
County total	25,048	10,928	27,500	12,000	29,900	13,000	30,900	13,500	32,600	14,200	33,400	14,600
City of Sheridan	15,146	6,604	16,600	7,200	18,100	7,900	18,700	8,200	19,700	8,600	20,200	8,800

NOTE: The totals for 1980 are actual census data. Figures may not add due to rounding.

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

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

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

TABLE 3-12
ESTIMATED POPULATION TRENDS AND HOUSING NEEDS FOR BENCHMARK YEARS
IN THE NORTHERN POWDER RIVER REGION

(figures may not add due to rounding)

	1980		1985		1987		1988		1990		1995	
	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Big Horn County[a]	11,096	3,867	12,600	4,400	14,100	4,900	13,400	4,700	15,600	5,400	15,700	5,500
Crow Reservation Div.[b]	5,645	1,734	6,400	1,970	7,200	2,210	6,800	2,090	7,900	2,430	8,000	2,460
Hardin Division[b]	4,249	1,737	4,800	1,960	5,400	2,210	5,100	2,090	6,000	2,450	6,000	2,450
Hardin[b]	3,300	1,360	3,700	1,520	4,200	1,730	4,000	1,650	4,600	1,900	4,700	1,940
Northern Cheyenne Div.[b]	1,013	288	1,150	330	1,300	370	1,220	350	1,420	400	1,430	410
Tongue River Division[b]	189	108	210	120	240	140	230	130	270	150	270	150
Powder River County[c]	2,520	1,123	2,520	1,123	3,250	1,450	3,260	1,450	4,640	2,070	4,640	2,070
Broadus Division[b]	1,321	612	1,321	612	1,700	790	1,710	790	2,430	1,130	2,430	1,130
Broadus[b,d]	715	337	715	337	920	430	920	430	1,320	620	1,320	620
East Powder River Div.[b]	725	303	725	303	940	390	940	390	1,340	560	1,340	560
Otter Division[b]	474	208	474	208	610	270	610	270	870	380	870	380
Rosebud County[e]	9,899	3,787	11,900	4,600	13,400	5,100	13,900	5,300	14,500	5,500	14,700	5,600
Ashland Division[b,f]	564	248	680	300	760	330	790	350	830	370	840	370
Ashland[f,g]	415	128	500	150	560	170	580	180	610	190	620	190
Forsyth Division[b]	3,516	1,472	4,200	1,760	4,700	1,970	4,900	2,050	5,100	2,140	5,200	2,180
Forsyth[b]	2,553	1,053	3,100	1,280	3,400	1,400	3,600	1,490	3,700	1,530	3,800	570
Northern Cheyenne Div.[b]	2,651	758	3,200	920	3,600	1,030	3,700	1,060	3,900	1,120	4,000	1,140
Rosebud Division[b]	3,168	1,309	3,800	1,570	4,300	1,780	4,400	1,820	4,600	1,900	4,700	1,940
Colstrip[b]	1,476	475	1,770	590	1,990	640	2,070	670	2,160	700	2,200	710

NOTE: Figures for 1980 are from the actual census count, except where otherwise noted. Housing needs based on 1980 ratio of persons per house.

a. Trends were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.992 was used for permanent employment, plus 1.256 for temporary employment.

b. Trends are based on the 1980 share of county population.

c. Trends were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 4.367 was used for permanent employment, plus 1.263 for temporary employment. As there was no apparent temporary population in Powder River County in 1980, the average of the temporary ratios for Rosebud and Big Horn counties was used for Powder River County.

d. The 1980 figures for Broadus are from the preliminary census releases.

e. Trends were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.997 was used for permanent employment, plus 1.270 for temporary employment.

f. Not to be confused with the Ashland District of the Northern Cheyenne Reservation.

g. Figure for 1980 is an estimate from the Miles City District, BLM.

TABLE 3-13
ESTIMATED POPULATION TRENDS AND HOUSING NEEDS IN BENCHMARK YEARS
FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

	1980		1985		1987		1988		1990		1995	
	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing	Population	Housing
Crow Reservation												
Indian	3,953	801	4,400	890	5,000	1,010	4,700	950	5,400	1,090	5,500	1,110
Non-Indian	2,020	1,038	2,270	1,170	2,540	1,310	2,400	1,230	2,770	1,420	2,810	1,440
Reservation total[a]	5,973	1,839	6,700	2,060	7,500	2,310	7,100	2,190	8,200	2,520	8,300	2,560
Lodge Grass	771	215	860	240	970	270	920	260	1,060	300	1,070	300
Northern Cheyenne Reservation												
Indian	3,101	718	3,700	860	4,100	950	4,100	950	4,500	1,040	4,600	1,070
Non-Indian	563	328	680	400	750	440	750	440	810	470	830	480
Reservation total	3,664	1,046	4,400	1,260	4,900	1,400	4,900	1,400	5,300	1,510	5,400	1,540
Ashland (on reservation)[b]	380	110	460	130	510	150	510	150	540	160	560	160
Birney (on reservation)[b]	145	40	170	50	190	50	190	50	210	60	210	60
Busby[b]	810	230	970	280	1,080	310	1,080	310	1,170	330	1,190	340
Lame Deer[b]	2,000	570	2,400	680	2,670	760	2,670	760	2,890	820	2,950	840

NOTE: Figures may not add due to rounding. Figures for 1980 are from actual census count except as noted. All population projections are based on the 1980 share of county population. All housing projections are based on the number of persons per house in 1980.

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

b. Population figures for Ashland, Birney, Busby, and Lame Deer were taken from a statement of the Northern Cheyenne Tribe at the EIS scoping meeting in Ashland, Montana, on May 26, 1983. Housing figures are based on the average number of persons per house for the Northern Cheyenne Reservation in 1980.

TABLE 3-14
LOCAL EXPENDITURE LEVELS IN THE EASTERN AND WESTERN POWDER RIVER REGION
IN 1979, WITH PROJECTIONS FOR BENCHMARK YEARS
(in thousands of dollars)

	1979[a]	1985[b]	1987[b]	1988[b]	1990[b]	1995[b]
Campbell County	13,681.1	18,800	24,500	25,900	26,900	29,500
School District 1	35,885.2	49,300	64,200	67,900	70,600	77,300
Gillette	10,122.0	14,000	18,200	19,200	20,000	21,900
Converse County	8,304.0	7,800	9,900	10,300	10,500	11,000
School District 1	15,279.5	14,300	18,200	19,000	19,300	20,300
Douglas	6,690.0	6,200	7,900	8,300	8,400	8,800
School District 2	5,735.5	5,400	6,800	7,100	7,200	7,600
Glenrock	1,234.0	1,100	1,400	1,500	1,500	1,600
Crook County	3,467.4	3,600	3,700	3,800	3,900	3,900
School District 1	4,578.5	4,800	4,900	5,000	5,100	5,200
Sundance	546.3	600	600	600	600	600
Moorcroft	384.0	400	400	400	400	400
Goshen County	1,899.1	2,100	2,300	2,300	2,300	2,400
School District 1	7,780.9	8,600	9,200	9,400	9,500	9,800
Torrington	4,136.7	4,600	4,900	5,000	5,100	5,200
Johnson County	2,062.3	2,200	2,400	2,500	2,500	2,600
School District 1	5,646.8	6,000	6,500	6,700	6,900	7,100
Buffalo	1,902.3	2,000	2,200	2,300	2,400	2,400
Natrona County	35,668.5	39,400	41,800	42,400	42,900	44,300
School District 1	30,908.8	34,100	36,200	36,800	37,200	38,400
Casper	41,792.5	46,200	49,100	49,800	50,400	52,000
Niobrára County	889.0	900	1,000	1,000	1,000	1,000
School District 1	2,812.5	2,900	3,000	3,000	3,100	3,100
Lusk	1,465.4	1,500	1,600	1,600	1,600	1,600
Platte County	2,773.9	2,000	2,200	2,200	2,200	2,300
School District 1	6,564.4	4,800	5,100	5,200	5,300	5,500
Wheatland	3,147.0	2,300	2,500	2,500	2,600	2,600
School District 2	1,278.0	900	1,000	1,000	1,000	1,100
Guernsey	592.9	400	500	500	500	500
Sheridan County	14,724.3	16,600	18,100	18,700	19,700	20,200
School District 2	9,898.8	11,200	12,200	12,600	13,300	13,600
Sheridan	7,143.8	8,100	8,800	9,100	9,600	9,800
Weston County	3,806.8	5,100	5,300	5,300	5,400	5,500
School District 1	3,671.2	4,900	5,100	5,100	5,200	5,300
Newcastle	1,662.8	2,200	2,300	2,300	2,300	2,400
School District 7	1,307.0	1,800	1,800	1,800	1,800	1,900
Upton	1,341.4	1,800	1,900	1,900	1,900	1,900

a. Actual expenditures reported by local entities. Includes debt servicing.

b. Figures projected on a per capita basis from 1979 per capita expenditure levels.

TABLE 3-15
LOCAL EXPENDITURE LEVELS IN THE NORTHERN POWDER RIVER REGION
IN 1980, WITH PROJECTIONS FOR BENCHMARK YEARS
(in thousands of dollars)

	1980[a]	1985[b]	1987[b]	1988[b]	1990[b]	1995[b]
Big Horn County	6,109.5	6,900.0	7,800	7,400	8,600	8,600
Schools	9,892.3	11,200.0	12,600	11,900	13,900	14,000
Hardin	778.1	870.0	990	940	1,100	1,100
Powder River County	3,887.5	3,887.5	5,000	5,000	7,200	7,200
Schools	2,025.8	2,025.8	2,600	2,600	3,700	3,700
Broadus	162.3	162.3	210	210	300	300
Rosebud County	6,392.5	7,700.0	8,700	9,000	9,400	9,500
Schools	5,911.7	7,100.0	8,000	8,300	8,700	8,800
Ashland[c]	---	170.0	190	200	210	220
Colstrip	4,813.1	5,800.0	6,500	6,800	7,000	7,200
Forsyth	1,341.0	1,600.0	1,800	1,900	1,900	2,000

a. Actual expenditures reported by local entities. Includes debt servicing.

b. Figures projected on a per capita basis from 1980 per capita expenditure levels.

c. Ashland had no formal budgeting in 1980. Projections are based on average per capita spending of Broadus, Hardin, and Forsyth in 1980.

TABLE 3-16
LOCAL EXPENDITURE LEVELS IN 1980
ON THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS
WITH PROJECTIONS FOR BENCHMARK YEARS
(in thousands of dollars)

	1980[a]	1985[b]	1987[b]	1988[b]	1990[b]	1995[b]
Crow Reservation	6,474.8	7,300	8,100	7,700	8,900	9,000
Lodge Grass	87.0	100	110	100	120	120
Northern Cheyenne Reservation	7,011.5	8,400	9,400	9,400	10,100	10,300

a. Source: For Crow Reservation and Lodge Grass--Mountain West Research-North, Inc., "Decker Area Mines Comprehensive Social Sciences Study," 1983. Report prepared for Montana Department of State Lands and U.S. Office of Surface Mining. For Northern Cheyenne--paper submitted by the Northern Cheyenne Tribe, dated October 27, 1983, containing comments on a review edition of this document.

b. Projected on a per capita basis.

The Northern Powder River Region

The primary sources of funding for counties and schools in the Northern Powder River Region are property taxes and the gross proceeds tax. Montana communities receive funding from property taxes, water and sewage fees, other local use taxes, and grants.

Communities can also develop special improvement districts for major projects (sewer, water, streets). The Montana Coal Board receives an allocation of 8¾ of the Montana coal severance tax to provide grants for the purpose of alleviating impacts.

The Crow and Northern Cheyenne Indian Reservations

The primary sources of revenue for the Crow Tribe are mineral leases, permits, bonuses, and royalties.

The primary sources of revenue for the Northern Cheyenne are grazing fees, timber fees, investment income, private contributions, fees for mineral exploration, and federal assistance. The Northern Cheyenne Tribe emphasizes that these revenues are not reliable and have declined substantially in recent years. In addition, the tribe has emphasized the inadequacy of facilities and services on the reservation. Given the declining revenues, these inadequacies can only intensify at the cost of degrading the quality of reservation life.

Legislation recently enacted by the Montana state legislature allows the Montana Coal Board to allocate 7% of its funds for loans and grants to Indian tribes and state agencies beginning October 1, 1983. However, this only imparts the right to apply for loans or grants; it does not guarantee funding.

COMMUNITY SERVICES

This section presents estimates of community service levels that would be required for the projected populations in the Powder River Region for benchmark years. The estimates are based on the levels per thousand population that existed in 1979-1980. This is done in order to maintain the standards that existed in the base year. Where there was no existing service, estimates are based on a standard that is footnoted on the table. Tables 3-17 through 3-22 present community service requirements for the Eastern and Western Powder River Region; tables 3-23 through 3-28 present requirements for the Northern Powder River Region; and tables 3-29 through 3-34 present requirements for the Crow and Northern Cheyenne.

SOCIOLOGY

In this section, after the social environment of Wyoming and Montana counties is described, the Crow and the Northern Cheyenne tribes and reservations are covered independently as social units. Even though the land areas are relatively large and the reservations include several small towns in Big Horn and Rosebud counties, the different administrative, political, and cultural structure of these areas justifies their treatment as separate entities.

Each potentially affected community and tribe is then portrayed in terms of its relative capacity to absorb changes that would occur through coal leasing. The criteria used in making these judgments are presented.

Wyoming

Campbell County

The effects of coal mining in Campbell County have been extensive over the past decade. The total population reached 24,367 in 1980, up from 12,957 in 1970. Projections for 1985 population in the county and in the city of Gillette are 31,900 and 15,900, respectively. Some believe these populations were considerably higher by 1982; however, the recent recession and the current depressed state of energy production suggest more conservative projections for 1985. The only other significant population center in Campbell County is the town of Wright, 40 miles south of Gillette, which has an estimated 1980 population of about 1,300.

Campbell County and Gillette are industrial areas. About 48% of the total county employment in 1982 was in the mining (petroleum, coal, and uranium extraction) and construction sectors of the economy (Browne, Bortz, & Coddington 1983).

While Campbell County has experienced many growth management problems since the early 1970s, it is now in a solid position to absorb additional growth successfully. Except in mental health care and number of physicians, the city and county have reached a substantial capacity to absorb population growth.

TABLE 3-17
LEVELS OF COMMUNITY SERVICES
IN THE EASTERN AND WESTERN POWDER RIVER REGION, 1979-1980

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons Per day)	Law Enforcement (sworn officers)	Firefighters Full-time	Firefighters Volunteers	Hospital Beds
Campbell				25			
Gillette	4,570	3.6[a]	1.7[a]	31	.5	22	31[b]
Converse				10			
Douglas	1,979	3.5	0.3[c]	10		30	31
Glenrock	1,172	1.5	1.5[d]	8		25	
Crook				4			
Sundance	479	0.6[h]	0.3[e]	5		15	16
Moorcroft	437	0.3[f]	0.14[g]	4		28	
Goshen				4			
Torrington	1,663	2.5[h]	[i]	13		40	56
Johnson				8			
Buffalo	1,392	3.8[h]	0.6[j]	7		17	35
Natrona				63			
Casper	13,559	26.0[h]	6 .5	117	95		282
Niobrara				2			
Lusk	574	2.2	0.3[k]	6		24	12
Platte				6			
Guernsey	413[l]	1.3	0.6[e]	7		34	
Wheatland	2,110	4.7	1.7[d]	12		70[m]	43
Sheridan				7			
Sheridan	3,352	10.0	5.0	29	18		97
Weston				5			
Newcastle	1,240	3.5	2.0	10		40	42
Upton	405	0.7	0.4[e]	5		25	

SOURCE: All data from Wyoming Department of Economic Planning and Development except where otherwise noted.

a. The city of Gillette now has an additional 10.1 million gallons per day (mgd) of water after completion of the Madison Project. In addition, a study has been undertaken to provide for construction of sewage treatment facilities with a 7.4 mgd capacity.

b. Expanding to 60 beds.

c. A new sewage system for Douglas is scheduled for completion by 1984.

d. Source: Glenrock Public Works Department

e. Estimate of 1979-1980 requirements based on 300 gallons per capita daily.

f. The town of Moorcroft hopes to buy water from the city of Gillette after the Madison project is completed.

g. The town of Moorcroft is seeking funding for improvement of sewage facilities.

h. Represents peak demand.

i. Torrington has sewage treatment facilities to serve a population of 6,000.

j. Sewage facilities for the town of Buffalo are to be rebuilt between 1981 and 1983.

k. Source: Lusk Water and Lights Department.

l. Source: Superintendent's office, School District 2, Guernsey, Wyoming.

m. Estimate of 1979-1980 requirement based on Casper District average of 12 volunteer firefighters per 1,000 population.

TABLE 3-18
ESTIMATED 1985 REQUIREMENTS FOR COMMUNITY SERVICES
FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Full time	Volunteers	
Campbell				33			
Gillette	6,000	4.7	2.2	41	7	29	41
Converse				9			
Douglas	1,740	3.1	0.3	9		26	27
Glenrock	1,030	1.3	1.3	7		22	
Crook				4			
Sundance	490	0.6	0.3	5		15	16
Moorcroft	440	0.3	0.14	4		29	
Goshen				4			
Torrington	1,820	2.8	a	14		44	61
Johnson				8			
Buffalo	1,450	3.9	0.6	7		18	36
Natrona				67			
Casper	14,500	27.8	6.9	125	102		301
Niobrara				2			
Lusk	590	2.3	0.3	6		25	12
Platte				4			
Guernsey	290	0.9	0.4	5		24	
Wheatland	1,460	3.3	1.2	8		48	30
Sheridan				7			
Sheridan	3,600	10.7	5.3	31	19		104
Weston				7			
Newcastle	1,640	4.6	2.6	13		53	56
Upton	540	0.9	0.5	6		33	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-19
ESTIMATED 1987 REQUIREMENTS FOR COMMUNITY SERVICES
FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Campbell				43			
Gillette	7,800	6.1	2.9	53	9	38	53
Converse				11			
Douglas	2,210	3.9	0.3	11		33	34
Glenrock	1,310	1.7	1.7	9		28	
Crook				4			
Sundance	510	0.6	0.3	6		16	17
Moorcroft	460	0.3	0.15	4		30	
Goshen				5			
Torrington	1,950	2.9	a	15		47	66
Johnson				9			
Buffalo	1,580	4.3	0.7	8		19	40
Natrona				71			
Casper	15,400	29.5	7.4	133	108		320
Niobrara			0.3	2		26	13
Lusk	610	2.3		6			
Platte				4		25	
Guernsey	310	1.0	0.5	5		52	32
Wheatland	1,570	3.5	1.3	9			
Sheridan				8			115
Sheridan	4,000	11.8	5.9	34	21		
Weston				7			
Newcastle	1,690	4.8	2.7	14		55	57
Upton	550	1.0	0.5	7		34	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-20
ESTIMATED 1988 REQUIREMENTS FOR COMMUNITY SERVICES
FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Campbell				45			
Gillette	8,200	6.5	3.1	56	9	40	56
Converse				12			
Douglas	2,310	4.1	0.3	12		35	36
Glenrock	1,370	1.7	1.7	9		29	
Crook				4			
Sundance	510	0.7	0.3	5		16	17
Moorcroft	470	0.3	0.15	4		30	
Goshen				5			
Torrington	1,980	3.0	a	16		48	67
Johnson				9			
Buffalo	1,640	4.5	0.7	8		20	41
Natrona				73			
Casper	15,600	30.0	7.5	135	109		330
Niobrara				2			
Lusk	620	2.4	0.3	7		26	13
Platte				5			
Guernsey	310	1.0	0.5	5		26	
Wheatland	1,600	3.6	1.3	9		53	33
Sheridan				8			
Sheridan	4,100	12.1	6.1	35	22		118
Weston				7			
Newcastle	1,710	4.8	2.8	14		56	58
Upton	590	1.0	0.6	7		35	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-21
ESTIMATED 1990 REQUIREMENTS FOR COMMUNITY SERVICES
FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Campbell				47			
Gillette	8,600	6.7	3.2	58	9	41	58
Converse				12			
Douglas	2,350	4.1	0.4	12		35	37
Glenrock	1,390	1.8	1.8	10		30	
Crook				4			
Sundance	520	0.7	0.3	5		16	18
Moorcroft	480	0.3	0.15	4		31	
Goshen				5			
Torrington	2,020	3.0	a	16		49	68
Johnson				10			
Buffalo	1,680	4.6	0.7	8		21	42
Natrona				73			
Casper	15,800	30.3	7.6	136	111		329
Niobrara				2			
Lusk	630	2.4	0.3	7		26	13
Platte				5			
Guernsey	320	1.0	0.5	5		26	
Wheatland	1,620	3.6	1.3	9		54	33
Sheridan				9			
Sheridan	4,200	12.4	6.2	36	22		120
Weston				7			
Newcastle	1,730	4.9	2.8	14		56	58
Upton	560	1.0	0.6	7		35	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-22
ESTIMATED 1995 REQUIREMENTS FOR COMMUNITY SERVICES
FOR EASTERN AND WESTERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Campbell				51			
Gillette	9,400	7.4	3.5	64	10	45	64
Converse				12			
Douglas	2,460	4.4	0.4	12		37	39
Glenrock	1,460	1.9	1.9	10		31	
Crook				4			
Sundance	530	0.7	0.3	6		17	18
Moorcroft	490	0.3	0.15	4		31	
Goshen				5			
Torrington	2,070	3.1	a	16		50	70
Johnson				10			
Buffalo	1,720	4.7	0.7	9		21	43
Natrona				76			
Casper	16,300	31.3	7.8	141	114		330
Niobrara				2			
Lusk	640	2.4	0.3	7		27	13
Platte				5			
Guernsey	330	1.0	0.5	6		27	
Wheatland	1,670	3.7	1.3	10		55	34
Sheridan				9			
Sheridan	4,300	12.7	6.4	37	23		124
Weston				7			
Newcastle	1,760	5.0	2.8	14		57	60
Upton	580	1.0	0.6	7		36	

a. Torrington has sewage treatment facilities to serve a population of 6,000.

TABLE 3-23
LEVELS OF COMMUNITY SERVICES
IN THE NORTHERN POWDER RIVER REGION, 1979-1980

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons Per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Full-time	Volunteers	
Big Horn	2,393	---	---	16	---	23	50[a]
Hardin	---	4.0	b	c	---	20	---
Powder River	580	---	---	4	---	15	---
Broadus	---	0.5[d]	e	c	---	f	---
Rosebud	2,536	---	---	19	---	---	26
Ashland	---	g	g	c	---	---	---
Colstrip	---	h	i	c	---	27	---
Forsyth	---	3.5	0.5	c	---	16	---

SOURCE: Miles City District, BLM.

a. A 36-bed nursing home and a 20-unit retirement home are to be opened in 1983.
b. Hardin has sufficient capacity to accommodate a community of 6,000 persons.
c. Community law enforcement is provided by the county.
d. Based on three wells and pumping capacity of 345 gallons per minute.
e. Broadus has a three-cell lagoon of 7.72 acres. Only one cell is in use at present.
f. Firefighting services provided by the county.
g. Sewage and water systems were built in 1980 to accommodate a community of 2,500 persons.
h. Considered adequate for peak populationof 7,200. (Mont. DSL & U. S. OSM, DEIS for Rosebud Mine, 1983.)

i. Adequate to serve 7,500 persons.

TABLE 3-24
ESTIMATED 1985 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	2,720	---	---	18	---	26	57
Hardin	---	4.5	a	b	---	23	---
Powder River	580	---	---	4	---	15	10[c]
Broadus	---	0.5	d	b	---	e	---
Rosebud	3,050	---	---	23	---	---	31
Ashland	---	f	f	b	---	3[g]	---
Colstrip	---	h	h	b	---	32	---
Forsyth	---	4.2	0.6	b	---	19	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

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

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would continue to be utilized at 1/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-25
ESTIMATED 1987 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	3,040	---	---	20	---	29	59
Hardin	---	5.1	a	b	---	25	---
Powder River	750	---	---	5	---	19	13[c]
Broadus	---	0.6	d	b	---	e	---
Rosebud	3,430	---	---	26	---	---	35
Ashland	---	f	f	b	---	3[g]	---
Colstrip	---	h	h	b	---	36	---
Forsyth	---	4.7	0.7	b	---	21	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

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

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would be utilized at less than 2/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-26
ESTIMATED 1988 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	2,890	---	---	19	---	28	60
Hardin	---	4.8	a	b	---	24	---
Powder River	750	---	---	5	---	19	13[c]
Broadus	---	0.6	d	b	---	e	---
Rosebud	3,560	---	---	27	---	---	37
Ashland	---	f	f	b	---	3[g]	---
Colstrip	---	h	h	b	---	38	---
Forsyth	---	4.9	0.7	b	---	23	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

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

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would be utilized at less than 2/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-27
ESTIMATED 1990 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	3,360	---	---	22	---	32	70
Hardin	---	5.6	a	b	---	28	---
Powder River	1,070	---	---	7	---	28	19[c]
Broadus	---	0.9	d	b	---	e	---
Rosebud	3,710	---	---	28	---	---	38
Ashland	---	f	f	b	---	4[g]	---
Colstrip	---	h	h	b	---	40	---
Forsyth	---	5.1	0.7	b	---	23	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

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

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would be utilized at less than 2/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-28
ESTIMATED 1995 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE NORTHERN POWDER RIVER REGION
(based on 1979-1980 levels per 1,000 population)

County/Community	School Enrollment	Water Capacity (million gallons per day)	Sewage Capacity (million gallons per day)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Big Horn	3,390	---	---	23	---	33	71
Hardin	---	5.7	a	b	---	28	---
Powder River	1,070	---	---	7	---	28	19[c]
Broadus	---	0.9	d	b	---	e	---
Rosebud	3,770	---	---	28	---	---	39
Ashland	---	f	f	b	---	4[g]	---
Colstrip	---	h	h	b	---	40	---
Forsyth	---	5.2	0.7	b	---	24	---

a. Hardin has sewage treatment capacity to serve a population of 6,000.

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

c. Based on regional average of 4 beds per 1,000 population.

d. On the basis of usage in 1979-1980, it is assumed that the present three-cell, 7.72-acre lagoon would be utilized at less than 2/3 of capacity.

e. It is assumed that the county can continue to provide adequate volunteer firefighting services.

f. Ashland has water and sewage capacity to serve a population of 2,500.

g. Based on regional community average of 6 volunteers per 1,000 population.

h. Colstrip has water capacity to serve a population of 7,200 and sewage capacity to serve 7,500.

TABLE 3-29
LEVELS OF COMMUNITY SERVICES IN 1979-1980
ON THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

Reservation/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Full-time	Volunteers	
Crow Reservation	a	---	---	15	6[b]	---	---
Crow Agency	a	900[c]	17	12	---	10	34
Lodge Grass	a	274[c]	12	2		10	---
Northern Cheyenne Reservation	a	---	---	15	6[d]	---	---
Ashland (on reservation)	420	72[c]	4	---	---	---	---
Birney (on reservation)	---	72[c]	2	---	---	---	---
Busby	218	144[c]	3	---	---	---	---
Lame Deer	a	360[c]	10	---	---	---	e

SOURCE: Miles City District, BLM.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-23.

b. Part-time firefighters employed by the Bureau of Indian Affairs, U.S. Department of the Interior.

c. Water capacities are based on 625 gallons per minute (gpm) pumping capacity for Crow Agency, 190 gpm for Lodge Grass, 50 gpm for Ashland, 50 gpm for Birney, 100 gpm for Busby, and 250 gpm for Lame Deer.

d. In addition, there is a seven-member forest crew during the summer.

e. At present Lame Deer has an outpatient clinic, four doctors, and three ambulances.

TABLE 3-30
ESTIMATED 1985 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	--	--	17	7[b]	--	--
Crow Agency	a	1,000	19	13	--	11	38
Lodge Grass	a	310	13	2	--	11	--
Northern Cheyenne Reservation	a	--	--	18	7	--	18[c]
Ashland (on reservation)	510	90	5	1[d]	--	3[e]	--
Birney (on reservation)	--	84	2	0[d]	--	1[e]	--
Busby	260	170	4	1[d]	--	6[e]	--
Lame Deer	a	430	12	3[d]	--	14[e]	--

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-24.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

TABLE 3-31
ESTIMATED 1987 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	---	---	19	8[b]	---	---
Crow Agency	a	1,100	21	15	---	13	43
Lodge Grass	a	340	15	3	---	13	---
Northern Cheyenne Reservation	a	---	---	20	8	---	20[c]
Ashland (on reservation)	560	100	5	1[d]	---	3[e]	---
Birney (on reservation)	---	94	3	0[d]	---	1[e]	---
Busby	290	190	4	2[d]	---	6[e]	---
Lame Deer	a	480	13	4[d]	---	16[e]	---

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-25.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

TABLE 3-32
ESTIMATED 1988 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	--	--	18	7[b]	--	--
Crow Agency	a	1,100	20	4	--	12	40
Lodge Grass	a	330	14	2	--	12	--
					8	--	
Northern Cheyenne Reservation	a	--	--	20	--	3[e]	20[c]
Ashland (on reservation)	560	100	0.5	1[d]	--	1[e]	--
Birney (on reservation)	--	94	3	0[d]	--	6[e]	--
					--	16[e]	
Busby	290	190	4	2[d]			--
Lame Deer	a	480	13	4[d]			--

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-26.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

TABLE 3-33
ESTIMATED 1990 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	--	--	21	8[b]	--	--
Crow Agency	a	1,200	23	16	--	14	47
Lodge Grass	a	380	16	3	--	14	--
Northern Cheyenne Reservation	a	--	--	22	9	--	21[c]
Ashland (on reservation)	600	100	6	1[d]	--	3[e]	--
Birney (on reservation)	--	100	3	0[d]	--	1[e]	--
Busby	310	210	4	2[d]	--	7[e]	--
Lame Deer	a	520	14	4[d]	--	17[e]	--

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-27.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

TABLE 3-34
ESTIMATED 1995 REQUIREMENTS FOR COMMUNITY SERVICES
FOR THE CROW AND NORTHERN CHEYENNE INDIAN RESERVATIONS

County/Community	School Enrollment	Water Capacity (thousand gallons per day)	Sewage Capacity (surface acres)	Law Enforcement (sworn officers)	Firefighters		Hospital Beds
					Fulltime	Volunteers	
Crow Reservation	a	---	---	21	8[b]	---	---
Crow Agency	a	1,300	24	17	---	14	47
Lodge Grass	a	380	17	3	---	14	---
Northern Cheyenne Reservation	a	---	---	22	9	---	22[c]
Ashland (on reservation)	620	110	6	1[d]	---	3[e]	---
Birney (on reservation)	---	100	3	0[d]	---	1[e]	---
Busby	320	210	4	2[d]	---	7[e]	---
Lame Deer	a	530	15	4[d]	---	18[e]	---

NOTE: Based on 1979-1980 levels per 1,000 population where existing; otherwise based on standards footnoted.

a. Schools at these locations are county public schools. Enrollment levels for Big Horn and Rosebud counties are presented in table 3-28.

b. Part-time firefighters employed by the Bureau of Indian Affiars, U.S. Department of the Interior.

c. Based on a regional average of 4 beds per 1,000 population.

d. Based on a regional average of 1.4 officers per 1,000 population.

e. Based on a regional average of 6 volunteers per 1,000 populations.

There are various reasons for this level of capacity. Past experience with growth has prepared officials and citizens to respond effectively. Regulatory functions at the local level (Gillette Planning District, zoning, permitting) and the state level (Wyoming Industrial Siting Commission) are well established. City-county relations appear to be positive. Residents of the area historically have had positive attitudes toward development. There are no large ethnic or racial groups that are vulnerable to social change, and there are elaborate ongoing capital improvement programs at the county and municipal levels.

Gillette's social structure is diverse. More than 48% of the respondents to an extensive 1982 survey of citizens had lived in Gillette for five years or less (Browne, Bortz, & Coddington 1983). When this fact is considered, along with the city's size, it is understandable that Gillette's social atmosphere is relatively urbane. Gillette and the county have firm relations with state government and with several large corporations.

As discussed above, the area's population remains largely transient. This results in several types of community instability. The Campbell County crime rate over the past several years has been higher than Wyoming's as a whole (Wyo. Ofc. of Atty. Gen.). Statistics showthat the incidence of divorce and school dropouts is somewhat higher in this area than in the rest of Wyoming (McGowan 1983). Unemployment has been low over the past several years, but the area's dependence on energy extraction means that labor demand is volatile.

Gillette and Campbell County are therefore well prepared to respond to additional growth, even rapid growth of high magnitude (5 to 10% annually), at the community level. For existing and potential future residents, however, such changes would prolong the relatively high levels of disruptive behaviors and the lack of solidarity evident during the past decades.

The population of Gillette and Campbell County is expected to grow in the next decade or so, whether or not additional federal coal leasing takes place. This expectation is fueled by the belief that the demand for oil, gas, and coal remains relatively consistent. Energy production is the base of the economy in this area and will remain so well into the future.

The population of this area is quite large and diversified. Sound fiscal and service-facility conditions, along with a stable regulatory environment at the state and local levels, mean that both the city and the county are well equipped to deal with future growth. Improvements in community cohesion also should become evident through time as the population becomes less transitory and more stable.

Sheridan County

Sheridan County and the city of Sheridan have been moderately affected by coal development, both historically and in the recent past. However, most of the recent effects have been caused by mining on the Montana side of the state line, as Decker, Montana, area workers have chosen to live in the Sheridan area. Sheridan County's population increased from 17,800 in 1970 to 25,000 in 1980. This pace of increase, 3 to 4% annually, is almost exactly the same as that of Wyoming during the 1970s.

Roughly 80% of Sheridan County's residents live in Sheridan and in the fringe areas near the city. Other communities in Sheridan County are Ranchester, Dayton, and Story. Sheridan County is quite racially homogeneous; 98% of the population is white. The area's economy has shifted from an agricultural base to a services-mining base as coal production has increased in the Decker area.

Perhaps the preeminent issue associated with the effects of coal development on the Sheridan area is jurisdictional. Montana taxes on Montana production are not shared with Sheridan, the location of most social and economic effects. This is widely recognized as inequitable, but there appears to be no mechanism to alter the situation. Wyoming's industrial siting regulations do not apply to Montana operations, but Sheridan has implemented a subdivision review process. There is a planner-grantsperson, an industrial association, and a monitoring program to track socioeconomic change. These measures are assets to Sheridan and Sheridan County.

It is reported that Sheridan area residents typically support additional growth but want it to occur at a moderate pace (Mtn. West 1983). Sheridan residents, like those in other areas, apparently recognize that reliance on agriculture as an economic base is, over the long term, less than optimal for stability and growth. Additional diversification was evident in the rapid retail expansion that occurred in the 1970s, particularly in franchised operations.

The administrative-political environment also has changed. Sheridan lost some of its small-town atmosphere as growth management processes were implemented, the bureaucracy grew,

and the area became more urban. Coordination between the city and the county, and between those entities and the state, is generally well established.

While the mining employees from the Decker area may not have been particularly well integrated into the community, it appears that Sheridan absorbed the changes of the 1970s without widespread disruption. Examination of divorce, dropout, crime, and unemployment figures for the past several years reveal that these rates are comparable to or lower than those for Wyoming as a whole (McGowan 1983; Browne, Bortz, & Coddington 1983). This is evidence that, all things considered, the moderate increases in population during the past decade did not have a traumatic effect on the community and its residents.

Sheridan and Sheridan County are in a good position to deal with the moderate growth levels forecast for the next several years if no additional federal coal in the area is leased. As in Gillette and Campbell County, local economic dependence on energy production means there would be some vacillation in employment and expenditure levels through time. However, the economy of the Sheridan area is somewhat more balanced than that of the Campbell County-Gillette area. Radical shifts in social stability are not expected—the projected growth will be vigorous without being disruptive.

Montana

Rosebud County

The principal communities in Rosebud County that would be affected by federal coal leasing are Forsyth, Colstrip, and Ashland. Forsyth, the county seat, is on the northern edge of Montana areas that have been influenced by past and present production. Its population increased at a moderate pace through the 1970s (from roughly 1,900 in 1970 to 2,600 in 1980), largely because of construction activities at Colstrip. Ongoing public dialogue on the local benefits and costs of additional coal development has accompanied the development that has occurred south of Forsyth. It appears that the leadership in Forsyth has been quietly supportive of the changes while many of the ranchers in the county have been and remain vigorously opposed to coal mining and conversion. This has resulted in some polarization in Forsyth and Rosebud County (Hooper and Branch 1982).

Forsyth is moderately diverse economically, politically, and socially. The effects of Colstrip construction on Forsyth were lessened by the short time that newcomers lived there during the 1970s. Many did not stay long enough to have great influence.

Ties between Forsyth and the state of Montana appear well developed, as the Montana Coal Board has granted substantial funding to Rosebud County. Furthermore, the city historically has interacted extensively with the Burlington Northern Railroad and the Montana Power Company. Thus, Forsyth and the county are fairly well connected to higher levels of government and to corporate organizations. However, these linkages have not helped Forsyth toaddress a persistent problem, medical care.

The moderate growth that was mainly due to Colstrip activities during the 1970s did cause some expansion of local government and attendant growth of the bureaucracy. Nevertheless, Forsyth maintains a small town atmosphere, with most relations being personalized.

Colstrip, about 25 miles south of Forsyth, is the center of energy development in Rosebud County. It has been transformed during the past decade. Its population grew from about 200 in 1970 to roughly 3,200 in 1980 for the portion of Rosebud County that includes Colstrip. Inevitably this resulted in extensive changes. Unlike that of the rest of the county, Colstrip's economy and labor force are tied almost exclusively to industrial mining and conversion processes. Perhaps because the population has been largely transient, Colstrip residents have been described as apolitical. An effort to incorporate Colstrip as a municipality was defeated, so the community remains dominated by the Montana Power Company (Mont. DSL 1982b).

Given its size, Colstrip is quite diverse. Many "blue-collar" and managerial persons and families have settled in Colstrip either permanently or temporarily. Because few of them grew up in Rosebud County, there is low identification with local affairs or with long-term local residents. Cohesion in the town is considered low; this is predictable given the circumstances of Colstrip's change.

Colstrip's major assets are its relationship with the Montana state government and with Rosebud County. Because of the growth during the 1970s, Colstrip received a lot of attention from the Montana Coal Board and other state agencies, and from the county. Its share of Rosebud County's

population increased from about 3% in 1970 to more than 30% in 1980. State and county resources were funneled into Colstrip as it attempted to deal with the wholesale changes that took place.

Ashland is another unincorporated town in Rosebud County. Its location on the eastern edge of the county and the area's transportation network have prevented its being affected much by coal mining and conversion activity to the northwest at Colstrip or by mining to the southwest in the Decker area. The population of Ashland, estimated at about 400, appears to be stable. The economic base of Ashland is limited—it contains a Forest Service Office, Saint Labre Mission School, a sawmill that operates intermittently, and some small services and retail operations.

It is reported that Ashland lacks cohesion socially. Because of its proximity to the Northern Cheyenne reservation, the community has a sizable Indian population as well as non-Indian residents. For that reason it is somewhat fragmented. The community is very informal, but this has not facilitated collective action in the past. As a community, however, Ashland has developed better ties with Rosebud County and the Montana Coal Board than previously existed. This has been accomplished through the county planning board and by the development of a water-sewer board that applied for and received a grant from the Montana Coal Board (Hooper and Jobes 1982).

For Rosebud County as a whole, conventional indicators of social well-being do not reveal profound existing problems. Reported crime has been low relative to other counties in Montana as recently as 1981 (Mont. Bd. of Crime Control). The divorce rate has fluctuated but generally has been below the nation's rate during the 1970s. Unemployment has been relative to construction activity at Colstrip. A significant problem for residents of Rosebud County has been the persistent shortage of medical care, a chronic situation in many rural areas.

It is projected that Rosebud County will experience significant population growth through the late 1980s and early 1990s if no additional federal coal leasing takes place. This expected growth will occur in the main communities, Forsyth and Colstrip, where it will be due largely to in-migration. Growth to a lesser extent is expected on the Northern Cheyenne Reservation. Given the locations and magnitude of these potential increases, patterns of community social life should not be distrupted beyond systemic changes involving the larger society.

Powder River County

The community most likely to be affected in Powder River County is Broadus, the county seat. The establishment of the Belle Creek oil field caused a small boom in Broadus in the late 1960s and early 1970s. The county's population has been fairly stable for some time, ranging from 2,000 to 3,000. Roughly 700 of these persons live in Broadus.

Revenues generated by the Belle Creek field have generally enabled Powder River County to provide adequate services. The major deficits are in medical care and housing, neither of which is typically addressed by county or municipal government. Exhaustion of the Belle Creek field through time will require the county government to obtain alternative sources of revenue or to reduce the level of services.

Broadus, a small town with characteristics more or less typical of such communities, serves as a trade center for the surrounding rural agricultural area. It is very informal, and its economy is not highly diversified. Linkages to state government and corporate organizations are limited, but the recent appointment of a county commissioner to the Montana Coal Board should be helpful in establishing ties to an important potential source of revenue.

Land use planning efforts in Powder River County, driven by expectations that coal development would cause population increases, have not been favorably received. Given that there has also been some recent instability in Broadus government, it appears that rapid growth would require both city and county government to quickly implement some management processes that are not now available. However, there is willingness and openness to economic growth among community leaders. This reflects the general atmosphere in the town and in the county. There is ongoing opposition to coal development in Powder River County, but persons holding these views are reportedly a small segment of the population, mostly living in the western areas of the county (Myers, Davidson, and Trent 1983).

Review of crime, divorce, unemployment, and similar indicators of social problems reveals that general stability prevails in Powder River County.

In summary, Broadus and Powder River County, facing long-term economic decline and the absence of alternative means of broadening the economic growth base, generally appear favorable toward coal extraction in the county. However,

present capabilities to deal with the consequences of such activity are quite limited in comparison with other regional communities that have already experienced either moderate or large-scale growth.

The population of Broadus and Powder River County may grow considerably during the next decade, with Broadus being the focus of the changes during the late 1980s and early 1990s. Should this growth materialize, the area's social setting will be affected. Pressures on services and facilities will be evident as leaders try to keep pace with increased demands. Interpersonal relations will become more impersonal as newcomers, many with industrial occupations and without local ties, enter the area. The growth figures are not large in absolute numbers, but Powder River County is so sparsely populated now that even small numbers of newcomers can have a significant effect.

Big Horn County

The main communities in Big Horn County that would be affected by additional regional coal development are Hardin (the county seat), Crow Agency, Lodge Grass, Wyola, Busby, and Kirby. Busy is on the Northern Cheyenne Reservation, and Crow Agency, Lodge Grass, and Wyola are on the Crow Reservation. Historically, the county's population has been quite stable. About 11,000 persons lived in Big Horn County in 1980, and roughly one-half of them were either Crow or Northern Cheyenne. There has recently been a slight out-migration of non-Indians and a steadily increasing Indian population; thus, the Indian population now amounts to a higher proportion of the total than in the past.

Agriculture has been the keystone of the economy of Big Horn County, but agricultural employment decreased by almost one-half from 1960 to 1980. Increases in other sectors have compensated for these reductions. Big Horn County is in a solid position as to public revenues—it receives revenues from several large coal mining operations.

As in other southeastern Montana areas, the county is fragmented by its cultural diversity. The presence of two Indian reservations has meant that authority is often unclear and jurisdictional issues are seldom settled to the satisfaction of all parties. Further complicating this source of division is the fact that much land on the reservations, particularly the Crow Reservation, is held by non-Indians. Given the multiple jurisdictions, coordination of local response to issues is complex. Big Horn County has tried to develop a planning board, but the principal reason for its existence, population growth associated with energy development, has not materialized to a significant level (Mtn. West Rsch. 1983). Population increases associated with the Decker area mines in Big Horn County have taken place primarily in Sheridan and Sheridan County, Wyoming.

Indicators of well-being for Big Horn County are mixed. It has had low divorce and suicide levels, yet per capita income has been consistently lower than that of Montana as a whole, and unemployment levels have been consistently higher. Unfavorable economic conditions on the Crow and Northern Cheyenne reservation are doubtless responsible for these chronic local problems.

If there is no additional federal coal leasing, Big Horn County is expected to grow at a moderate pace. Much of the change is expected to occur on the Crow Reservation. In areas not included in either Indian reservation, the changes should be subtle, incidental, and not the source of major conflicts or issues.

The Northern Cheyenne

The Northern Cheyenne Indian Reservation occupies about 450,000 acres in Rosebud and Big Horn counties. The tribe has estimated the population of the two major settlements, Lame Deer and Busby, at 2,000 and 810, respectively (Northern Cheyenne Tribe 1983b). The villages of on-reservation Ashland (across the Tongue River from the Ashland discussed previously) and Birney, further south on the Tongue River (across the river from predominantly non-Indian Birney), also are significant population centers on the reservation. The rest of the reservation population lives in the country.

Relative to non-Indian communities, the Northern Cheyenne reservation is culturally homogeneous, even though the tribe estimates that 15% of the area's population is non-Indian (Northern Cheyenne Tribe 1983b). Traditional cultural values are strong on kinship, spirituality, and the natural environment. This is especially influential in such traditional villages as Birney (Mont. DSL 1982a).

There has been some oil and gas exploration on the reservation, but the tribe has opposed on-reservation coal extraction without tribal control. Tribal policy regarding off-reservation development is largely attached to the potential for tribal members to obtain employment and other benefits at mines and facilities within daily commuting distance of the reservation. If this potential cannot

be realized, it is likely that the tribe will oppose the proposed development. The tribe also expressed concern about air quality, water quality, tribal government operations, and maintenance of the existing culture. Making tradeoffs between economic development and cultural preservation is a continuing dilemma for the Northern Cheyenne Tribe and its members (Kroll 1983).

Given the absence of other economic development proposals, and with access to potential benefits, coal development in the vicinity of the Northern Cheyenne Reservation may present an opportunity for the tribe to address several pressing problems. Unemployment is chronically very high. The age structure of the population means that expansion of the potential labor force is inevitable. Alcohol abuse is apparently widespread.

The tribe is responsible for providing several basic services, but its funding is limited. The federal presence on the reservation is also evident, as the Indian Health Service (IHS), Bureau of Indian Affairs (BIA), Public Health Service (PHS), and other federal and Montana agencies are also providing services. Services provided are municipal services (BIA), health services (PHS and IHS), welfare and social services (state of Montana and BIA), community health representative (PHS and IHS), education (BIA), housing (HUD), and water (IHS) (Northern Cheyenne Tribe 1981). Thus, the tribe and other institutions share the responsibilities for responding to reservation social conditions. The tribe has reported that tribal liability is increasing as federal funds have diminished over the past several years.

Without economic development of some sort, the cycle of poverty now evident on the reservation will persist and probally will be aggravated in the future. An employment agreement with the Montana Power Company for designation of jobs for Northern Cheyenne has evidently been effective over several years in providing employment opportunities.

Northern Cheyenne Tribe representatives met with BLM representatives in May 1983 to discuss tribal concerns associated with possible federal coal leasing. The tribe said the EIS should address the potential effects listed below (Northern Cheyenne Tribe 1983b).

Effects of leasing on tribal government operations. Ability of the tribal government to respond to the potential changes brought on by leasing.

Effects of leasing on the Northern Cheyenne culture and homeland. The extent to which coal development in the vicinity could endanger the reservation as the homeland of the Northern Cheyenne.

Effects of leasing on reservation communities. Effects on reservation communities such as Lame Deer and Busby.

Effects on services and facilities on the reservation. How regional population increases could affect the tribe's provision of services and facilities, and how those effects could be mitigated.

Effects on public finance. The tribe felt the EIS should address the revenue and expenditure processes of the tribe and the reservation.

Effects on law and order. Effects on traffic and other potential law enforcement problems caused by leasing in the vicinity. Mitigation also should be analyzed.

Employment Opportunities. The tribe said that the EIS should consider the level of living of tribal members and the possibility of using employment preferences as a mitigating measure.

Potential population increases. The effects of population increases in the region, both on and off the reservation.

Mitigative measures. The tribe is particularly interested in the use of lease stipulations as a means of mitigating adverse effects on the tribe.

Adequacy of site-specific analyses. The tribe belives that site-specific analyses should be included in the regional EIS.

Maintenance tract treatment in the EIS. The tribe feels that development of maintenance tracts would result in increased production and new impacts.

The "no action" alternative, the need for leasing, and cumulative analysis in the EIS. The tribe belives that the "no action" alternative is misleading with regard to additional development, that additional leasing needs should be analyzed, and that cumulative impacts should be examined.

The future population on the Northern Cheyenne Reservation is forecast to be higher than the present level. This moderate growth, in concert with some form of economic development on or near the reservation that would generate jobs, could give the tribe and its members an opportunity to begin to address their prevailing substandard living conditions. However, the likelihood of this happening is quite low. Capital investment in the present and the forseeable future is very limited. For these reasons, there is likely to be no improve-

ment in chronic problems such as alcoholism, housing, education, unemployment, and health in the future.

Government policies and programs will vary, with attendant fluctuations in funding. These changes will have some consequences; however, without stable improvements in economic opportunity, the near-term and mid-term outlook for improving living conditions among the Northern Cheyenne is not good.

The Crow

The Crow Indian Reservation, west of the Northern Cheyenne, contains another indigenous Native American population in southeastern Montana. The reservation is very large, 2.25 million acres, but the tribe owns only about 350,000 acres. The rest is controlled by individual Crow, non-Indians, and the state of Montana. Most of the reservation is in Big Horn County, with part of Yellowstone County also within reservation boundaries. Principal Crow Reservation communities are Crow Agency, Lodge Grass, Wyola, Saint Xavier, and Pryor, all of which are quite small. Hardin is a major off-reservation city just north of the boundary.

Cultural homogeneity within the tribe is relatively high because of historical continuity. The Crow and their leaders, unlike the Northern Cheyenne, appear to be convinced that industrial development on the reservation and in the vicinity does not present a threat to the Crow culture. The Crow have encouraged development of coal resources on the reservation as a means of economic expansion (Amer. Ind. Tech. Svcs. 1983). The tribe also has an agreement with Westmoreland Resources at the Absaloka mine, which has led to the hiring of Crow employees (Pacifica 1982).

The Crow also are highly dependent on nontribal sources for basic services and facilities. The economy is not highly diversified, and with a young population causing future expansion of the potential labor force, economic development is critical. However, such proposals have been met with considerable internal controversy within the tribe. Crow government is democratic, and dissent is a fundamental part of the tribe's decision process. This leads to delays as the tribe establishes policy. It now appears; after several years of discussion within the tribe, that the Crow want to take advantage of coal extraction on the reservation as a means of presenting job opportunities to tribe members (Amer. Ind. Tech. Svcs. 1983).

The future of the Crow tribe and its members is tied to economic development in some form, as is that of the Northern Cheyenne. The Crow are open to coal development on the reservation, however. Should this occur, at least a segment of the population would benefit directly, and all tribal members would receive some monetary benefits or benefit from improved services and facilities.

The Crow population is expected to increase in the next decade. Further declines in living conditions should be expected unless employment opportunities keep pace. Reliance on shifting government programs carries the risk that artificial and temporary solutions will be applied to fundamental structural conditions. Such programs may not be conducive to long-term improvements. Therefore, genuine economic development represents a sounder approach, and energy development may be one of the very few potential sources of such development for the tribe.

Capacity of Communities to Absorb Change

This section summarizes the twelve factors that influence the ability of a community to respond to growth and change (Mtn. West 1982). Observations are made about each community in the Powder River Region.

History of Development

Substantial development has occurred near Gillette, Sheridan, and Colstrip. Forsyth and the Cheyenne have been moderately affected by Colstrip, as have Hardin and the Crow by mining at Westmoreland. Broadus has gone through the Belle Creek experience, but that was a decade ago, and the field is well removed from the city. Ashland is in the vicinity of change but little has actually happened there.

Cultural Characteristics

As Native American communities, the Crow and Cheyenne are inherently more vulnerable to harm from industrialization than are predominantly white communities. Forsyth, Broadus, and Ashland are characterized as having relatively large populations of long-term residents.

Affected Environment

Population Size and Change

Gillette and Sheridan are the area's largest communities. The Crow and Cheyenne have sizable populations, but they are dispersed over large areas. Broadus and Ashland are simply small towns. Colstrip, Forsyth, and Hardin are intermediate.

Labor Force

Gillette, Sheridan, and Colstrip have relatively large industrial labor forces that may or may not be consistent with local labor demand at any particular time. Forsyth's labor force is intermediate because of Colstrip and the railroad. Because of the Montana Power Company agreement and Westmoreland, the Cheyenne, the Crow, and Hardin also have some labor that could respond to new development. Ashland and Broadus have limited industrial labor forces.

Facilities and Services

Colstrip would be in a better position to deal with growth if it were incorporated. The Crow and Cheyenne are largely dependent on other government entities. Otherwise, facilities and services are tied closely to population.

Local Regulations

The siting law in Wyoming is advantageous to Sheridan and Gillette, even though Decker development is not covered. Rosebud County has planning. Powder River County does not have organized planning; however, Broadus is incorporated. Colstrip has been tightly controlled even though it is unincorporated. The Crow and the Cheyenne have autonomy, but land use controls apparently are not feasible.

Leadership Experience

With a few exceptions, leadership experience parallels history of development. Colstrip apparently lacks formal, noncorporate leaders and stability even though its experience is extensive. Leaders at the county level in Big Horn County have had significant ongoing exposure to coal issues. Broadus and Powder River County are now represented on the Montana Coal Board, but they have not gone through recent growth. Even with changing leadership, the Crow and the Cheyenne have been involved in negotiation processes with companies.

Attitudes

Gillette and Campbell County have historically been very favorable toward development. Sheridan is more moderate. The Montana areas are mixed, with support in the towns and significant opposition in rural areas. The Crow are open to mining on-reservation. The present Northern Cheyenne policy is to exclude on-reservation coal development.

Economic, Social, and Political Diversity

The Crow and the Cheyenne are culturally and economically homogeneous. Gillette and Sheridan are relatively large and complex. The other communities fall between these extremes.

Linkages to Nonlocal Organizations

Gillette and Sheridan are well connected to state government and corporate organizations. Colstrip is linked to Montana Power and Forsyth to Montana Power and the railroad. The other Montana communities are more isolated, largely because of lack of development in the immediate vicinity. The Crow and the Northern Cheyenne have no experience in applying for Montana Coal Board funds.

Coordination

City-county-state coordination is high in Gillette and Sheridan. The Crow have much internal dissent, and the Northern Cheyenne are not closely associated with state-county government. Ashland lacks cohesion. Forsyth, Broadus, and Colstrip are intermediate.

Patterns of Interaction

Gillette, Sheridan, and Colstrip are relatively urban communities with established bureaucracies. Broadus, Ashland, the Cheyenne, and the Crow are personalized, small communities even though there are bureaucratic, professional presences on the reservations. Forsyth is in transition and Hardin is intermediate.

Conclusions

Consideration of the above leads to the following conclusions.

Gillette and Sheridan have a high capacity to absorb change. Colstrip, Forsyth, and Hardin are communities with moderate capacity to absorb change, and Broadus, Ashland, the Northern Cheyenne, and the Crow have limited capacity to absorb change.

The potential for widespread disruption, given similar levels of development and population growth, is lowest for the two Wyoming communities and highest for the communities with limited capacities.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

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

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

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

GEOLOGY AND MINERALS

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

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

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

SOILS, VEGETATION, AND RECLAMATION

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

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

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

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

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

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

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

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

Reestablishment of any type of vegetation

Reestablishment of forbs, shrubs, and trees

Reestablishment of diverse native plant communities

Topographic and landscape alterations with respect to vegetative reclamation

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

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

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

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

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

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

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

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

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

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

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

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

WATER RESOURCES

Groundwater

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

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

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

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

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

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

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

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

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

The removal of springs and seeps from their former locations would affect the plants and animals that depend on the additional water at those locations. Springs and seeps might reappear at different locations after the completion of reclamation, or the extra recharge to the water table might discharge into streams. The overall impact of mining would be a permanent change in groundwater flow, but mining would not permanently diminish the quantity of water available in the area of the mine.

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

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

Surface Water

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

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

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

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

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

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

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

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

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

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

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

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

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

Requirements for sediment control measures on areas disturbed by mining would result in reduced sediment yields from those areas compared to natural levels (Wyoming statute 35-11 to 35-406; Montana Strip and Underground Mine Reclamation Act [84-4-2 MCA]). However, existing regulations do not apply to off-site disturbances resulting indirectly from coal mining, such as housing construction and related urbanization. Such off-site disturbance could cause sediment yields from construction sites to double for one to two years and then gradually decrease, returning to the predisturbance rate in three to four years. The decreased sediment yield from mined areas would offset increases resulting from urbanization; thus, impacts from increased erosion and sedimentation would be local and short term.

LAND USE

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

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

TABLE 4-4

TOTAL ACREAGE CONSUMED BY COAL MINING AND RELATED LAND USES

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

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

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

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

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

WILDLIFE

Alternative 2

Wyoming

The major impacts on big game from Alternative 2 would occur in the Highlight antelope herd unit south of Gillette. These impacts would be caused primarily by new impediments to daily and seasonal movements such as road right-of-way fences and railroad spurs. There also would be impacts from road kills, poaching loss, and habitat loss. About 1.8% of the habitat in the herd unit would be disturbed. Because disturbance would not occur to a large part of the land at any one time, habitat loss caused by the projects included in this alternative would not be significant. With the other impact factors mentioned above included, in the worst case there would be a net loss to the population of 230 antelope over the life of the mines.

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

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

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

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

Montana

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

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

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

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

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

Alternative 3

Wyoming

Since the same Wyoming tracts are included in Alternative 2 and Alternative 3, the impacts of Alternative 3 in the Wyoming portion of the region would be the same as those described under Alternative 2.

Montana

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

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

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

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

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

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

Alternative 4

Wyoming

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

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

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

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

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

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

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

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

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

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

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

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

Montana

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

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

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

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

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

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

Alternative 5

Wyoming

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

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

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

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

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

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

Montana

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

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

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

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

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

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

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

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

Alternative 6

Wyoming

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

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

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

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

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

Bald eagles in Wyoming would suffer only minor effects from the loss of some hunting habitat. Alternative 6 would have no adverse effects on peregrine falcons in Wyoming.

Montana

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

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

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

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

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

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

All Alternatives

Unavoidable Adverse Impacts

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

Short-term and Long-term Effects

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

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

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

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

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

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

Irreversible or Irretrievable Effects

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

CULTURAL RESOURCES

Alternative 1

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

Alternatives 2 through 6

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

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

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

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

VISUAL RESOURCES

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

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

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

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

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

NOISE

The noise-related impacts within the 55 dBA zone would be interference with sleep and work tasks, disruption of concentration, and general annoyance to people who live within these zones along rail lines. These impacts would be most significant along new railroad lines such as the Tongue River Railroad and the Chicago and North Western line.

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

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

AIR QUALITY

Introduction

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

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

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

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

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

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

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

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

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

Possible Effects in This Region

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

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

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

Visibility Impairment

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

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

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

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

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

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

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

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

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

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

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

Total Suspended Particulates

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

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

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

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

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

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

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

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

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

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

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

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

a. Numbers in parentheses denote the federal secondary standard.

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

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

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

Effects by Area

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

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

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

North of Gillette. In the area north of Gillette, Wyoming, the Wyoming 24-hour standard would be violated in 1990 and 1995 between North Rawhide and Eagle Butte under all alternatives. Violations of the 24-hour standard would occur in 2000 east of Buckskin under all alternatives and in 1995 north of Calf Creek under Alternative 6.

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

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

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

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

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

TSP Effects on Visibility

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

Sulfur Dioxide and Nitrogen Dioxide

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

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

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

Unavoidable Adverse Impacts

Coal cannot be produced by surface mining without generating fugitive dust. The impacts of dust from individual mines decrease rapidly beyond the mine boundary. Violations of 24-hour ambient air quality standards would occur under the worst-case meteorological conditions near the Thundercloud, Kintz Creek, Mount Logan, Calf Creek, and Downey Coulee tracts under alternatives that include those tracts.

Short-term and Long-term Effects

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

Irreversible and Irretrievable Effects

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

TRANSPORTATION FACILITIES

Railroads

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

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

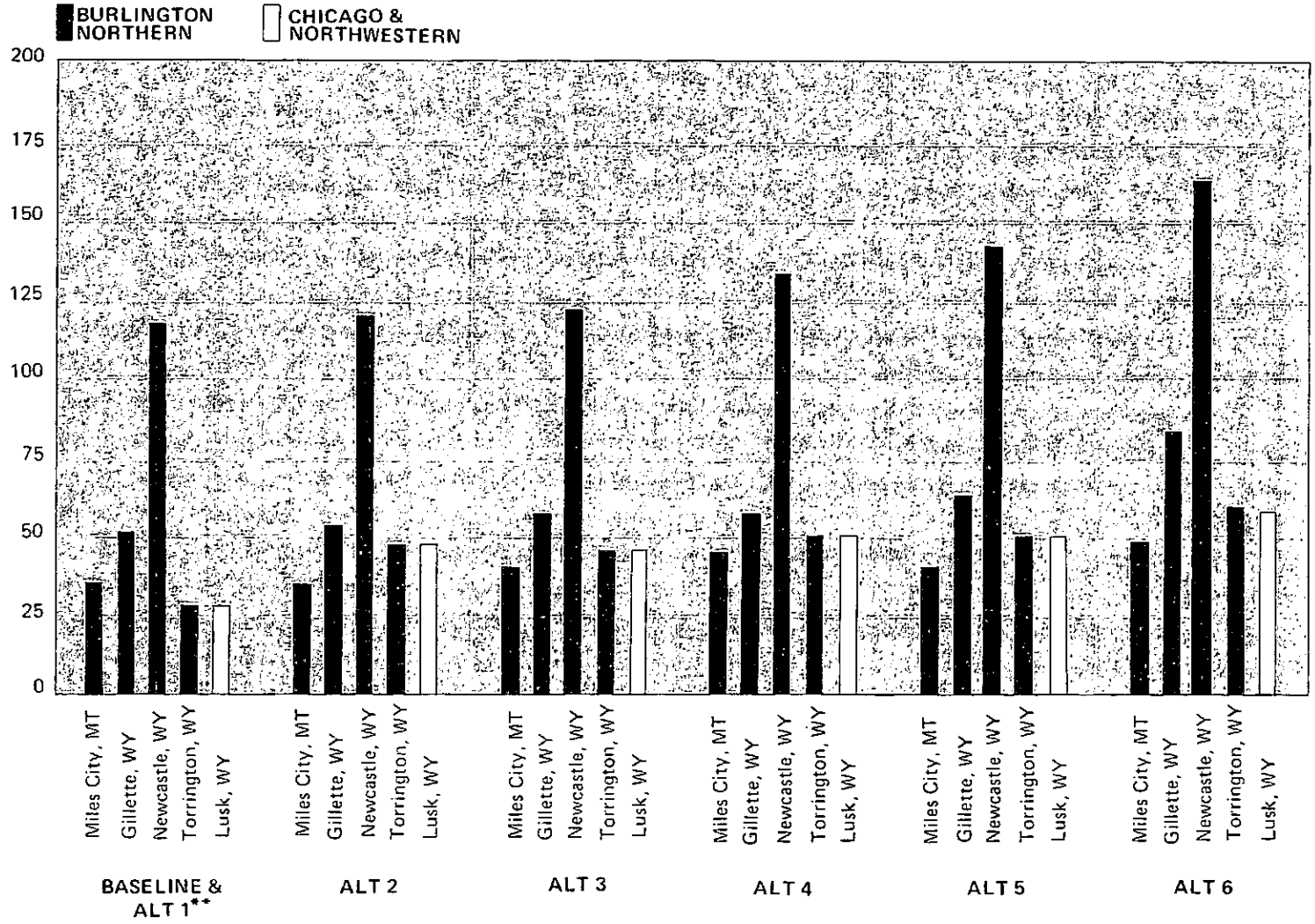


Figure 4-1
PROJECTED UNIT TRAINS/DAY*
BASED ON 1981 FIGURES AND
1995 COAL PRODUCTION POTENTIAL

*100 cars holding 100 tons each (includes empty and loaded trains)

** All alternatives include baseline

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

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

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

a. Based on 1,000 vehicles per day.

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

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

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

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

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

Highways

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

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

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

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

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

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

EMPLOYMENT AND SALARIES AND WAGES

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

The Eastern and Western Powder River Region

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

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

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

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

Niobrara County												
Mining and construction[a]	120	1.8	120	1.8	120	1.8	120	1.8	120	1.8	120	1.8
All other employment	710	6.7	710	6.7	710	6.7	720	6.7	720	6.7	730	6.8
All covered employment	830	8.5	830	8.5	830	8.5	840	8.5	840	8.5	850	8.6
Platte County												
Mining and construction[a]	10	0.2	20	0.5	20	0.5	20	0.5	30	0.5	40	0.5
All other employment	2,990	32.4	3,000	32.5	3,000	32.5	3,100	33.6	3,100	33.6	3,200	34.7
All covered employment	3,000	32.6	3,000	33.0	3,000	33.0	3,100	34.1	3,100	34.1	3,200	35.2
Sheridan County	A separate table has been prepared for Sheridan County because some impacts to that county will come from mining in the Northern Powder River Region. See table											
Weston County												
Coal employment	---	---	---	---	---	---	---	---	---	---	---	---
Construction employment	260	4.0	260	4.0	260	4.0	270	4.2	270	4.2	280	4.4
All other employment	3,140	45.6	3,200	46.5	3,200	46.5	3,200	46.5	3,200	46.5	3,300	48.0
All covered employment	3,400	49.6	3,500	50.5	3,500	50.5	3,500	50.7	3,500	50.7	3,600	52.4

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

a. Mining and construction have been combined for Goshen, Niobrara, and Platte counties so that individual operations will not be disclosed.

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

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

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

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

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

result in an increase in secondary employment in Sheridan County.

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

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

The Northern Powder River Region

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

The Crow and Northern Cheyenne Indian Reservations

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

POPULATION AND HOUSING

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

The Eastern and Western Powder River Region

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

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

The Northern Powder River Region

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

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

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

NOTE: Figures may not add due to rounding.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The Crow and Northern Cheyenne Indian Reservations

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

Alternate "Scenario" for the Northern Cheyenne Reservation

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

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

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

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

Colstrip has new, well-developed community services.

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

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

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

There is school bus between Ashland and Broadus.

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

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

Lame Deer has its own utility company.

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

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

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

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

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

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

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

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

Non-Indians can purchase deeded land on the reservation.

Approximately 25% of the Northern Cheyenne Reservation is deeded.

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

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

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

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

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

NOTE: Figures may not add due to rounding.

a. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.992 was used for permanent employment, plus 1.256 for temporary employment.

b. Projections are based on the 1980 share of county population, except for Ashland and the Ashland district of Rosebud County. It is expected that some of the workforce for the Ashland (Decker-Birney) and Northwest Otter Creek tracts (in Powder River County) would live in Rosebud County; accordingly, projections for those areas include the population effect of 50% of the workforce from those tracts.

c. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 4.367 was used for permanent employment, plus 1.263 for temporary employment. As there was no apparent temporary population in Powder River County in 1980, the average of the temporary ratios for Rosebud and Big Horn counties was used for Powder River County. Fifty percent of the workforce from the Ashland (Decker-Birney), Northwest Otter Creek, and Mud Springs tracts was excluded from these computations so that population effects could be allocated to Rosebud and Sheridan counties.

d. Projections were derived by applying 1980 population-to-employment ratios to projected employment. A ratio of 2.997 was used for permanent employment, plus 1.270 for temporary employment. Population effects of the workforce from the Ashland (Decker-Birney) and Northwest Otter Creek tracts were then added to Ashland, Ashland Division, and the county total.

e. Includes population impacts resulting from 50% of the work force on the Ashland (Decker-Birney) and Northwest Otter Creek tracts.

f. Not to be confused with the Ashland District of the Northern Cheyenne Reservation.

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

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

NOTE: Figures may not add due to rounding.

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

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

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

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

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

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

Interstate 90 will be completed between Lodge Grass and Sheridan.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

REVENUES AND EXPENDITURES

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

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

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

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

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

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

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

NOTE: Figures may not add due to rounding.

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

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

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

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

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

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

The Eastern and Western Powder River Region

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

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

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

The Northern Powder River Region

Table 4-19 presents a comparison of potential revenues to estimated peak expenditures in the Northern Powder River Region under the alternatives. Estimates of revenues for counties and schools are based on the gross proceeds tax and property taxes. The taxable value of gross proceeds is 45% of the contract value of coal (estimated at $7.83 per ton of coal production). The taxable value of coal property is 11% of the market value of the property (estimated at $5 million per million tons of production capacity).

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

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

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

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

The Crow and Northern Cheyenne Indian Reservations

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

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

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

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

NOTE: Debt servicing is included.

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

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

(continued on next page)

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

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

(continued on next page)

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

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

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

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

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

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

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

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

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

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

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

COMMUNITY SERVICES

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

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

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

SOCIOLOGY

Alternative 2

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

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

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

Alternative 3

Wyoming

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

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

Montana

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

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

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

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

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

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

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

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

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

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

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

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

	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5		Alternative 6	
	Full-time	Volunteer	Full-time	Volunteer	Full-time	Volunteer	Full-time	Volunteer	Full-time	Volunteer	Full-time	Volunteer
Eastern and Western Powder River Region												
Campbell County												
Gillette	9	41	10	44	10	44	10	45	10	45	11	49
Coverse County												
Douglas		35		36		36		36		36		38
Glenrock		30		30		30		30		31		32
Crook County												
Sundance		16		17		17		17		17		17
Moorcroft		31		31		31		31		31		32
Goshen County												
Torrington		49		49		49		50		50		51
Johnson County												
Buffalo		21		21		21		21		21		21
Natrona County												
Casper	111		112		112		114		116		117	
Niobrara County												
Lusk		26		26		26		26		27		27
Platte County												
Guernsey		26		27		27		27		27		28
Wheatland		54		55		55		55		57		58
Sheridan County												
Sheridan	23		24		26		27		27		29	
Weston County												
Newcastle		56		57		57		57		57		58
Upton		35		35		35		35		35		36
Northern Powder River Region												
Big Horn County												
Hardin		32		32		34		35		36		37
Powder River County		28		28		30		30		31		32
Broadus		28		28		45		49		36		49
Rosebud County		a		a		a		a		a		a
Ashland		4[b]		4[b]		7[b]		10[b]		10[b]		10[b]
Colstrip		40		40		43		44		41		46
Forsyth		23		23		25		26		24		27

Crow Reservation																		
Crow Agency			14			14			15			15			15			16
Lodge Grass			14			14			15			15			15			16
Northern Cheyenne Reservation																		
Ashland (on reservation)[b]			3			3			3			4			3			4
Birney (on reservation)[b]			1			1			1			1			1			1
Busby[b]			7			7			8			8			7			8
Lame Deer[b]			17			17			19			19			19			20

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

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

b. *Projections are based on a regional community average of 6 volunteers per 1,000 population.

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

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

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

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

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

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

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

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

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

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

c. Surface acres of sewage lagoon.

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

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

Powder River County

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

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

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

Rosebud County

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

The social effects of this alternative would be moderate elsewhere in Rosebud County, except possibly on the Northern Cheyenne Indian Reservation, which is discussed in the next section. The expected base conditions in Forsyth and Colstrip are such that the levels of growth under this alternative could be managed without extensive or intensive difficulty. In fact, such development probably would supplement similar changes that already have occurred because of past development, and it probably would be widely viewed as beneficial.

The Northern Cheyenne Indian Reservation

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

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

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

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

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

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

Alternative 4

Wyoming

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

Sheridan County

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

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

Campbell County

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

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

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

Montana

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

Big Horn County

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

Powder River County

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

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

Rosebud County

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

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

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

The Northern Cheyenne Indian Reservation

It is projected that some non-Indians would move to the reservation and that there would be some return migration of non-reservation Northern Cheyenne, with the same type of effects as were described for Alternative 3. Assuming the reservation would have several hundred additional residents, growth management problems could be expected, particularly along the main transportation corridors. The number of persons projected above the baseline is not high, but the area's capacity to deal with growth is very limited. Problems would be evident in housing, law enforcement, emergency medical care, education, and racial friction.

The Crow Indian Reservation

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

Alternative 5

Wyoming

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

Montana

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

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

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

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

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

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

Alternative 6

Wyoming

The Wyoming areas that would be significantly affected by Alternative 6 are Sheridan and Campbell counties. Both areas are protected by Wyoming's siting law, have firm relations with the state government, have experience with industry, and have relatively large, diversified, and occupationally industrialized labor forces. The capacities of these two counties to deal with local social changes are the highest in the Powder River Region, and both areas are expected to experience substantial population growth whether or not there is additional federal coal leasing.

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

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

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

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

Montana

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

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

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

Powder River County

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

Rosebud County

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

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

The Northern Cheyenne Indian Reservation

Alternative 6 would cause substantial changes on the Northern Cheyenne Reservation. Effects described for Alternatives 3, 4, and 5 would be evident, but even more intense and widespread. The addition of several hundred non-Indians to the reservation would further stress racial-cultural relations and the tribal government's ability to operate effectively. It also could put further pressure on the limited base of services and facilities. Areas along transportation corridors would be immediately and decidedly affected as traffic increased and residential and retail settlement took place. The Northern Cheyennes' sense of propriety toward the homeland would be reduced.

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

The Crow Indian Reservation

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

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

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

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

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

CHAPTER 5: PROPOSED MITIGATION OF SOCIAL, ENVIRONMENTAL, AND ECONOMIC ISSUES

INTRODUCTION

Social, environmental, and economic effects at the local level are important issues associated with the leasing of coal. In the Powder River Region, the Northern Cheyenne Tribe has expressed concern regarding social, environmental, and economic effects on the Northern Cheyenne Indian Reservation. The Northern Plains Resource Council has expressed concern about effects on local units of government.

Two specific elements are involved in dealing with social and economic effects: (1) Description of the expected effects by alternative and (2) portrayal of mechanisms that are available to respond to the projected community changes. The effects are assessed in chapter 4. As a means of sharing information with affected units of government, the assessments are of themselves important elements of the mitigation process. However, the focus of this chapter is the description of post-assessment processes of mitigating off-site social, environmental, and economic effects. In particular, mitigative measures proposed by the Northern Cheyenne Tribe and by the Northern Plains Resource Council will be considered.

For the proposed 1984 Powder River coal lease sale, mitigation proposals are primarily related to the potential leasing of Montana tracts. The reasons for this segmentation are explained in the following discussion. The discussion applies to all the leasing alternatives. Distinctions have not been made between maintenance tracts and new development tracts, even though the implications of the discussion differ considerably between the two types of tracts. The Northern Cheyenne Tribe believes there is no distinction between the two types of tracts.

Regulatory Environments in Montana and Wyoming

Montana and Wyoming have fundamentally different approaches in responding to rapid growth brought on by mineral development. Some sources of funding are similar—both states receive 50% of the bids and subsequent royalties generated by federal leasing and production; both states have severance taxes on coal production; and counties and communities in both states receive property tax revenues from industrial operations. However, Wyoming's passage of the 1975 Industrial Development Information and Siting Act gave local units of government considerable leverage in the permitting of mines, power plants, synfuels plants, and other large industrial developments.

This legislation is widely viewed as an effective means of responding to growth. It specifies that, as part of the permit application process, project proponents must describe their intentions for direct assistance to host communities that must absorb the off-site populations of the operations. Permits can be denied if these arrangements are judged not to be appropriate.

The situation in Montana is different. Severance tax monies are received by the state government, and a portion of the annual total is reserved for distribution to affected units of government through the Montana Coal Board. Attachment of off-site social and economic requirements is not provided for either by the Montana Environmental Policy Act or by the Montana Strip and Underground Mining and Reclamation Act, which guides mine plan permitting in the state. The Major Facility Siting Act does present an opportunity for such requirements to be employed in the permitting of conversion facilities; however, mines are not included.

Because of Wyoming's siting legislation, Wyoming units of government possess a direct source of mitigation of the effects of proposed large or moderate sized mines that Montana communities do not have through state legislation and permitting requirements. Therefore, Montana communities are somewhat more vulnerable to rapid growth than are Wyoming communities. The timely acquisition by counties, school boards, other boards, and municipalities of funds to manage growth is less predictable in Montana than in Wyoming. There is ongoing dialogue in both states with regard to distributing royalty and severance tax funds equitably in terms of the location of the effects.

Local Siting Authority in Montana

Nothing prohibits local units of government in Montana from adopting measures that would give them authority to approve, deny, or qualify industrial operations being located in, for example, a

particular county. These powers have not been exercised in the coal counties of southeastern Montana, however.

It appears that the Northern Cheyenne and Crow tribes possess adequate authority to prohibit both industrial operations and secondary consequences of those operations—mobile home parks, residential subdivisions, and the like—on-reservation.

The tribes clearly have the authority to control surface use of tribal lands. A 1982 Tenth Circuit Court of Appeals decision in Wyoming, *Knight, et al. v. Shoshone and Arapahoe Indian Tribes,* indicates the tribal authority in controlling surface use on privately owned land within the reservations is extensive, although not unlimited, independent of ownerhip (Indian or non-Indian), proponent's background (tribal members, Indians, non-Indians), and type of development. The tribes also have authority to control surface use of allotted land within the reservation, although the extent of this authority has not been judicially established. For both county and municipal governments and tribal governments in Montana, however, the feasibility of implementing these controls is evidently limited by the residents' historical mistrust of such measures. The Northern Cheyenne Tribe has concluded that such measures are not practical and not consistent with tribal policy.

The need for such measures in Wyoming is lessened by the presence of the Siting Act.

Montana Energy Impact Funding and Indian Tribes

On October 1, 1983, federally recognized Indian tribes in Montana became eligible for energy impact grants and loans from the Montana Coal Board. Since that date tribes have been able to apply for grants or loans as county, municipal, and other public entities have been able to do in the past.

Perhaps as important as the legal change described above in the context of this discussion is an implicit recognition on the part of the Montana state government that Indian tribal governments are jurisdictionally equivalent to other area units of government with regard to growth management funding. A source of assistance previously not accessible to the tribes is now available, even though it appears that limitations on this funding from the Montana Coal Board are pronounced and that documentation of past, present, future adverse consequences would be required. The tribes have no experience in applying for those grants and loans.

The Mineral Leasing Act and Off-site Mitigation

Two matters deserve attention with regard to the Mineral Leasing Act of 1920, as amended in 1976. First, review of the legislative history of the act and its amendments revealed that congressional intent in responding to off-site social and economic funding problems arising from mineral leasing is limited to the sharing of federal revenues from bonus bids, rent, and royalty. Despite full opportunity to provide the Secretary of the Interior with additonal powers (at least in considering the 1976 amendment), the Congress approved no other fiscal mechanisms. This limits the secretary's ability to require the lessee to provide funding, and it is consistent with traditional separation of responsibilities between the federal and state governments.

Second, section 30 of the act authorizes inclusion of terms and conditions in mineral leases for protection of the public welfare. This statement empowers the Secretary of the Interior with broad discretionary authority in terms of federal mineral leasing. However, these broad powers historically have not been exercised with regard to off-site social and economic effects.

Thus, one interpretation of the Mineral Leasing Act relative to this issue is that the Secretary of the Interior may choose to condition leases to protect the general welfare but that Congress has specifically addressed the sharing of funds with host states. Additional funding mechanisms may be viewed as contrary to the intent of Congress. However, this would not necessarily preclude other, nonfiscal measures that the secretary might choose to implement to safeguard the welfare of citizens or communities affected by leasing.

Section 35 of the Mineral Leasing Act establishes the national policy that state legislatures address fiscal response at the sub-state level to conditions caused by leasing. That section expressly authorized the use of redistributed lease revenues by the legislatures to mitigate impacts in affected localities. However, section 35 does not address parallel matters on Indian reservations in the vicinity of off-reservation federal leasing.

Federal Mine Plan Review and Off-site Mitigation

There is substantial legal dispute as to whether SMCRA or NEPA provides sufficient authority for the Secretary of the Interior to attach to mine plan permits any stipulations or requirements regarding off-site social and economic conditions. If the Department of the Interior chooses to address these matters in its coal management process, it is advisable that it do so at the leasing stage to avoid the risk of being unable to do so when reviewing permit application packages.

The decision above is a preliminary analysis. A more detailed review is needed to consider the policy and legal questions concerning the proposals submitted.

PROPOSALS RECEIVED

Background

The Powder River Regional Coal Team unanimously approved a motion at its June 21, 1983, meeting that invited the Northern Cheyenne tribe to submit its proposed mitigating measures. A commitment was made to consider those proposed measures in the draft EIS. The tribe's proposed measures, which are in the form of potential lease stipulations, are summarized and discussed in this chapter. The complete text of the tribe's proposal appears in appendix F. The proposed stipulations apply in concept to all Montana tracts, both maintenance and new production.

The Northern Plains Resource Council (NPRC) submitted a proposal for mitigation of social and economic effects on local units of government.

No mitigation proposals were invited or received from entities in Wyoming. This is perhaps indicative of the solid position of the potentially affected communities and counties in their ability to respond to rapid growth.

Northern Cheyenne Proposals

The proposals of the Northern Cheyenne are summarized and discussed in the following sections. It should be made clear that the steps discussed below are proposals. Other mechanisms designed to achieve the same or similar goals are open for discussion; however, the discussion in this section is confined to the proposals of the Northern Cheyenne Tribe. In each case, implementation would be through written agreements to be pursued immediately after the successful bidder was identified.

Review of each of these measures should include consideration of the Secretary of the Interior's well-established historical and continuing trust responsibilities relative to the Northern Cheyenne and other Indian tribes. Among these responsibilities are protection of the homeland, coordination of the provision of services and facilities, and the implementation of measures that enhance living conditions and economic opportunity.

The BLM, through its coal leasing and other resource programs, has not in the past been a major factor in implementing the trust responsibilities of the Secretary of the Interior. However, it is clear that both coal leasing and trust responsibilities relative to Indian tribes rest with the Department of the Interior.

Proposed Measure 1: Employment Preference

Proposal

The Northern Cheyenne Tribe proposes that tribe members and members of tribal families be given preferential consideration in recruitment, training, hiring, promotion, and workforce reductions in all categories of employment attached to development of the tracts. This requirement, according to the proposal, would be implemented through a written agreement between the tribe and the lessee, subject to the approval of the Secretary of the Interior. The agreement would cover the following programs:

- Quantitive goals and schedules for each employment category
- Protection of the lessee with regard to personnel decisions
- Recruitment of preferred employees
- Training
- Scholarships and tuition programs
- Cultural awareness workshops for non-Indians
- Mass transportation programs for commuting workers
- Announcement of the preferential program to involved labor unions

Requirements for contractors and subcontractors to abide by the agreement on employment preference

Establishment of a lessee-tribal employment committee

The lessee's bearing of administrative costs associated with the employment committee

Discussion

Attaching the proposed stipulation would have broad effects that are not quantifiable at this time. Specifics of the proposed agreements are unknown. For the Northern Cheyenne, it obviously would result in an improved climate of economic opportunity. Unemployment has been and remains high among the Northern Cheyenne, and a number of associated social problems may be related to a sense of lack of job potentials either in the near term or in the long term. Perhaps some off-reservation Northern Cheyenne would be attracted back to the reservation for residential purposes.

For the tribe itself, the proposed stipulation would serve to reduce the dependence of some tribal members on scarce tribal funding resources.

It is likely that the requirements of the proposed stipulation would reduce the projected level of non-Indian in-migration onto the reservation that could result from additional federal coal leasing. To some extent the lower level of in-migration would address the expected land use changes (trailer parks, residential subdivisions), stress on transportation corridors, and potential cultural conflict situations that would be attached to moderate levels of population change.

Effects associated with population growth in off-reservation areas and communities also would be moderated because the projected level of labor in-migration to those areas would be reduced.

Major uncertainties also deserve attention. It is not known how the application of the proposed stipulation would affect the private sector's view of the value of the coal resource. As it would serve to increase production costs either substantially or marginally, the effect could be to reduce the market value of the resource. The tribe has concluded that this factor should not affect consideration of the measure in any way.

Furthermore, labor supply could be in question—it would depend on the level of surplus labor (which appears to be adequate), the level of sequencing of production, the actual agreed-upon levels of preferential hiring and training, and similar factors. It is not known if available labor exists to fulfill the requirements, but it is assumed that it would be available. As a practical matter, the application of the proposed stipulation on maintenance tracts might be quite difficult. However, the tribe has suggested that this measure could be implemented as turnover in existing jobs took place.

Authority for employment preferences may rest in section 30 of the Mineral Leasing Act. In addition, section 703(i) of the 1964 Civil Rights Act legitimizes preferential treatment of Indians in employment practices for enterprises on or near Indian reservations. Non-Indian family members may not be covered by that legislation, however—the act refers only to Indians.

The major alternative to making this proposal a stipulation is an approach that would not directly involve the federal government. The Crow Tribe has a preferential employment agreement with Westmoreland Resources at the Absaloka mine, and it appears to be effective. The Northern Cheyenne and the Montana Power Company signed a preferential employment agreement of the type discussed here in 1980. Its effect has been viewed positively by the tribe. In that case, however, because the power company was operating a coal-fired power plant, the tribe was able to use its Class I air quality status as a means of reaching an agreement. Such a point of leverage might not be available to the tribe in connection with Powder River Region leasing for mines from which the coal would be transported out of the region.

Encouragement of such approaches by the Department of the Interior and the state probably would be the main alternative to a requirement like that proposed by the Northern Cheyenne. The Northern Cheyenne do not believe that such voluntary approaches would be effective, because employment of tribe members at other mining sites in the region is very limited.

Proposed Measure 2: Contracting Preference

Proposal

The Northern Cheyenne Tribe proposes that businesses controlled by the Northern Cheyenne Tribe or its members be given preferential consideration in all contract awards associated with conduct of operations and purchases of material and equipment for operations. According to the

proposal, this requirement would be implemented through an agreement between the tribe and the lessee, subject to the approval of the Secretary of the Interior. This agreement would cover the following points:

- Quantitive goals and schedules for their achievement
- A certification procedure under which a business seeking preferred status would document (a) its control by the tribe or a tribal member and (b) its capability of providing particular services, materiel, or equipment
- Technical and financial assistance to prefered businesses in obtaining certification
- Advance notice to preferred businesses of contracts to be awarded
- In competitive situations, the establishment of formulas for the granting of competitive margins (a reasonable sum by which a preferred business's bid could exceed all other bids)
- A requirement of all contractors and subcontractors that they in turn also comply with terms of the agreement
- Establishment of a contracting preference committee with members from the lessee and the tribe
- The lessee's bearing of administrative costs associated with the contracting preference committee

Discussion

The proposed stipulation would have effects similar to those discussed for the employment preference proposal. Employment would be generated by the economic activity on the reservation resulting from the proposal, and capital investments on the reservation would be enhanced. If Indian businesses were consistent in hiring Indians, the level of non-Indian in-migration would be somewhat reduced. If the Indian businesses hired non-Indians, it could actually increase the number of non-Indians on the reservation.

As would be true of the employment preference proposal, implementing this proposed stipulation could affect the level of private sector interest and the bid value of the potential leases covered by this stipulation. The level of that effect is not known. Furthermore, the application of the proposed requirement on maintenance tracts would be difficult, because maintenance tracts would be added to ongoing operations with existing contracts. The Northern Cheyenne Tribe has concluded that market value factors do not constitute a valid criterion of consideration. The tribe suggests that the measure could be implemented on existing operations as contracts expire.

At this time, the number and types of Northern Cheyenne-controlled businesses that could take advantage of this opportunity are very limited. The idea of the proposal is that such agreements would lead to the creation of appropriate businesses with sufficient backing to acquire needed loans for investment. Again, the tribe's goal is to capture more benefits of nearby coal development than has occurred in the past.

Authority for stipulating contracting preference may rest in section 30 of the Mineral Leasing Act.

An alternative method of achieving the goals of this proposed stipulation would be the establishment of voluntary programs between the lessee and the tribe. Federal involvement would be absent from such a program, and its effectiveness is uncertain. The tribe has concluded that such an approach would be ineffective and impractical.

Proposed Measure 3: Law and Order and Traffic

Proposal

The Northern Cheyenne Tribe proposes that each lessee be required to obtain a covenant from each of its employees that the employee, while on the reservation, will comply with all standards of conduct generally applicable to tribe members. Truckers operating on the reservation also would be required to sign a covenant with the lessee to operate their vehicles in compliance with all laws, ordinances, and rules applicable to the use of motor vehicles by tribe members. Each lessee would contractually require each of its contractors, subcontractors, and suppliers to obtain like covenants from their truckers and employees. Enforcement, through disciplinary action, would be the responsibility of the lessee, contractors, and subcontractors if a violation was reported by the tribe.

These provisions would be implemented by an agreement between the tribe and the lessee, subject to approval by the Secretary of the Interior. The agreement would cover the following points:

- As a condition of employment, written assumption of the conditions described above by each employee and each trucker

Education of employees and truckers on standards of conduct prevailing on the reservation

Appropriate employment-related disciplinary procedures for particular violations

Resolution of disputes concerning the occurrence of violations

Notification to labor unions of the agreement

Funding by the lessee to cover administrative costs incurred by the tribe in implementing the agreement

Discussion

Implementation of the proposed measure could reduce the expected adverse public safety consequences on and along transportation corridors on the reservation. These anticipated consequences are described in chapter 4. Truck traffic on highway 212 is dangerous, and increased volume would worsen the problem. Delays in processing offenders occur because of jurisdictional complications on the reservation, particularly off the state highways.

The costs to the lessee associated with this proposed stipulation probably would be minor, but the introduction of an administrative process could in itself be significant on occasion. Authority for making the proposed stipulation may be found in section 30 of the Mineral Leasing Act.

The major questions relative to this proposal involve the appropriate federal role. First, law enforcement in regard to vehicular traffic and other nonfelony offenses generally is the responsibility of state and local authorities, and processes for dealing with those types of violations already exist. This proposal appears to duplicate existing laws and processes.

Second, this proposal has greater likelihood of being accomplished without federal involvement than other measures discussed in this section; that is, agreements of the type proposed probably could be achieved between the tribe and the lessees. The lessees' costs would be minimal, and agreements arrived at voluntarily probably would be as effective as substantively parallel required agreements. Federal imposition might be neither warranted nor useful. However, the tribe has concluded that existing law enforcement mechanisms are inadequate, that voluntary agreements are not feasible, and that federal involvement in on-reservation law enforcement already is well established.

Proposed Measure 4: Environmental Protection

Proposal

The Northern Cheyenne Tribe proposes a lease stipulation for environmental protection on the reservation. The proposed stipulation would require establishment of a program to monitor air quality, visibility, water quality, water quantity, and biological and other resources that might be adversely affected by coal leasing and development. The proposal calls for baseline monitoring for a reasonable period before construction and for ongoing monitoring throughout the life of the project.

The stipulation proposes the program be conducted under an agreement among the tribe, the coal lessee, and all federal and state agencies with pollution control jurisdiction over the project. The agreement, which would be subject to approval by the Secretary of the Interior, would include the following provisions:

Comprehensive monitoring of reservation resources using state-of-the-art monitoring equipment and techniques, designed and conducted by qualified professionals who would analyze the results

Recruitment, training, and employment of tribe members and families to operate the monitoring program

Establishment of an environmental monitoring committee with members from the tribe, the lessee, and involved state and federal agencies

Arrangements for remedies in the event of violations of air or water quality standards or impairment of resources resulting from construction or operation of a project

Funding by the lessee to cover the cost of the monitoring programs and the expenses of the tribe's representatives on the committee

Discussion

Federal coal leasing and development will not occur on the Northern Cheyenne Reservation or on lands owned or controlled by the tribe. For that reason, any environmental impacts that would affect the tribe under any alternative would be off-site impacts.

One coal tract included in the alternatives, Downey Coulee, adjoins the north boundary of the Northern Cheyenne Reservation. The Northwest Otter Creek tract is 2 miles east of the

reservation; Ashland (Decker-Birney) is 8 miles east. All other tracts are more than 12 miles from the reservation boundary.

Six of the 11 Montana tracts included in the alternatives are maintenance tracts. It is expected that they would be developed in association with existing coal mines. Therefore, they would not significantly increase impacts from coal development; rather, they would extend the time that any existing impacts might continue.

Only the Mud Springs tract has been considered for development of a coal-fired generator on the site. Coal from the other tracts, if they were leased, would be transported out of the region.

The PEDCo air quality model did not forecast violations or cumulative violations of air quality standards from the proposed Mud Springs generator (PEDCo 1983).

A requirement already exists for monitoring effects on air quality. State statutes require an applicant to conduct air quality monitoring for a minimum of one year before obtaining a PSD permit. After the permit is granted, continuous monitoring is required during mining to determine if air quality violations are occurring.

Only the Downey Coulee tract has been projected to affect water quantities on the reservation. All other tracts are outside the 2 to 3 mile radius where effects normally occur. State statutes require groundwater monitoring around surface mining operations and replacement of water quantities lost; that is, water lost through damage to existing wells on the vicinity of surface mines must be replaced.

The increase in TDS in the Tongue River is projected to range from 1.4% to 7.2% for the six alternatives. Potential degradation of water quality on the reservation would occur only from tracts on the Tongue River drainage. Discharges from other tracts included in the alternatives flow away from reservation boundaries. State statutes requires mine permittees to monitor groundwater and surface water and to comply with water quality standards.

Neither the regional EIS nor the Northern Cheyenne Tribe identified coal-related impacts to biological or other resources. The main reason for this finding is that coal development will not occur on reservation lands.

Proposed Measure 5: Impact Assistance

Proposal

The Northern Cheyenne Tribe proposes two alternative stipulations aimed at responding to the issue of impact funding. The first alternative would make the following provisions:

Lessees would be required to contribute to the tribe for planning and providing public service and facilities on the reservation.

Contributions would be calculated by taking the bid royalty funds generated by the lease, dividing that figure by the non-reservation resident population of Big Horn, Rosebud, and Powder River counties, and then multiplying that number by the resident population of the reservation.

Contributions would be provided to the tribe in concert with federal royalty payments.

This funding would be implemented through an agreement between the tribe and the lessee, subject to the approval of the Secretary of the Interior.

The requirements of the second alternative would be as follows:

Lessees would be required to contribute to the tribe for planning and public services and facilities on the reservation.

The contribution would be based on the previous year's tribal expenditures for reservation services and facilities, divided by the total reservation population.

The per capita expenditure described above would be matched by the lessee for each project employee and family member residing on the reservation. Furthermore, the lessee would contribute one-third of this per capita expenditure level for each employee residing off the reservation.

The program would be implemented through an agreement between the tribe and the lessee, subject to approval by the Secretary of the Interior. This alternative would cover the following tribal expenditures: education, ambulance service, health care, alcoholism and drug abuse treatment, law and order, tribal court, rural officers, recreational facilities, transportation, shelter home for children, day care, elderly residence and care, garbage canister program, utility commission, and tribal government.

Mitigation Proposals

Discussion

The first alternative would essentially be a mechanism to ensure that the tribe would receive per capita funding equivalent to the level received by state government, relative to non-Indian residents of the three-county area. The second alternative is a cost-sharing approach that would ensure that the lessee would bear costs associated with project-related residents. The tribe believes this would compensate for spillover effects from in-migrants living off-reservation in southeastern Montana and in the Sheridan area of Wyoming.

The tribe has expressed no preference between the alternatives proposed. Evaluation of these proposals is difficult. Policy and legal questions of some complication are involved. The following factors are among those that might be considered.

The actions of Congress in making decisions on the distribution of mineral royalties imply that federal funding involvement should be limited to a proportionate return of the local revenues to state governments. The Northern Cheyenne Tribe has asserted that the Secretary of the Interior, given trust authority, has unequivocal authority to attach stipulations to leases in the manner described in the proposals, even though that authority is not expressed.

Equity questions between non-Indian, non-reservation residents in the area and the Northern Cheyenne Tribe and its members deserve attention. For example, the state's application of royalty funds from the federal government may not be entirely consistent with the location of the effects of mining. The first alternative apparently is based on the idea that these funds are targeted more or less exclusively to the areas affected by mining.

Jurisdictional and taxation issues between the state of Montana, the counties, and the tribe are unresolved. Under the second alternative, a lessee would bear the costs of providing service in a jurisdiction where neither its operation nor its employees was located.

Tribal qualification for state severance tax funds is now secure, but limited. The tribe does not have access to other funding sources that are available to other jurisdictions, such as federal rentals, bid bonuses, and property taxes.

The extent to which the tribe bears responsibility for services and facilities used by non-Indian residents of the reservation is restricted relative to a broader array of services and facilities provided by other local governments in the area. However, the tribe has listed the following programs that are at least partially funded by the tribe and which non-Indians may use: roads, law enforcement, tribal court, recreation areas, utility services, emergency medical services, and firefighting. Non-Indians married to Indians formerly were eligible for tribal health care; however, it appears that restrictions recently have been placed on this eligibility. Non-Indian eligibility for housing benefits provided by the Department of Housing and Urban Development, the Bureau of Indian Affairs, and the tribe are very limited. The tribe has concluded that coal development in the region has increased the tribe's cost of responding to Northern Cheyenne needs, independent of non-Indian settlement on the reservation. A primary example is law enforcement.

Legal authority for attaching stipulations of this type remains to be clearly established. It appears to be somewhat less secure than the possible measures such as employment preference. However, the tribe has concluded that this authority is unequivocal.

Tribal sovereignty in land use control is established. While it may be difficult to implement, the tribe has the power to exclude the siting of subdivisions and the like on the reservation. Such action would largely reduce the need for the measures proposed. However, the tribe has concluded that these actions are not realistic.

Given that there are several ongoing and proposed operations in the area, evaluation of baseline populations and populations attributable to any particular construction project or mining operation would be technically difficult and imprecise. It would require a monitoring program of considerable scale. A funding source, or sources, for such an effort has not been identified.

It would be difficult to evaluate the effect that attaching these stipulations to individual leases would have on the market value of the coal resource. However, the tribe has concluded that this is not a valid consideration.

The principal available alternative to requiring agreements like those proposed would be a voluntary approach without federal participation. The effectiveness of such approaches is uncertain. The tribe has concluded that such an approach would be ineffective.

Northern Plains Resource Council Proposal

Proposal

For provision of impact information and assistance to local units of government, the Northern Plains Resource Council proposes that each lessee submit a plan to all potentially affected Montana units of government (school districts, counties, municipal governments, water and sewer districts). The plan would address two factors, (1) the expected fiscal and social effects of construction and operation of proposed mines and all associated facilities on the affected area and (2) proposed mitigating measures to be undertaken by the lessee to address the impacts.

The plan would specifically consider prepayment of taxes, grants, and other measures available to assist local government units. If local government officials did not agree with the assessment or the proposed mitigation, then the BLM Miles City District Manager would appoint an arbitrator with the advice and consent of the Montana Coal Board. The results of any agreement between local units of government and the lessee would be appended to the lease and would become enforceable.

Discussion

The two distinct elements of this proposal, taken together, are similar in concept to the Wyoming means of responding to off-site social and economic effects, the siting process. However, the process proposed by the NPRC would involve the participation of the federal government.

The first element is essentially an information-sharing mechanism. As such, it is parallel to aspects of the permit application processes required by Montana laws for mines (the Strip and Underground Mining and Reclamation Act) and facilities (Major Facility Siting Act). Those permitting processes include social and economic forecasts of the type proposed. Attachment of this element of the proposed stipulation to leases would appear to duplicate such ongoing efforts in Montana.

The second element extends well beyond the distribution of information to the distribution of funds. Prepayment of taxes is now authorized for some mining operations in Montana. However, this authorization is apparently limited to the county unit of government for operations employing a minimum annual average of 100 persons.

Montana school superintendents can require an educational impact statement from operators within their jurisdiction. Such a statement is evidence toward bringing bond issues before the voters. Approval of such issues permits the district to exceed its bonding limitation. The developer would then pay the excess in principal and interest above the limitation.

Finally, the Montana Coal Board is designed to respond, with severance tax funds, to fiscal problems brough on by mining activities. Funds are directed to a variety of units of government.

The NPRC's proposal reflects an apparent belief that Montana mechanisms are not comprehensive enough to deal with growth at the local level and that there are jurisdictional mismatches between the location of operations and the location of consequences. Thus, federal intervention in these matters is proposed.

It appears that Montana has adequate authority to implement the information-sharing component of this proposal in its process for permitting coal operations. Information available during that process would be adequately specific to allow much more precise forecasting that could be accomplished at the leasing stage.

The regulatory environment in Montana for requiring lessees to implement the second element of the proposal is less consistent and comprehensive than that for implementing the first component. It is possible, if not likely, that affected local units of government would not have the authority or the access to funding required to respond to rapid growth in a timely manner.

Implementation of this proposed stipulation would require the design of an administrative process within the Department of the Interior that does not exist at this time.

CHAPTER 6: CONSULTATION AND COORDINATION

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Cartographic and Typesetting Services provided by BLM Wyoming State Office, Cheyenne.

COOPERATING AGENCIES

The Forest Service, U. S. Department of Agriculture, assisted directly in preparation of site-specific analyses for tracts in the Thunder Basin National Grassland. The Forest Service also reviewed the draft document.

The Office of Surface Mining Reclamation and Enforcement, U. S. Department of the Interior, reviewed the draft document.

CONSULTATION

In addition to the scoping meetings described in chapter 1, many informal consultations were held with various federal, state, and local governments and with Indian tribal councils. The many BLM specialists assigned to the project have held a broad range of "one-on-one" meetings. The information received has been incorporated into the EIS as appropriate.

Formal consultation for the EIS consisted of the following:

Consultation with the State Historic Preservation Officers of Wyoming and Montana under section 106 of the National Historic Preservation Act.

Submission to the U.S. Fish and Wildlife Service of a biological assessment indicating no significant impacts would occur to threatened and endangered species under the proposed action

Results of the cultural resource consultations are reflected in the EIS. Final evaluation of the biological assessment in Wyoming is pending. Evaluation of the Montana biological assessment has been completed.

DISTRIBUTION

Federal Agencies

Department of Agriculture
- Farmers Home Administration
- Forest Service
- Soil Conservation Service

Department of Defense
- Department of the Army, Corps of Engineers

Department of Energy

Department of the Interior
- Bureau of Indian Affiars
- Bureau of Mines
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey
- National Park Service
- Office of Surface Mining Reclamation and Enforcement

Environmental Protection Agency

General Accounting Office

Interstate Commerce Commission

Small Business Administration

Indian Tribes

Crow Tribal Chairman
Northern Cheyenne Tribe

State Agencies

Governor's Clearinghouse, Wyoming
Montana State Clearinghouse
Governor Herschler, Wyoming
Governor Schwinden, Montana

Local Governments

Campbell, Converse, and Sheridan County Commissioners or Planning Departments, Wyoming

Big Horn, Powder River, and Rosebud County Commissioners or Planning Departments, Montana

Cities and Towns of Douglas, Gillette, Ranchester, and Sheridan, Wyoming

Cities and Towns of Broadus, Forsyth, Hardin, and Miles City, Montana

Special Interest Groups

Audubon Society
Chamber of Commerce, Gillette, Wyoming
Chamber of Commerce, Sheridan, Wyoming
Citizens for Orderly Energy Development
Council of Energy Resource Tribes
Earthtech
Ecology and Environment
Environmental Policy Institute
Friends of the Earth
Montana Senior Citizens Association
National Wildlife Federation
Natural Resources Defense Council
The Nature Conservancy
Northern Plains Resource Council
Powder River Basin Resource Council
Public Lands Institute
Sierra Club
Tongue River Resources Council
Trout Unlimited
The Wilderness Society
Wyoming Heritage Society
Wyoming Mining Association
Wyoming Outdoor Coordinating Council
Wyoming Stockgrowers Association
Wyoming Wildlife Federation
Wyoming Woolgrowers

Other Organizations and Individuals

Copies of this EIS have been sent to a number of individuals, companies and organizations not listed above.

APPENDIX A: NET ENERGY ANALYSIS

INTRODUCTION

A net energy analysis was conducted for Powder River coal tracts at the site-specific analysis and cumulative analysis stages of coal activity planning. The results of the analysis for each tract are shown in the individual tract profiles.

Both types of analyses used the ratio of Btus expended in mining to the Btus recovered per pound of coal. A net energy analysis factor of 37.7 Btus expended to produce a pound of coal was used as directed in BLM Washington Office instruction memorandum 79-282.

METHODOLOGY

Coal Btu content in the tracts selected ranged from 7,800 to 9,500 per pound for all leasing alternatives. To calculate net energy ratios by alternative, we multiplied the weighted average Btu content per tract by the total coal reserves in the tract, obtaining a weighted value. We then took the sum of these values for all tracts in a given alternative and divided it by the sum of the total coal reserves to get a weighted Btu content by alternative. This weighted Btu value was then divided by 37.7 to obtain ratios by alternative.

NET ENERGY RATIO FOR EACH ALTERNATIVE

Alternative	Total Reserves[1] (in billions of tons)	Weighted Btu Value per pound	Net Energy Ratio
1	No leasing		
2	1.475	8,760	232 to 1
3	2.122	8,694	230 to 1
4	3.466	8,710	231 to 1
5	3.976	8,729	231 to 1
6	6.131	8,511	225 to 1

[1]The totals are for all reserves in the tract, including federal, state, and private coal.

CONCLUSION

Favorable energy balances were found for all alternatives considered. Differences between ratios for the various leasing alternatives were not great enough to formulate meaningful conclusions about which alternative would be best.

APPENDIX B: ENERGY-RELATED INDUSTRIAL DEVELOPMENT IN THE POWDER RIVER REGION (projects included in baseline)

PRODUCING COAL MINES

Colstrip (Western Energy)
Big Sky (Peabody)
Absaloka (Westmoreland)
Coal Creek
Spring Creek (Nerco)
Decker—East and West (Peter Kiewit)
Big Horn (Peter Kiewit)
North Rawhide (Carter)
Eagle Butte (AMAX)
Fort Union (Delzer Construction)
Clovis Point (Kerr-McGee)
Wyodak (Wyodak)
Caballo (Carter)
Belle Ayr (AMAX)
Cordero (Cordero)
Jacobs Ranch (Kerr-McGee)
Black Thunder (Anaconda)
Dave Johnston (Glenrock Coal)
Buckskin (Shell)
Coal Creek (Anaconda)

NONPRODUCING COAL MINES

Montco-Nance (Montco)
CX Ranch (Consolidation-Chevron)
Ash Creek (Ash Creek Mining)
Black Mountain (Black Mountain)
Dutchman (JMT)
Wildcat Creek (Gulf)
Dry Fork (Phillips)
South Rawhide (Carter)
East Gillette (Kerr-McGee)
Peabody (Peabody)
Caballo Rojo (Mobil)
Wymo Fuels (Wymo)
North Rochelle (Shell Oil)
Rochelle (Peabody)
Antelope (NERCO)
Coal Creek (Wesco Resources)
Cook Mountain (Thermal Energy)
Rocky Butte (Texas Energy)
Keeline (Neil Butte)
Crow-Shell (Shell)
North Antelope (North Antelope Coal Company)

PREFERENCE RIGHT LEASE APPLICATIONS

Ulm Project (Fred C. Woodson)—2 PRLAs
Wildcat Creek Area (Gulf)—7 PRLAs
Thunderbird Project (Western Fuels)—16 PRLAs
Thunderbird II (Wold-Jenkins)—11 PRLAs
South Gillette (Peabody)—6 PRLAs (6 PRLAs were rejected and are under appeal)
Belle Fourche (John Wold)—1 PRLA (1 PRLA was rejected and is under appeal)
East Black Thunder (Anaconda)—3 PRLAs
Rochelle Area (Peabody)—5 PRLAs
North Antelope (NERCO)—2 PRLAs
South Antelope (Peabody)—1 PRLA
Dull Center (Peabody)—2 PRLAs
Sand Draw (Peabody)—5 PRLAs
Stevens North (Western Fuels)—3 PRLAs
Stevens South (Western Fuels)—1 PRLA
Southern Powder River (CDT)—2 PRLAs

COAL EXCHANGES

Big Horn
Gulf
Belco
Kerr-McGee
Whitney Benefits
Peabody Coal
Consolidation Coal

POWER PLANTS

Colstrip 1
Colstrip 2
Neil Simon
Wyodak

Appendix B

Osage
Dave Johnston
Colstrip 3
Colstrip 4
Missouri Basin Project

REFINERIES

Osage
Wyoming
Texaco
Little America
Glenrock
Amoco

URANIUM MINE AND MILL AREA

Irigary in situ
Greasewood Creek Mine
North Butte Mine and Mill
PINTEC and Thunderbird joint in situ
Reno Road in situ
Charlie Ore Body Mine and Mill
Moore Ranch Mine
Sand Rock Mill
Bear Creek Mine and Mill
Open Pit and Section 34 Mines
Teton Exploration in situ
SPRB Mill
Highland Mine and Mill
Nine Mile Lake in situ
Morton Ranch Mine and Mill
Bill Smith Mine

BENTONITE MINE AND MILL AREA

American Colloid Mine and Mill
NL-Industries Mine and Mill
International Mineral Co. Mine and Mill
Federal Bentonite Corp. Colony Mine and Mill
American Colloid Mine
Federal Bentonite Division Mine
Benton Clay Corp. Mine
Kaycee Bentonite Corp. Mine
Benton Clay Corp. Mill
Kaycee Bentonite Corp. Mill

OIL AND GAS

Regional Developments

RELATED ENERGY DEVELOPMENT

ETSI Coal Slurry Pipeline
Tongue River Railroad
Chicago and North Western Railroad Connector

APPENDIX C: MITIGATION REQUIREMENTS

INTRODUCTION

Lessees will be required to develop their federal leases in compliance with all applicable federal, state, and local laws and regulations. These are considered to be in-place constraints to a lessee's activities. Therefore, enforceable statutes, performance standards, and other license requirements are considered part of proposed federal actions under all alternatives and are applicable to all coal tracts. (Refer to the "Legislation and Regulations" section of chapter 1 of this document for a discussion of the laws pertaining to federal coal leasing.)

In addition, through the land use planning and activity planning processes, the BLM has considered the practicable means to avoid or minimize environmental harm resulting from the alternative leasing actions, above and beyond the standards that are already required by existing regulations or laws. The following mitigating measures are considered to be real, committed, and legally enforceable. The general mitigating measures apply to all tracts under all leasing alternatives. The tract-specific measures apply only to particular tracts and the alternatives in which they occur. Additional mitigating measures, if warranted, may be identified as a result of the EIS process.

MEASURES APPLIED TO ALL TRACTS

Cultural Resources

a. Before undertaking any activities that may disturb the surface of the leased lands, the lessee shall conduct a cultural resource intensive field inventory in a manner specified by the authorized officer of the appropriate surface management agency on portions of the mining plan area and adjacent areas, or exploration plan area, that may be adversely affected by lease related activities and which were not previously inventoried at such a level of intensity. The inventory shall be conducted by a qualified professional cultural resource specialist (i.e., archeologist, historian, or historical architect, as appropriate) approved by the authorized officer of the appropriate surface management agency, and a report of the inventory and recommendations for protecting any cultural resources identified shall be submitted to the Office of Surface Mining (OSM) and the authorized officer of the appropriate surface management agency (or only to the surface management agency if activities are associated with coal exploration outside an approved mining permit area). The lessee shall undertake measures, in accordance with instructions from OSM (or the surface management agency if activities are associated with coal exploration outside an approved mining permit area), to protect cultural resources on the leased land. The lessee shall not commence the surface-disturbing activities until permission to proceed is given by OSM (or the surface management agency if activities are associated with coal exploration outside of approved mining permit area.)

b. The lessee shall protect all known cultural resource properties within the leased area from lease related activities until the cultural resource mitigating measures can be implemented as part of an approved mining and reclamation plan or exploration plan.

c. The cost of conducting the inventory, preparing reports, and carrying out mitigating measures shall be borne by the lessee.

d. If cultural resources are discovered during operations under a lease, the lessee shall immediately bring them to the attention of OSM, the appropriate state regulatory agency, or the authorized officer of the surface managing agency if OSM is not available. The lessee shall not disturb such resources except as may be subsequently authorized by OSM, the state regulatory agency, or the authorized officer of the appropriate surface management agency. Within two (2) working days of notification, OSM, the state regulatory agency, or the authorized officer of the appropriate surface management agency will examine or have examined any cultural resources discovered and will determine if any action may be required to protect or preserve such discoveries. The cost of data recovery for cultural resources discovered during lease operations shall be borne by the surface managing agency unless otherwise specified by the authorized officer of the surface managing agency.

e. All cultural resources shall remain under the jurisdiction of the United States until ownership is determined under applicable law.

Paleontological Resources

a. Before undertaking any activities that may disturb the surface of any leased lands, the lessee shall contact the surface managing agency to determine whether the authorized officer will require the lessee to conduct a paleontological appraisal of the mining plan and adjacent areas, or exploration plan areas, that may be adversely affected by lease related activities. If the authorized officer determines that one is necessary, the paleontological appraisal shall be conducted by a qualified paleontologist approved by the authorized officer of the surface managing agency, using the published literature and, where appropriate, field appraisals for determining the possible existence of larger and more conspicuous fossils of significant scientific interest. A report of the appraisal and recommendations for protecting any larger and more conspicuous fossils of scientific interest on any leased lands so identified shall be submitted to the authorized officer (AO) of the surface managing agency (BLM, if the surface is privately owned). When necessary to protect and collect the larger and more conspicuous fossils of significant scientific interest on any leased lands, the lessee shall undertake the measures provided in the approval of the mining and reclamation plan or exploration plan.

b. The lessee shall not knowingly disturb, alter, destroy, or take any larger and more conspicuous fossils of significant scientific interest and shall protect all such fossils with the measures included in the approval of the mining and reclamation plan or exploration plan.

c. The lessee shall immediately bring any such fossils that might be altered or destroyed by his operation to the attention of OSM or the authorized officer of the surface managing agency, as appropriate. Operations may continue as long as the fossil specimen or specimens would not be seriously damaged or destroyed by the activity. OSM or the AO, as appropriate, shall evaluate or have evaluated such discoveries brought to his attention and, within five (5) working days, shall notify the lessee what action shall be taken with respect to such discoveries.

d. All such fossils of significant scientific interest shall remain under the jurisdiction of the United States until ownership is determined under applicable law. Copies of all paleontological resource data generated as a result of any lease term requirements will be provided to OSM or the AO of the surface managing agency, as appropriate.

e. The cost of any required salvage of such fossils shall be borne by the United States.

f. These conditions apply to all such fossils of significant scientific interest discovered within any lease whether discovered in the overburden or in the coal seam or seams.

Existing Rights

The lease is subject to valid existing rights. Any negotiations for relocation or displacement are between the lessee and the existing right holder, except such negotiations must be approved by the authorized officer of the surface managing agency.

Soils

a. It is required that the B horizon (where present) and soil that lies above it be segregated from the underlying material.

b. It is required that B horizon material be handled only when it is dry.

Survey Markers

The lessee must protect all survey monuments, witness corners, reference monuments, and bearing trees against destruction, obliteration, or damage during operations on the lease areas. If any monuments, corners, or accessories are destroyed, obliterated, or damaged by this operation, the lessee will hire an appropriate county surveyor or registered land surveyor to reestablish or restore them at the same locations. Surveying procedures must be carried out in accordance with the *Manual of Surveying Instruction for the Survey of Public Lands in the United States*, and the surveyor will record the survey in the appropriate county records and send a copy to the authorized officer.

Appendix C

MEASURES FOR WYOMING TRACTS

Youngs Creek

1. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the event that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

2. Youngs Creek and Ash Creek have been preliminarily identified as alluvial valley floors where they pass through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVFs will be unsuitable for mining. Floodplains associated with these streams must be protected and provided for in accordance with the law and current regulations.

3. No surface occupancy is permitted within 100 feet of the right-of-way boundary for Wyoming Highway 338, which passes through the east side of the tract. This measure will become void in the event that the highway is relocated off the tract at a later date.

4. Land within the buffer area around the existing prairie falcon and bald eagle nesting sites is classified as unsuitable for coal mining. Land included within the Youngs Creek tract and within the buffer area is described as follows:

   T58N, R83W
   Section 19: Lots 1, 2, 3, 4, 5, 6, N½NE¼SW¼, N½NW¼SE¼, S½NE¼, SE¼NW¼
   Section 20: Lots 3, 4, SW¼NW¼
   Section 31: Lot 2

   T58N, R84W
   Section 24: Lot 1, E½SE¼NE¼, NE¼NE¼SE¼

5. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for burrowing owl and Lewis' woodpecker, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the permit application package. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of burrowing owls and Lewis' woodpeckers will not decline in the lease area.

Appendix C

Hidden Water

1. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the event that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

2. Slater Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Slater Creek must be protected and provided for in accordance with the law and current regulations.

3. Land within the buffer area around the golden eagle nesting sites is classified as unsuitable for coal mining. Land included within the Hidden Water tract and within the buffer area is described as follows.

   T57N, R84W
   Section 2: Lot 4
   Section 3: Lots 1, 2, 3, NE¼NE¼SW¼

4. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habat for burrowing owl and Lewis' woodpecker, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of burrowing owls and Lewis' woodpeckers will not decline in the lease area.

Hay Creek

1. Hay Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Hay Creek must be protected and provided for in accordance with the law and current regulations.

2. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for burrowing owl and prairie falcon, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of burrowing owls and prairie falcons will not decline in the lease area.

3. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the even that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

Calf Creek

1. Calf Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Calf Creek must be protected and provided for in accordance with the law and current regulations.

2. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk and burrowing owl, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit

application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks and burrowing owls will not decline in the lease area.

3. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the even that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

Mount Logan

1. Portions of the Belle Fourche River passing near or through the Mount Logan tract have been identified as possible alluvial valley floors. AVFs may only be mined subject to mitigating measures for AVF protection that are made a part of an approved mine plan. Determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development.

2. No surface occupancy is permitted within 100 feet of the right-of-way boundary for the Burlington Northern railroad, which passes through the tract.

3. One pair of nesting golden eagles has recently been moved onto the Mount Logan tract from an adjoining coal lease. A buffer area around this nest site will not be classified as unsuitable pending continued activation of the existing mitigation plan.U.S. Fish and Wildlife Service and the lessee should continue to monitor this situation and formulate modifications to the mitigation plan.

   The pair of golden eagles previously nesting on the ground in T46N, R71W, Section 9, have constructed a tree nest in Section 10 of the same township and range. Land within the buffer area around the golden eagle nesting sites is classified unsuitable for coal mining. Land within the Mount Logan tract and within the buffer area is described as follows:

   T46N, R71W
   Section 10: SW¼NW¼, E½NW¼SW¼, NE¼SW¼, NW¼SE¼, W½SE¼SE¼, SE¼SE¼SE¼.

4. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk, which is a migratory bird of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of this species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for this species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of this species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious im-

pacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks will not decline in the lease area.

Kintz Creek

1. No surface occupancy is allowed within the Kintz Cemetery or a 100-foot buffer area adjoining the cemetery. The location of the cemetery is T45N, R70W, Section 20, NE¼NE¼SE¼.

2. Kintz Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Kintz Creek must be protected and provided for in accordance with the law and current regulations.

3. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawks and golden eagles, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for this species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of this species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks and golden eagles will not decline in the lease area.

Donkey Creek

1. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk, which is a migratory bird of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of this species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for this species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of this species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks will not decline in the lease area.

Appendix C

Timber Creek

1. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk, which is a migratory bird of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of this species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for this species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of this species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the BLM, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks will not decline in the lease area.

Porcupine

1. The buffer areas for golden eagle nests that are near the Porcupine tract fluctuate because the pair of golden eagles has nested in three different locations in different years. Land within the buffer areas will not be classified as unsuitable pending submission of an acceptable mitigation plan by the lessee and approval of such a plan by the Wyoming Game and Fish Department and the Fish and Wildlife Service.

2. Porcupine Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Wyoming and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Porcupine Creek must be protected and provided for in accordance with the law and current regulations.

3. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the even that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the FS.

   The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

Ridgerunner

1. The lessee will be required to monitor and inventory the lease area for establishment of potential black-footed ferret habitat (i.e., prairie dog towns) and, if any such habitat is found, to conduct ferret inventories, all in accordance with the guidelines below. In the event that ferret occurrence is identified, the lessee will be required to adhere to any

suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

The following black-footed ferret inventory guidelines will be followed. Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments must be surveyed for prairie dog towns before the project is approved. If prairie dog towns are found on the proposed site, colonies must be mapped on topographic maps and each colony surveyed using recommended black-footed ferret survey procedures. Ferret searches must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move onto the area during the period between completion of surveys and the start of construction. Where project disturbance takes place over a long period of time, such as on a coal site, additional surveys for black-footed ferrets are recommended.

2. Land within the buffer area around the golden eagle nest site is classified as unsuitable pending submission of an acceptable mitigation plan. Land included within the Ridgerunner tract and within the buffer area is described as follows.

   T41N, R71W
   Section 14: SW¼SW¼NE¼, SE¼NW¼, S½NE¼NW¼

3. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk and mountain plover, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Forest Service.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the FS, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks and mountain plovers will not decline in the lease area.

Thundercloud

1. The lease area or land adjacent to the lease area is known to contain, or has a high likelihood of containing, important habitat for ferruginous hawk and burrowing owl, which are migratory birds of high federal interest. The lessee must survey the leased area and adjacent lands within ½ mile of the lease area for occurrence of these species and for important habitat such as nesting sites, brooding areas, or staging areas essential for their maintenance.

   If important habitat for these species is identified, the lessee must develop a habitat recovery and replacement plan for protection or enhancement of populations of these species affected by habitat loss or displacement due to mine-related activities. The plan must be developed in consultation with, and approved by, the Forest Service, the U. S. Fish and Wildlife Service, the Office of Surface Mining, and the state of Wyoming.

   The plan may be submitted before or concurrently with the filing of the mine permit application. However, because serious impacts can result from an inadequate plan, a minimum of 120 days must be allowed for the FS, the FWS, the OSM, and the state of Wyoming to review the plan in order to resolve any conflicts or problem areas therein.

   The final habitat recovery and replacement plan must indicate the methods that the lessee will employ to ensure that the productivity and species diversity of ferruginous hawks and burrowing owls will not decline in the lease area.

MEASURES FOR MONTANA TRACTS

Ashland (Decker-Birney)

1. Otter Creek, Home Creek, and Threemile Creek have been preliminarily identified as alluvial valley floors where they pass through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Montana and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVFs will be unsuitable for mining. Floodplains associated with these creeks must be protected and provided for in accordance with the law and current regulations.

Northwest Otter Creek

1. Otter Creek has been preliminarily identified as an alluvial valley floor where it passes through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, extent, significance, and required mitigating measures (if possible) is made by the state of Montana and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVF will be unsuitable for mining. Floodplains associated with Otter Creek must be protected and provided for in accordance with the law and current regulations.

Hanging Woman Creek

1. The lessee will be required to monitor and inventory all prairie dog towns in the lease area for black-footed ferrets. Colonies must be mapped on topographic maps, and each colony müst be surveyed using black-footed ferret survey procedures recommended by the U. S. Fish and Wildlife Service. Ferret surveys must be scheduled as close to construction as is reasonable to minimize the possibility of missing ferrets that might move into an area during the period between completion of surveys and the start land disturbance. Ferret surveys are considered valid for one year. In the event that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.
2. If the mitigation plan covering the loss of two sage grouse leks, approved in 1982, is allowed to lapse, the leks and surrounding habitat will be designated unsuitable for mining unless another mitigation plan is developed and agreed upon by the state of Montana and the lessee.
3. Hanging Woman Creek, Trail Creek, and the East Fork of Trail Creek have been preliminarily identified as alluvial valley floors where they pass through the tract. AVFs may only be mined subject tomitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Montana and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVFs will be unsuitable for mining.

Mud Springs

1. The tract contains one occupied dwelling, an operating schoolhouse, and approximately 4 miles of a county road. The area within a 300-foot perimeter of the dwelling and the schoolhouse cannot be mined unless an agreement is reached between the affected parties and the lessee. The county road right-of-way, plus a buffer zone extending 100 feet outside of each edge of it, cannot be mined unless the Powder River County Commissioners and the lessee agree to a relocation plan.
2. The lessee will be required to monitor and inventory all prairie dog towns in the lease area for black-footed ferrets. Colonies must be mapped on topographic maps, and each colony must be surveyed using black-footed ferret survey procedures recommended by the U. S. Fish and Wildlife Service. Ferret surveys must be scheduled as close to con-

struction as is reasonable to minimize the possibility of missing ferrets that might move into an area during the period between completion of surveys and the start land disturbance. Ferret surveys are considered valid for one year. In the event that ferret occurrence is identified, the lessee will be required to adhere to any suggested modifications in the mining operation provided by the Fish and Wildlife Service and the BLM.

3. Mud Springs and Bear creeks have been preliminarily identified as alluvial valley floors where they pass through the tract. AVFs may only be mined subject to mitigating measures for alluvial valley floor protection that are made a part of an approved mine plan. Final determination of existence, significance, and required mitigating measures (if possible) is made by the state of Montana and the Office of Surface Mining at the mine plan approval and permitting stage of development. If mitigation is not possible, the delineated AVFs will be unsuitable for mining.

Downey Coulee

1. Any successful bidder must show, to the satisfaction of the state of Montana, that the mitigation plan for the buffer around the identified sharp-tailed grouse lek on the Downey Coulee tract will ensure that all or stipulated methods of mining will not have significant long-term impact on the areawide population of this species. Reclamation and management of reclamation areas must also provide suitable post-mining habitat for sharp-tailed grouse. If the state of Montana does not agree that mitigation and reclamation are acceptable, the subject buffer zone will be dropped from the lease as unsuitable at the mine plan stage. This stipulation does not preclude the Montana Department of State Lands from enforcing its selective denial and unsuitability process.

Colstrip Area C

1. Approximately 2¼ miles of a county road lie within the tract. The road right-of-way, plus a buffer zone extending 100 feet outside each edge of the right-of-way, cannot be mined unless the lessee and the Rosebud County Commissioners agree to a relocation plan. The county road is in portions of Section 32, T2N, R40E, and Section 6, T1N, R40E.

2. Any successful bidder must show, to the satisfaction of the state of Montana, that the mitigation plan for the buffer around the identified sharp-tailed grouse lek on the Colstrip C tract will ensure that all or stipulated methods of mining will not have significant long-term impacts on the areawide population of this species. Reclamation and management of reclamation areas must also provide suitable post-mining habitat for sharp-tailed grouse. If the state of Montana does not agree that mitigation and reclamation are acceptable, the subject lek will be dropped from the lease as unsuitable at the mine plan stage. This stipulation does not preclude the Montana Department of State Lands from enforcing its selective denial and unsuitability process.

Wolf Mountain Maintenance

1. Approximately ¾ mile of Montana State Route 314 lies across the southeast corner of the tract in Section 20, T9S, R40E. The road right-of-way, plus a buffer zone extending 100 feet outside each edge of the right-of-way, cannot be mined unless the lessee and the state of Montana agree to a relocation plan.

2. Squirrel Creek has been identified as an alluvial valley floor by the state of Montana and the Office of Surface Mining. The portions so identified are unsuitable for mining.

North Decker I

1. Approximately two miles of Montana State Route 314 and ½ mile of a railroad spur lie within the North Decker I tract. The portion of the highway right-of-way that crosses private surface, plus a buffer of 100 feet outside each edge of the right-of-way, is unsuitable for mining. For the portion of the highway on public surface, only the area within the right-of-way is unsuitable for mining. Mining can be allowed in this road right-of-way only if an agreement is reached between the lessee and the state of Montana. The area within the railroad right-of-way that crosses public surface is also unsuitable for mining unless the lessee reaches an agreement with the railroad owner.

Appendix C

Montana State Route 314 lies in portions of Section 34, T8S, R40E, and Section 3, T9S, R40E. The railroad crosses public land in the SE¼SW¼ of Section 34, T8S, R40E, and the NW¼SE¼ of Section 3, T9S, R40E.

APPENDIX D: VISUAL MANAGEMENT SYSTEMS

FOREST SERVICE VISUAL MANAGEMENT SYSTEM

Variety Classes

Variety classes are based on the premise that the more variety there is in the landscape, the higher the scenic quality is. The three variety classes are as follows:

Class A (distinctive) areas are areas in which features (landforms, vegetation, water, color) are not common in the character type or are unusual or outstanding.

Class B (common) areas are those in which features contain variety in form, line, color, and texture but are fairly common within the character type and are not unusual or outstanding.

Class C (minimal) areas are those in which features are common to the character type and contain little variety.

Quality Objectives

Quality objectives determine the visual management of the landscape. Each objective determines the extent to which the basic elements of the landscape will be modified or altered. The five possible objectives are as follows:

Preservation (P) is applied to special areas such as wilderness or primitive areas or to some management units that are unique but for which special classification is not justified. The only management activities allowed in "P" areas are low visual impact recreation facilities.

The retention (R) objective allows for activities that repeat form, line, color, and texture but are not evident within the landscape.

The partial retention (PR) objective allows for activities that repeat form, line, color, and texture but remain visually subordinate to the characteristic landscape.

The modification (M) objective allows for activities that visually dominate the landscape, but they must repeat or be compatible with the natural characteristics of the landscape.

The maximum modification (MM) objective allows management activities to dominate the landscape, but they must repeat visual characteristics when viewed as background. When viewed as foreground or middleground, they may appear not to borrow completely from the natural characteristics. Alterations may appear to be out of scale or may contain in harmonious details when viewed as foreground or middleground.

More detailed information on the Forest Service's visual management system appears in a publication available from the Government Printing Office, Washington (USDA, FS 1979a).

BLM VISUAL RESOURCE MANAGEMENT

Scenic quality classes are defined by a system rating seven key factors: landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modification. There are three scenic quality classes.

Class A areas are those that combine the most outstanding characteristics of each rating factor.

Class B areas are areas in which there is a combination of some outstanding features and some which are fairly common to the physiographic region.

Class C areas are those in which the features are fairly common to the physiographic region.

Management classes determine the amount of modification allowed to the basic elements of the landscape. There are five classes.

Class I: Very limited management activity is allowed. Created contrasts must not attract attention. This classification applies to wilderness areas, wild and scenic rivers, etc.

Class II: Changes in any of the basic elements caused by management activity should not be evident in the characteristic landscape. Contrasts are seen but must not attract attention.

Class III: Contrasts to the basic elements caused by a management activity are evident but should remain subordinate to the existing landscape.

Class IV: Any contrast attracts attention and is a dominant feature of the landscape in terms of scale, but it should repeat the form, line, color, and texture of the characteristic landscape.

CLass V: The Class V classification is applied to areas where the natural character of the landscape has been disturbed to a point where

rehabilitation is needed to bring it up to one of the four other classifications. The classification also applies to areas where there is potential to increase the landscape's visual quality. It is often used as an interim classification until objectives of another class can be reached.

APPENDIX E: AIR QUALITY

AIR QUALITY LAWS

Federal law for the control of air pollution has been evolving for more than a decade. Congress passed the Air Quality Act, the first clean air legislation, in 1967. This was followed by the Clean Air Acts of 1970 and 1977, in which Congress reaffirmed its determination to cope with the growing national problem of air pollution.

The EPA, which has the major federal role in ensuring compliance with the requirements of the Clean Air Acts, issues national air quality regulations, approves and oversees state implementation plans, and conducts major enforcement programs.

State air pollution control agencies have the primary responsibility for carrying out the acts on non-Indian lands through the development and execution of an acceptable state implementation plan, which must provide for the attainment and maintenance of air quality standards within the state. The states of Wyoming and Montana both have EPA-approved state implementation plans.

The EPA has jurisdiction over the air quality of Indian lands, since it has not been given the authority to delegate that responsibility to the states or the tribes.

To enforce the NAAQS requirements described in chapter 3, every part of the country has been classified as one of the following: (1) an "attainment" area, where air quality levels are better than the NAAQS limits; (2) a "nonattainable" area, where pollution levels in the air exceed the NAAQS limits; or (3) an "unclassified" area, where there is insufficient data for classification. Nonattainment areas, typically urban, are subject to regulatory requirements designed to bring area pollution levels down to the NAAQS ceiling.

The PSD program, which is designed to protect air quality from significant deterioration in areas that meet the NAAQS, allows specific increments above existing pollution levels. PSD requirements are enforced by a complex preconstruction permit system for major new stationary pollution sources and for major modification to existing sources. The PSD permit process involves the study of existing air quality, requirements for the use of best available pollution control technology, and various impact studies to ensure that PSD standards (established thus far only for particulate matter and sulfur dioxide) will not be exceeded by allowing pollution sources to operate in the area.

If the PSD source is to be located near a Class I area, it may not exceed the PSD standards or have any adverse impact on the air quality-related values of the Class I area, including visibility. Visibility is protected both within the Class I area itself and with respect to "integral vistas" extending outside the Class I boundary.

If a proposed PSD source cannot satisfy the maxiumum allowable deterioration increments for a mandatory Class I area, it may have an opportunity to seek a waiver or a variance.

All pollutant sources must be evaluated to determine PSD applicability. Coal mines are subject to a new source review of PSD only if nonfugitive emissions of any regulated pollutant exceed 250 tons per year after application of controls. Surface coal mines will seldom have the potential to exceed that level. This essentially eliminates the proposed lease tracts from the detailed PSD review process. However, end-use facilities such as coal-fired power plants like the proposed Mud Springs power plant are subject to PSD review and "new source" performance standards.

Air pollution also may result in significant visibility reductions. The effects of such reductions include not only the aesthetic degradation of the environment but also economic burdens on society.

METHODOLOGY USED IN ANALYSIS

Advanced computer modeling was used to evaluate the cumulative regional effects of ground-level concentrations of major air contaminants that could be expected under each alternative. The modeling study included determination of worst-case ground-level concentrations of the major air pollutants named above and sulfates, a secondary pollutant deriving from sulfur dioxide.

The resulting projections of pollutant concentrations were compared with state and federal air quality standards to determine the extent to which the standards could potentially be violated under each alternative. Incremental pollutant concentrations also were compared with increments allowable under the regulations for prevention of significant deterioration of air quality to determine the extent to which those regulations could be violated. The effects of air pollutants on visibility also were modeled.

Appendix E: Air Quality

A technical report prepared by PEDCo Environmental, Inc., discusses the models, meteorological data, receptor array, and vistas used in the analysis. It also describes characterization of the source of emission, including emission factors, control devices, and effeciencies. Also included are the major point sources and are sources that would be affected by mines and end-use facilities included in the alternatives.

KEY TO MINES SHOWN ON AIR QUALITY FIGURES

[1] = BLM Tract Included in Alternatives

1. Ridgerunner
2. Porcupine
3. Thundercloud
4. Kintz Creek
5. Mount Logan
6. Timber Creek
7. Donkey Creek
8. Hay Creek
9. Calf Creek
10. Hidden Water
11. Youngs Creek
12. Wolf Mountain Maintenance
13. North Decker II
14. North Decker I
15. Spring Creek
16. Northwest Otter Creek
17. Ashland (Decker-Birney)
18. Downee Coulee
19. Colstrip Maintenance
20. Colstrip C
21. Hanging Woman Creek
22. Mud Springs

(1) = Existing or Committed Operation

1. Antelope
2. North Antelope
3. North Rochelle
4. Black Thunder
5. Jacobs Ranch
6. Keeline
7. WYMO Fuels
8. Coal Creek
9. Cordero
10. Caballo Rojo
11. Pronghorn
12. Belle Ayr
13. Caballo
14. Rocky Butte
15. Wyodak
16. East Gillette
17. East Gillette No. 16
18. South Rawhide
19. Fort Union
20. Dry Fork
21. Eagle Butte
22. ETSI
23. North Rawhide
24. Buckskin
25. Big Horn
26. Ash Creek
27. East Decker
28. West Decker
29. North Decker
30. Spring Creek
31. Coal Creek
32. Big Sky
33. Colstrip A and B
34. Colstrip D

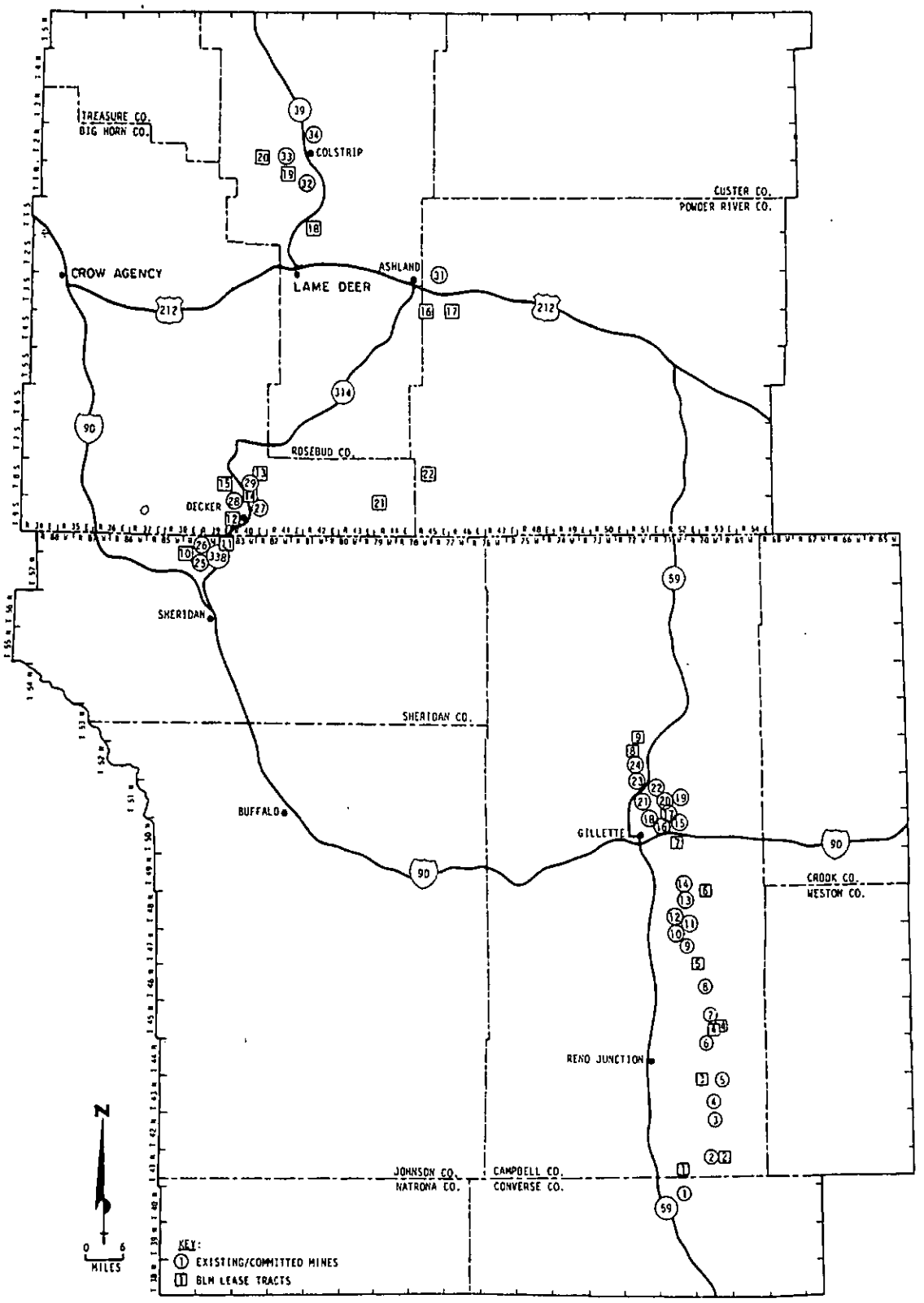

Figure 1. Regional Study Area

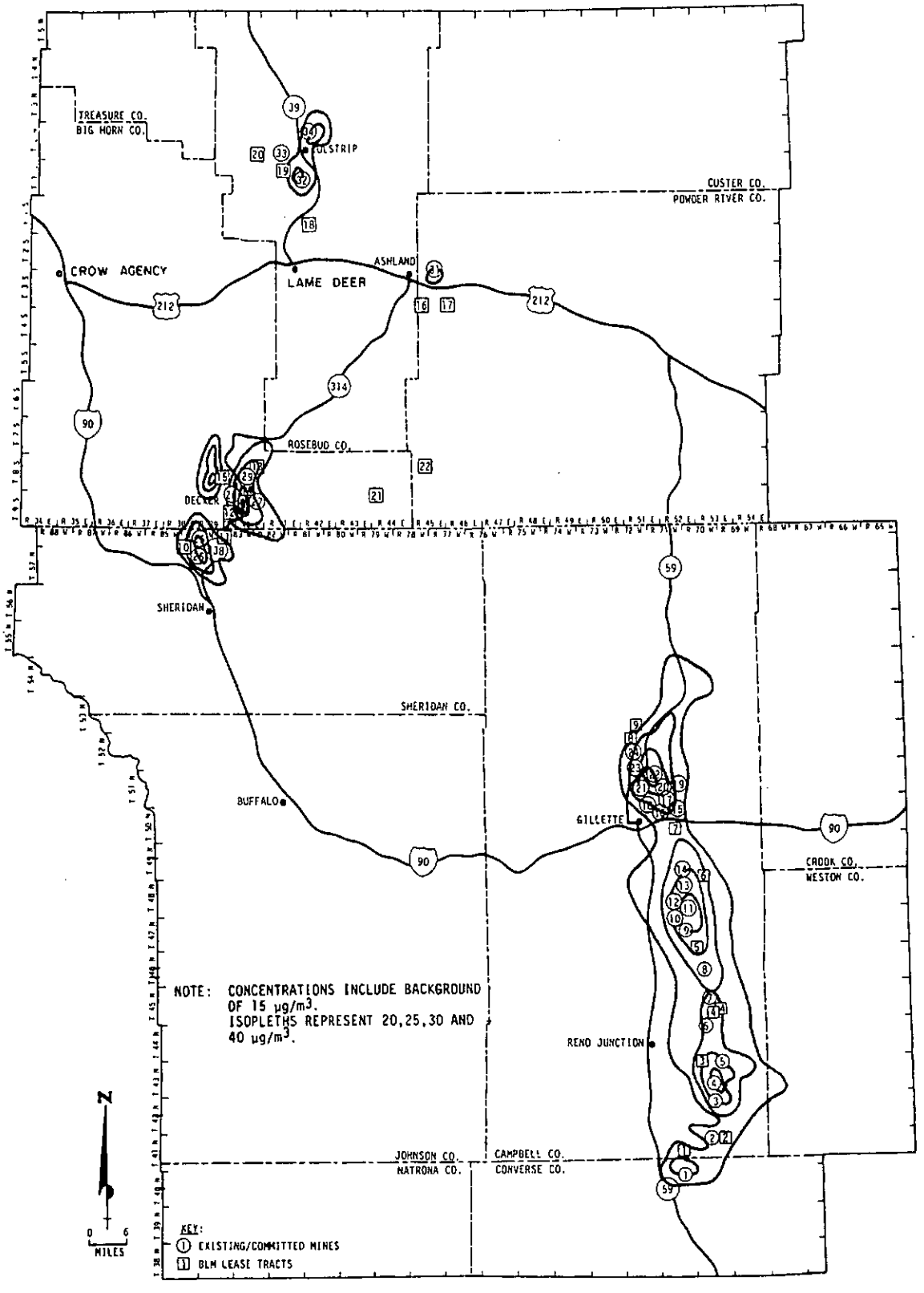

Figure 2. 1995 annual TSP concentrations ($\mu g/m^3$), Alternative 1.

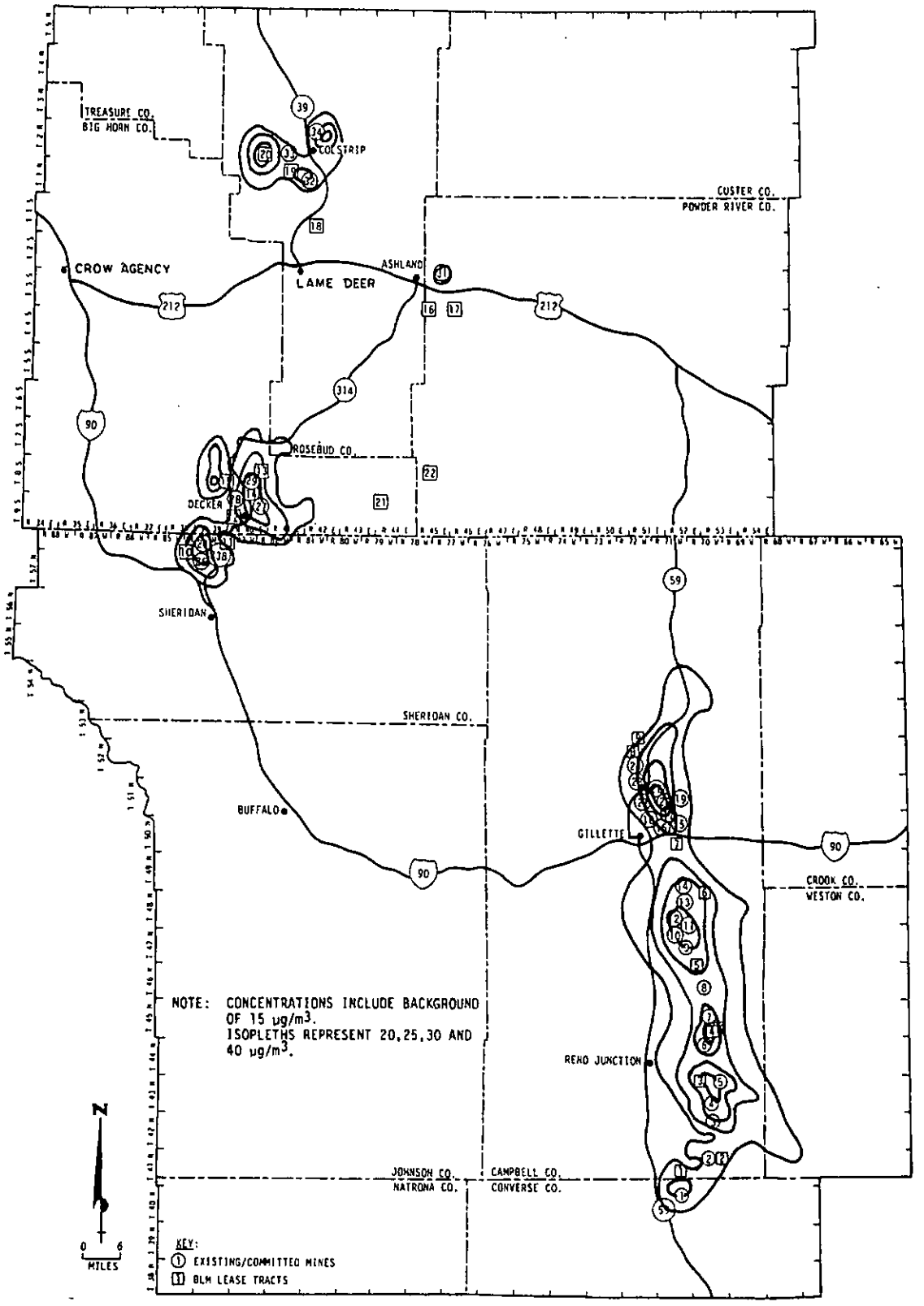

Figure 3. 1995 annual TSP concentrations ($\mu g/m^3$), Alternative 2.

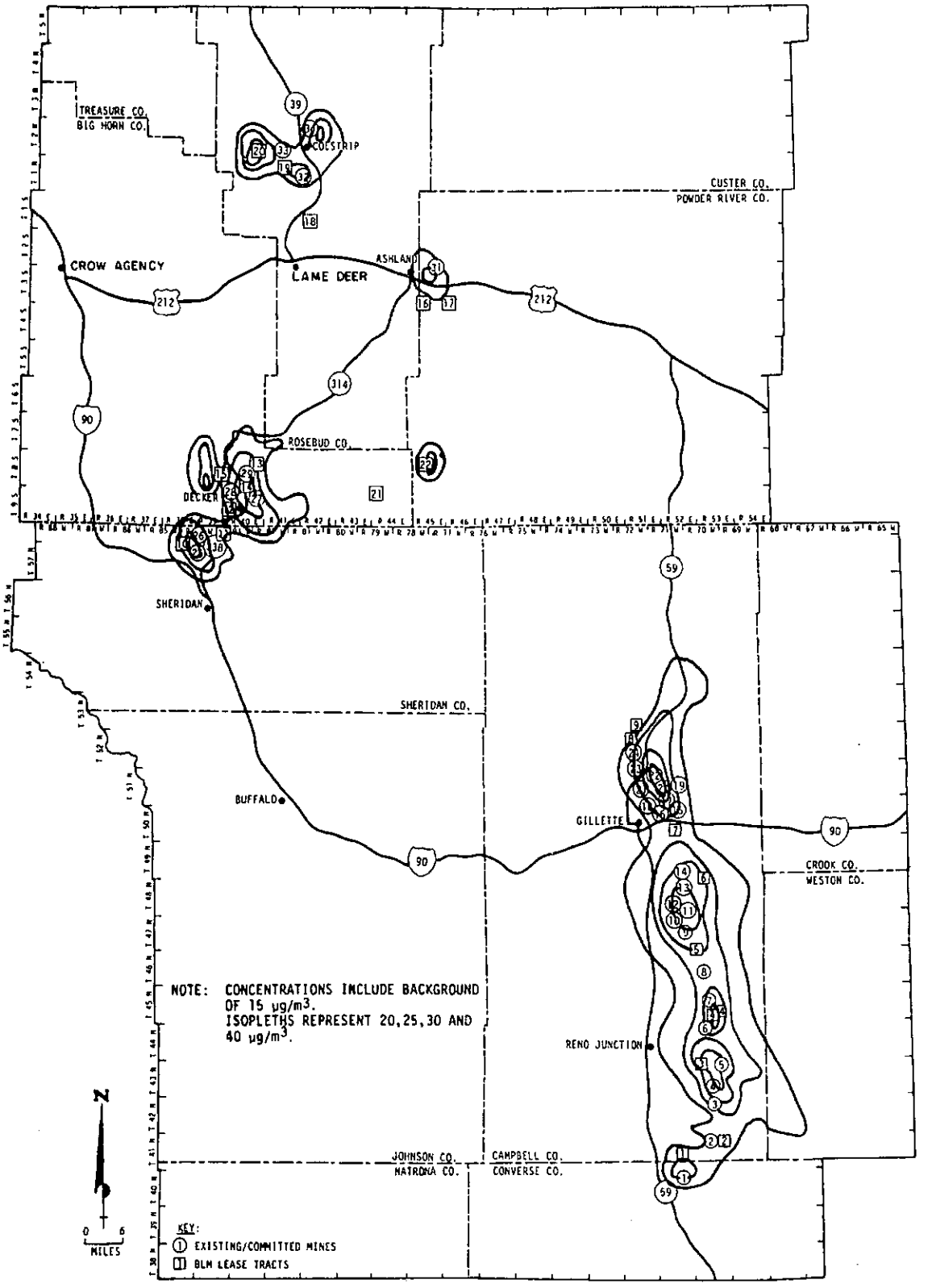

Figure 4. 1995 annual TSP concentrations ($\mu g/m^3$), Alternative 3.

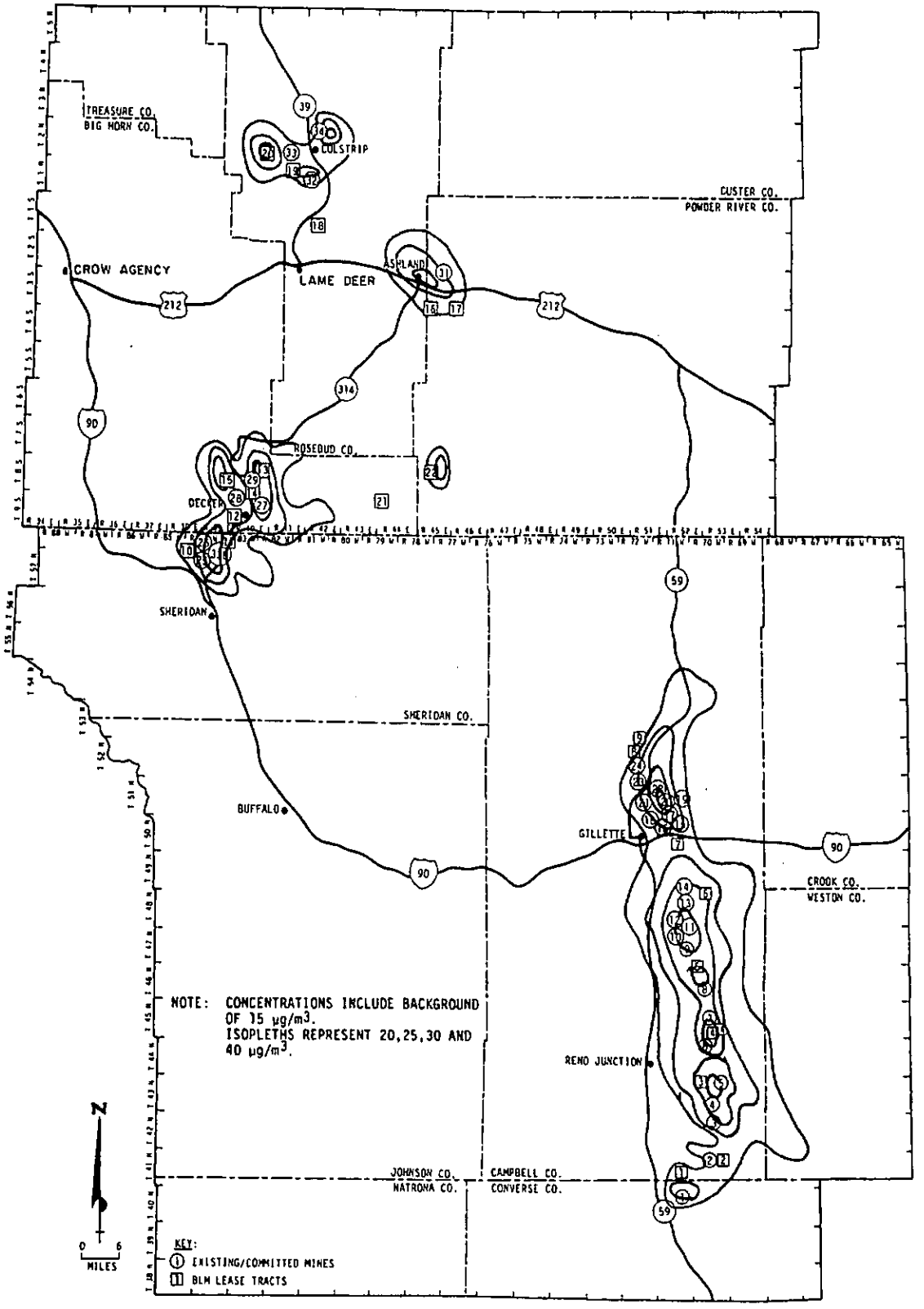

Figure 5. 1995 annual TSP concentrations (µg/m^3), Alternative 4.

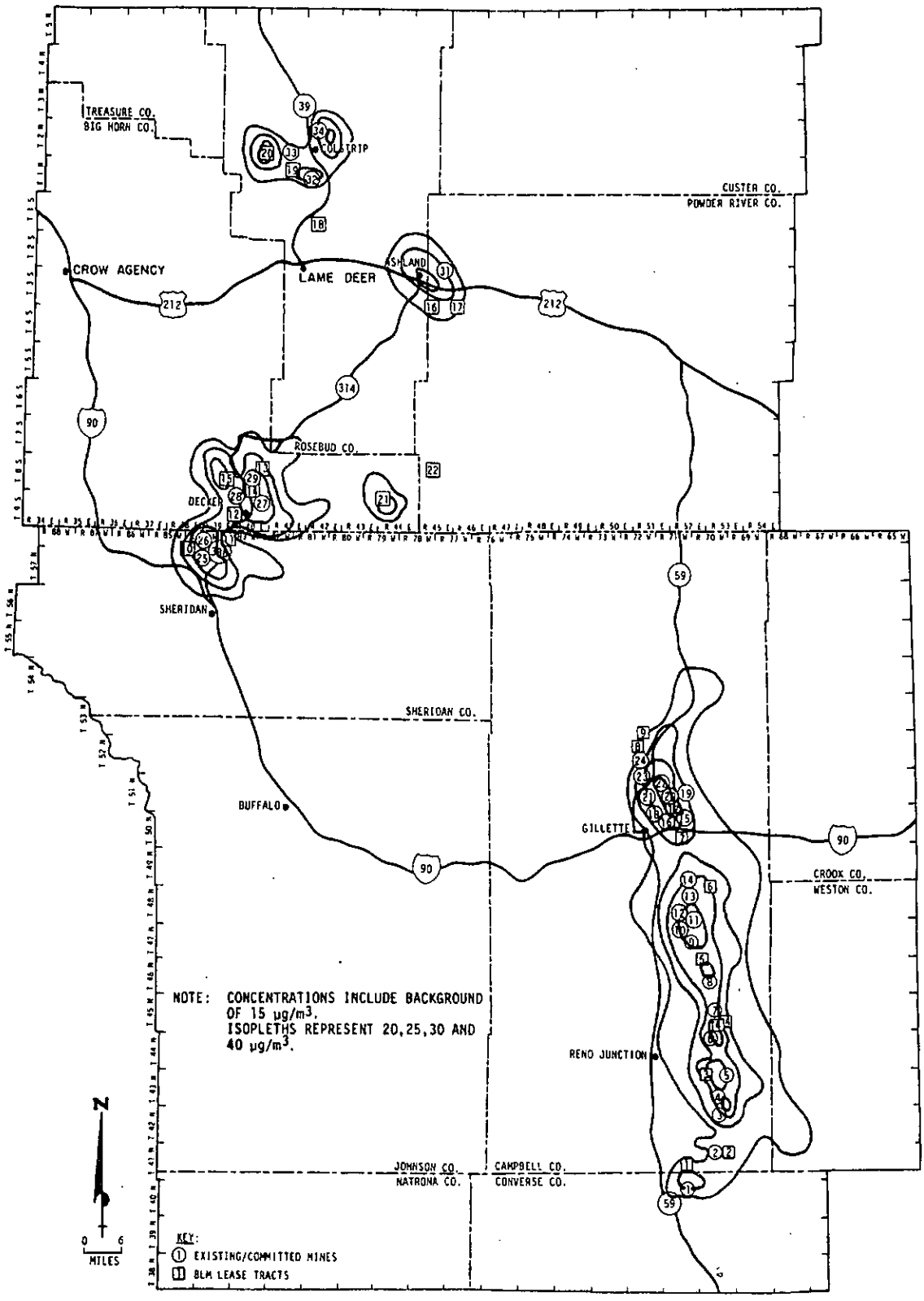

Figure 6. 1995 annual TSP concentrations ($\mu g/m^3$), Alternative 5.

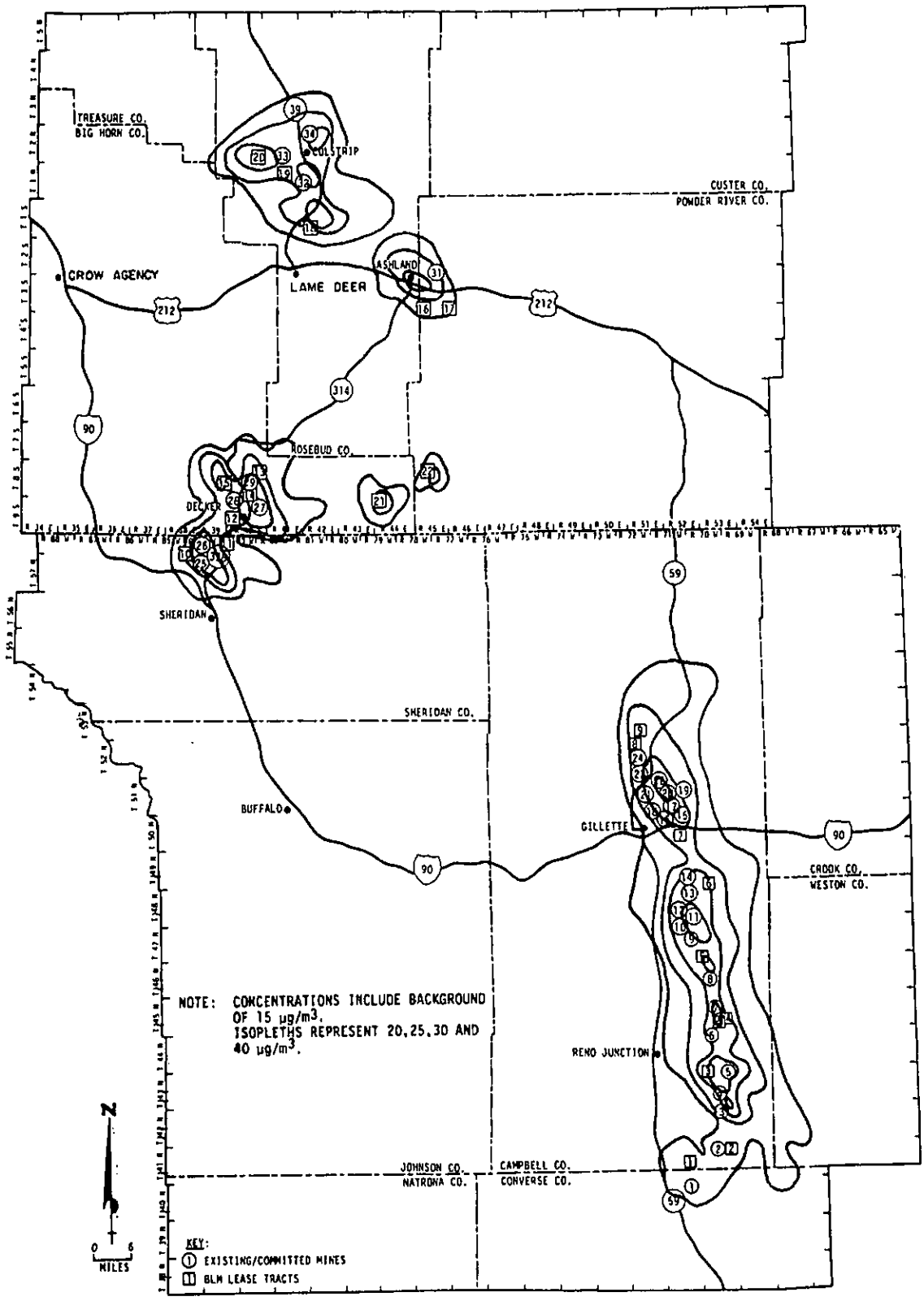

Figure 7. 1995 annual TSP concentrations (µg/m^3), Alternative 6.

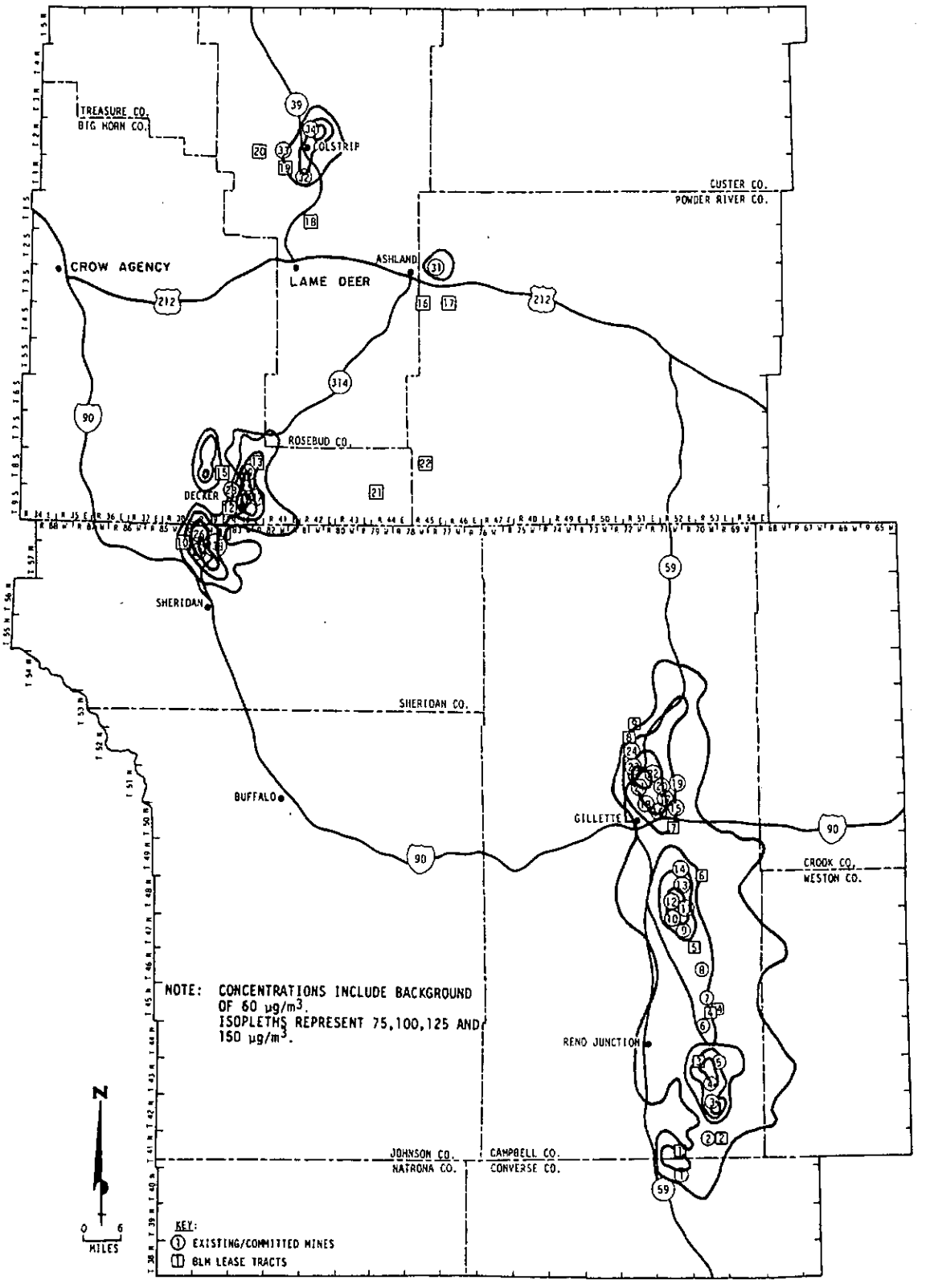

Figure 8. 1995 second-maximum 24-hour TSP concentrations ($\mu g/m^3$), Alternative 1.

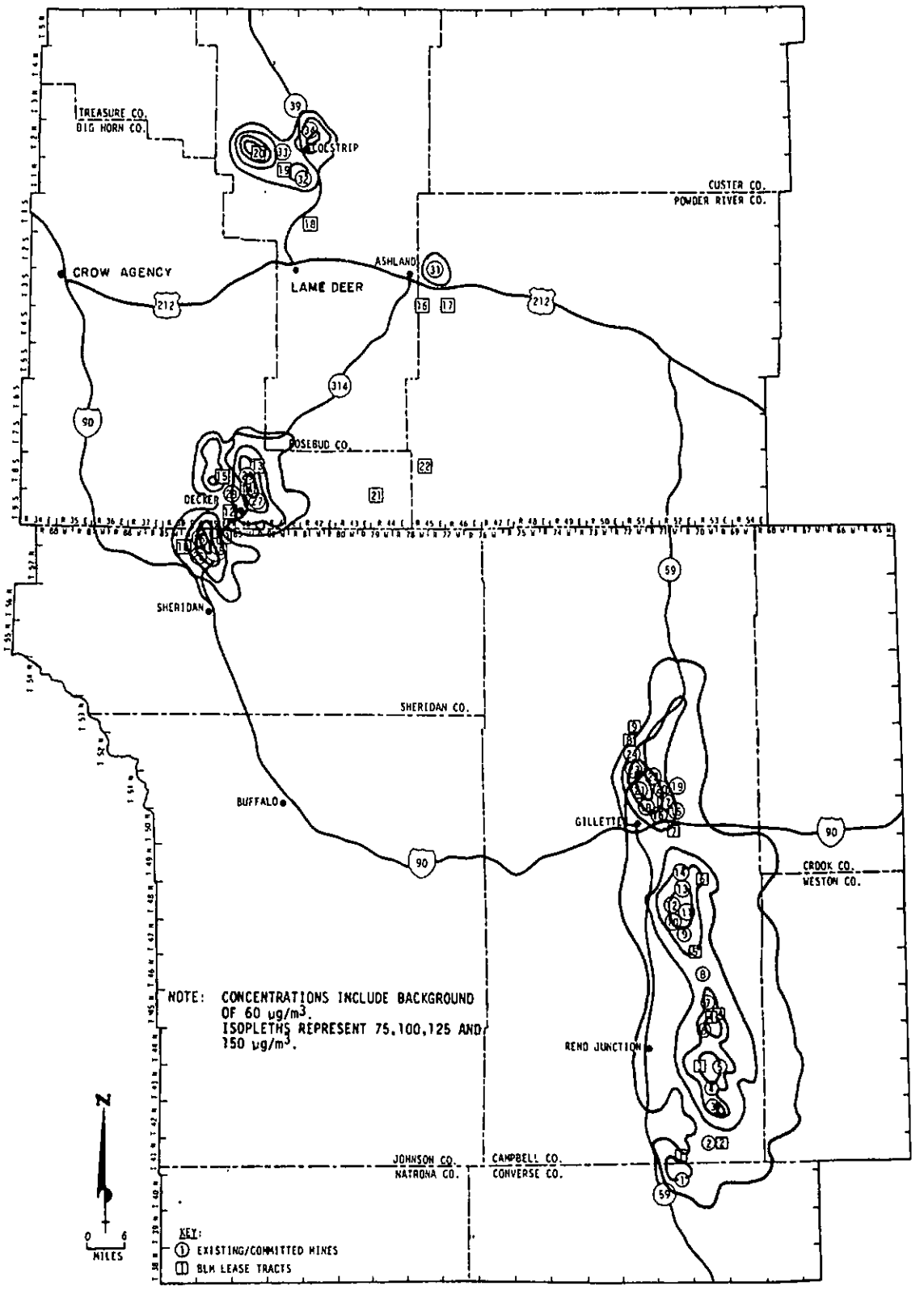

Figure 9. 1995 second-maximum 24-hour TSP concentrations ($\mu g/m^3$), Alternative 2.

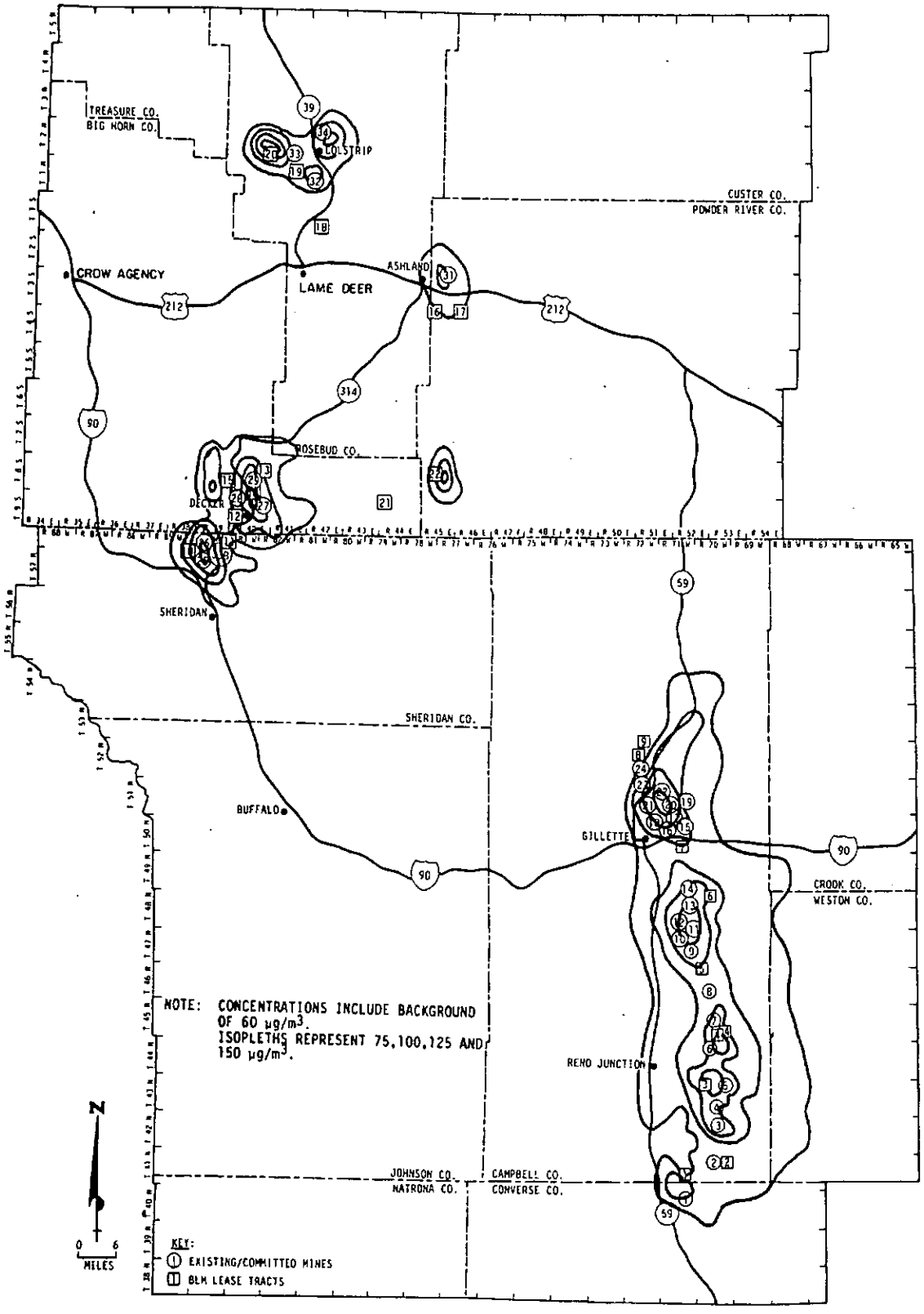

Figure 10. 1995 second-maximum 24-hour TSP concentrations ($\mu g/m^3$), Alternative 3.

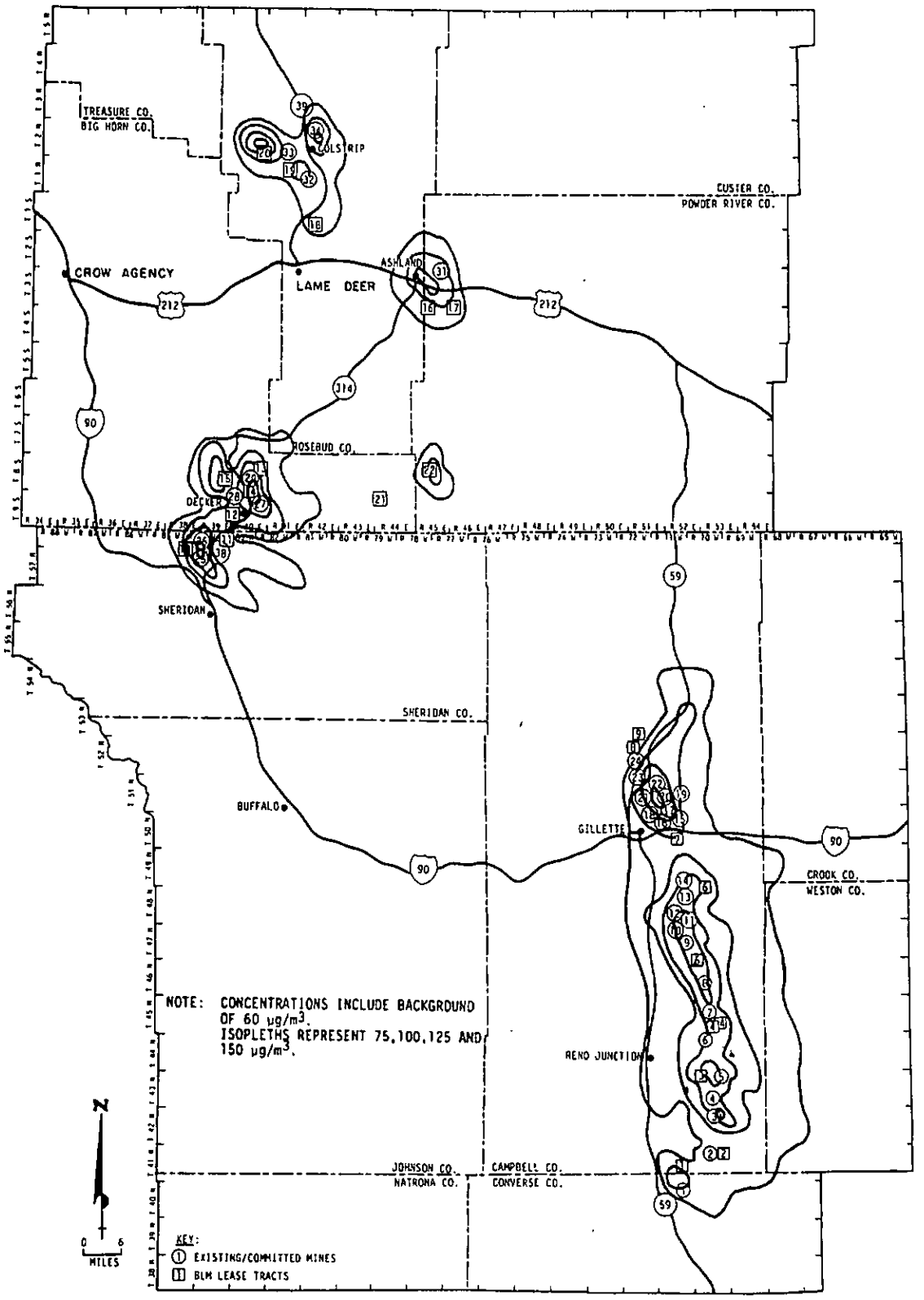

Figure 11. 1995 second-maximum 24-hour TSP concentrations ($\mu g/m^3$), Alternative 4.

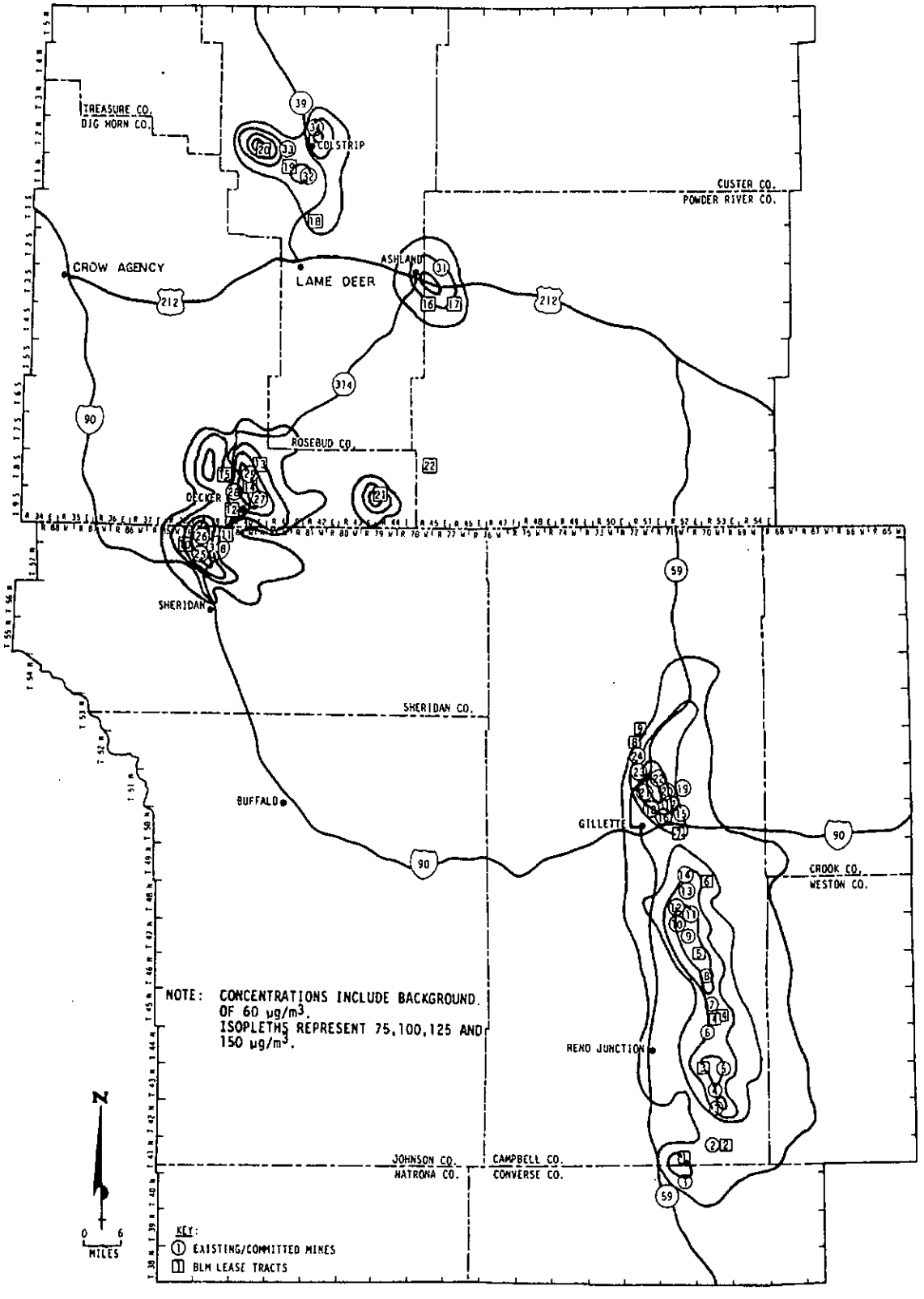

Figure 12. 1995 second-maximum 24-hour TSP concentrations ($\mu g/m^3$), Alternative 5.

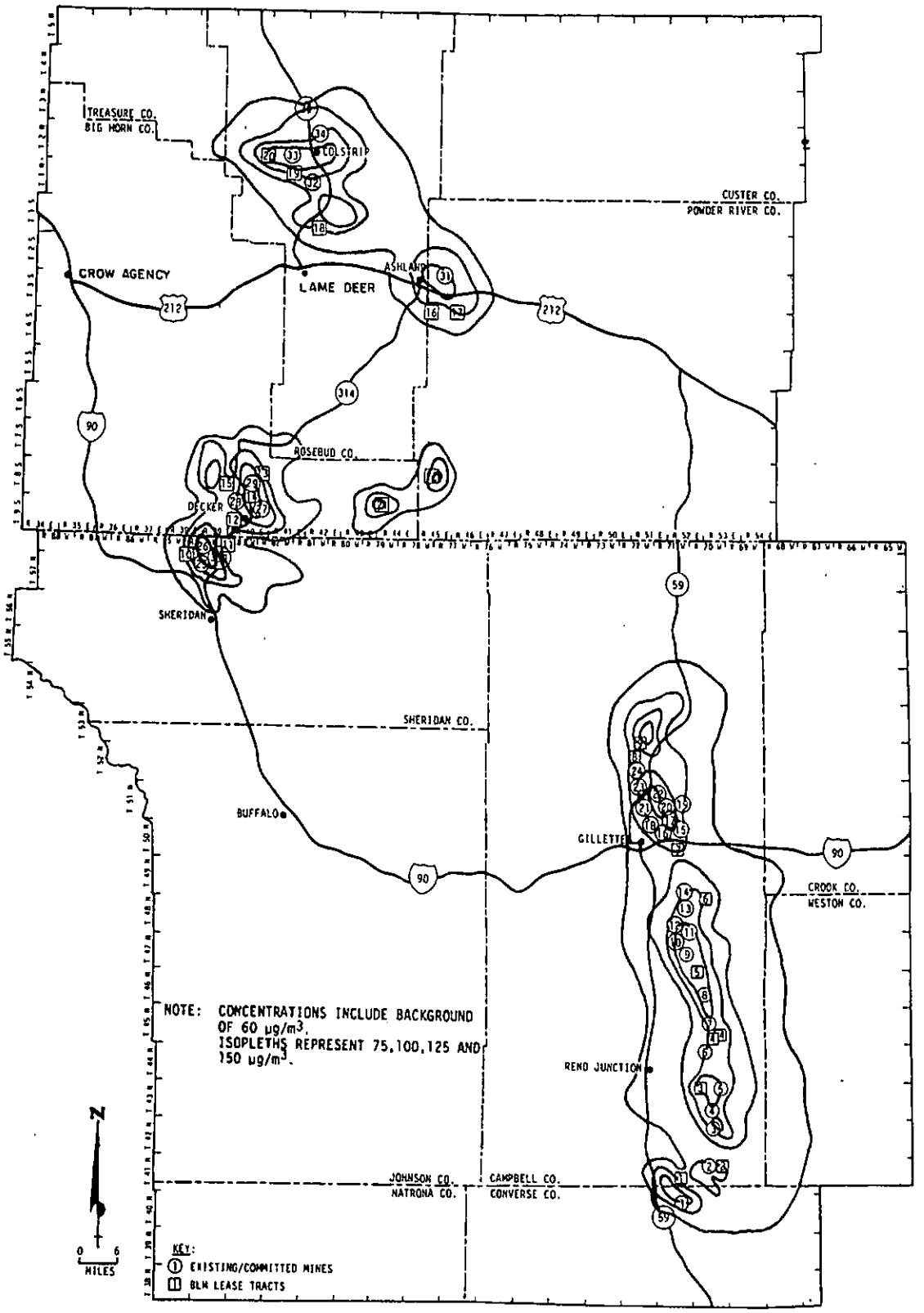

Figure 13. 1995 second-maximum 24-hour TSP concentrations ($\mu g/m^3$), Alternative 6.

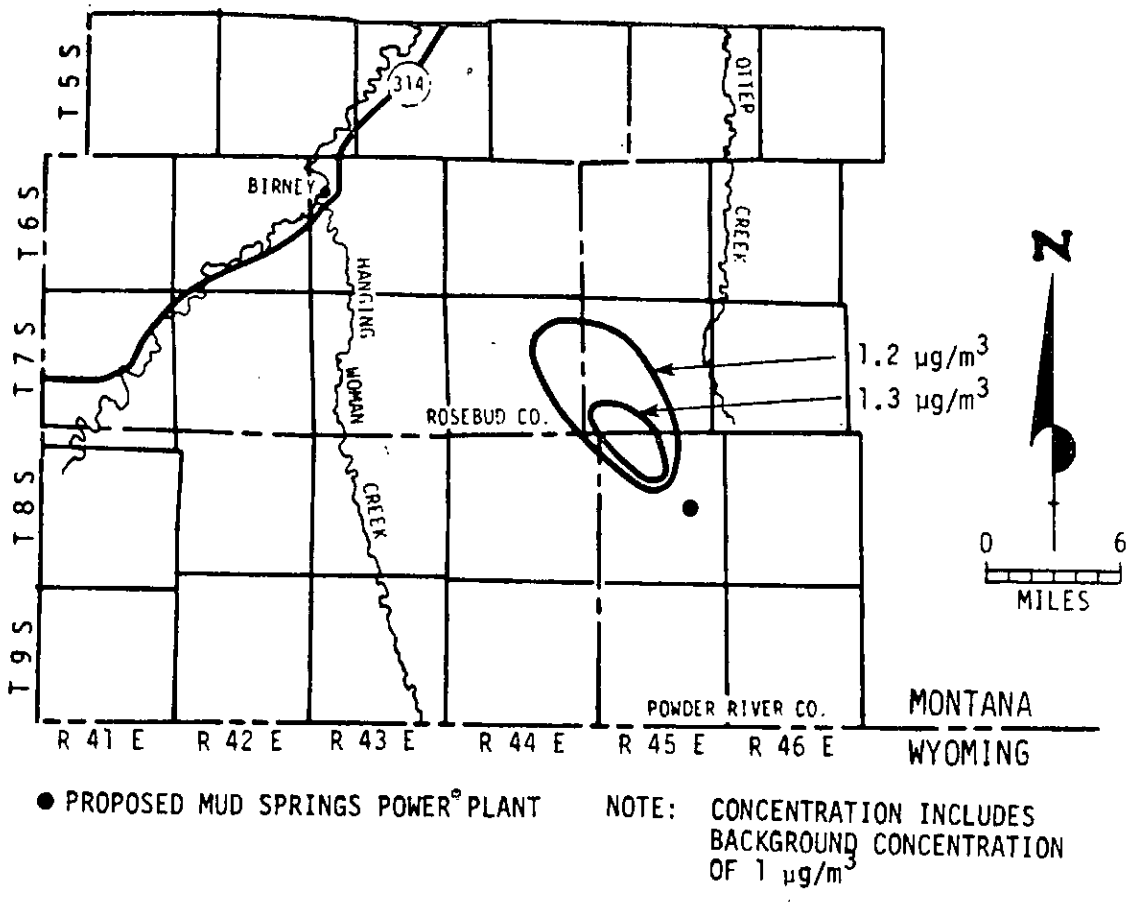

Figure 14. Annual Sulfur Dioxide Concentrations ($\mu g/m^3$)

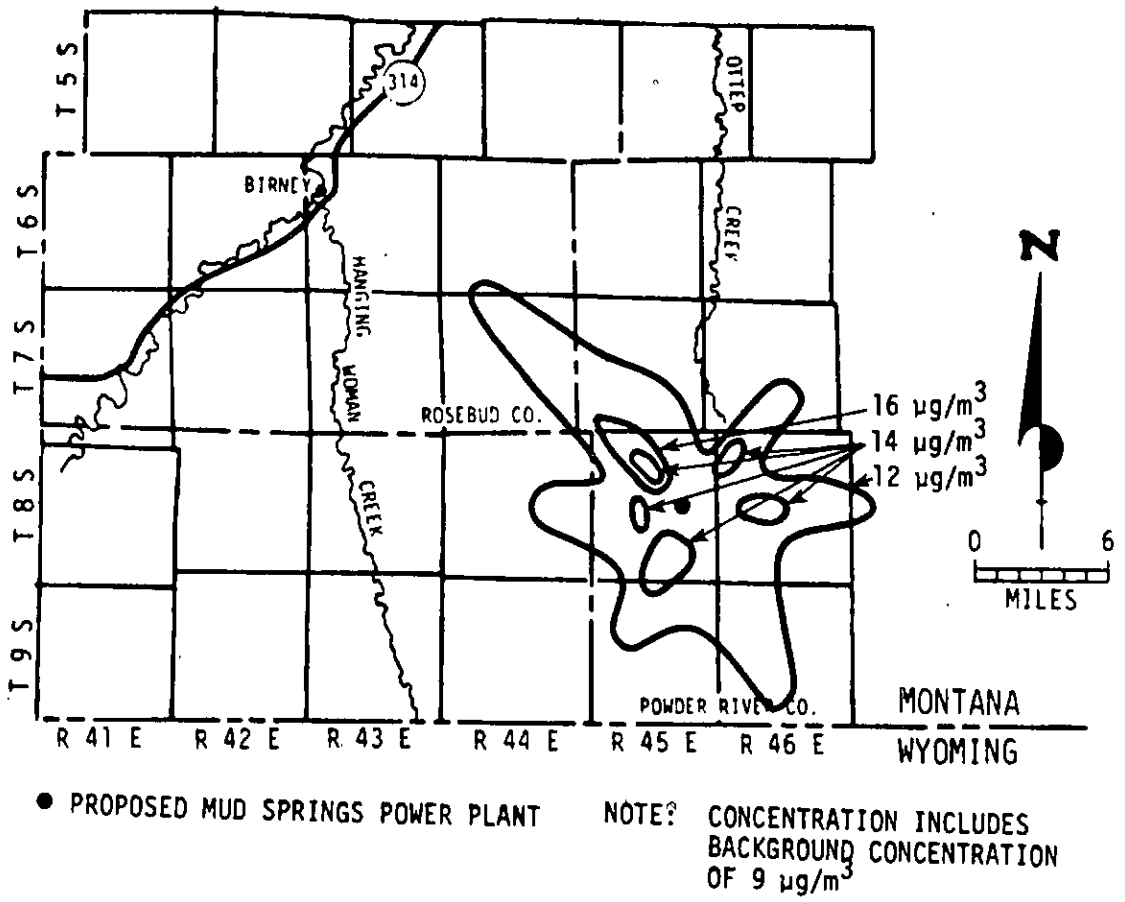

Figure 15. Highest Second High 24-Hour Sulfur Dioxide Concentrations ($\mu g/m^3$)

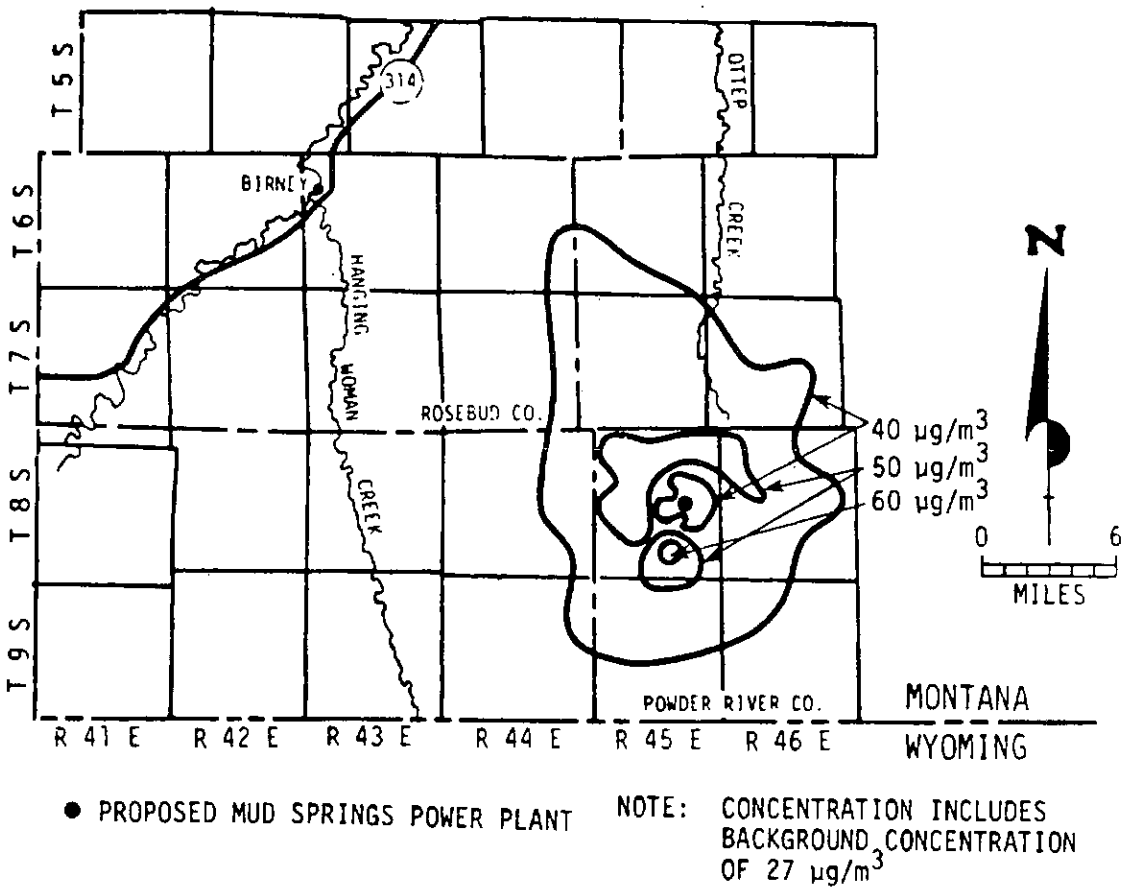

Figure 16. Highest Second High 3-Hour Sulfur Dioxide Concentrations ($\mu g/m^3$)

APPENDIX F: NORTHERN CHEYENNE TRIBE'S PROPOSED STIPULATIONS

[Note: The following is the text of the report submitted to the BLM by the Northern Cheyenne Tribe.]

INTRODUCTION

The Department of the Interior is obliged to consider, fashion and adopt measures to mitigate the adverse impacts of the proposed Powder River Regional coal development. The goals of impact mitigation are twofold: (1) to assure that the benefits of development are shared by local residents, and (2) to prevent or ameliorate the adverse effects of development. The duty to mitigate is especially strong as to the Northern Cheyenne Tribe, to which the Secretary of the Interior owes a solemn trust obligation.

The Northern Cheyenne Tribe proposes five types of mitigation measures—measures I through V set forth below. Measures I and II are designed primarily to achieve the first goal of mitigation. Measures III, IV and V are designed to achieve the second goal. Each of the measures addresses major concerns and vulnerabilities of the Tribe which have been described extensively in the Tribe's prior written and oral communications to the Department.[1]

Each mitigation measure should be implemented through the adoption of a suitable coal lease stipulation embodying the terms and conditions of the measure. The resulting five lease stipulations should be inserted in each federal coal lease arising from the second Powder River Sale that includes federal coal reserves lying within 25 miles of the borders of the Northern Cheyenne Reservation.

Each mitigation measure contemplates some form of financial assistance to the Tribe. Although, as set forth below, these measures place the burden of providing such assistance on the lessees, the Tribe is, in fact, indifferent as to the source of such assistance. Other sources of financial assistance, including existing sources of federal funds administered by the Department, should be considered.

These consist of written and oral Tribal statements made during the formulation of the first Powder River Sale, in the Tribe's lawsuit against that Sale, at the three Regional Coal Team meetings held subsequent to the Sale, at the Ashland, Montana scoping meeting for the second Powder River Sale, and in subsequent communications to BLM.

MITIGATION MEASURE I

Employment Preference

Historically, the Northern Cheyenne have been deprived of equal opportunity to participate in off-Reservation workforce. An employment preference will counteract this and assure that the employment benefits of development will reach the Northern Cheyenne and their families.

The appropriateness of an employment preference has been demonstrated at the Colstrip Powerplant Project. There, an employment preference has—for the first time—achieved the employment of significant numbers of Northern Cheyenne at Colstrip. We believe that the Montana Power Company would confirm that, on the basis of this preference, the Northern Cheyenne have established an admirable employment record which has served the Project well. However, this preference exists only because it was imposed on the Montana Power Company as part of a settlement of litigation brought by the Tribe against the project to protect the Reservation's Class I air quality standard. Similarily, other projects, such as those arising from the second Powder River Sale, will not adopt an employment preference unless compelled to do so.

It is the current perception of the Tribe that encirclement by large-scale coal development portends uniformly negative consequences for the Northern Cheyenne. The natural environment of the Reservation will be degraded, major social and cultural stresses will occur, and unmitigated financial burdens will be visited on a tribal government which presently is unable to provide adequate public services and facilities. Therefore, adopting an employment preference will endow the planned development with one positive attribute insofar as the Northern Cheyenne are concerned. This will serve federal regional coal development policy by generating significant grass roots support among the Northern Cheyenne.

The standard of living on the Northern Cheyenne Reservation is substantially lower than that which prevails off-Reservation. In light of his trust responsibility to the Tribe, the Secretary would be acting appropriately in ameliorating the harsh economic conditions prevailing on the Reservation by providing to the Northern Cheyenne the advantage of an employment preference.

Industry should prefer the development of an indigenous workforce: relocation costs are avoided, stability is enhanced, and much local goodwill is created. Also, to the extent that labor force is drawn from the local community, socio-economic impacts resulting from the in-migration of workforce will be decreased. We belive that the validity of these observations has been demonstrated in the employment preference program adopted at Colstrip.

Proposed Lease Stipulation

On the basis of the foregoing considerations, the Northern Cheyenne Tribe proposes the following lease stipulation as a mitigation measure:

1. Members of the Northern Cheyenne Tribe, their children and their spouses ["Preferred Employees"], shall be given preferential consideration in recruitment, training, hiring, promotion, and reductions in workforce, in all categories of employment.

2. The employment preference shall be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith. Without limitation, the written agreement shall include terms and conditions providing for the following:

   a. Quantitative goals, and a timetable for their achievement, for the employment of Preferred Employees in each job classification.

   b. Preservation of the lessee's authority to establish reasonable, even-handed and job-validated training programs, employment criteria, and work rules for all employees including Preferred Employees.

   c. Special programs for the recruitment of Preferred Employees.

   d. Special programs for the training of Preferred Employees, including on-the-job training, and training for advancement into supervisory positions.

   e. Special scholarships and tuition reimbursement programs for Preferred Employees.

   f. Special workshops for other project workforce to develop an awareness of Northern Cheyenne culture and concerns and an understanding of the need for and requirements of the employment preference.

   g. Special programs for the mass transportation of Preferred Employees between their homes and the job site.

   h. Notification to all involved labor unions of the existence of the employment preference and of the lessee's duty and intent to abide by its terms.

   i. A requirement that project contractors and subcontractors assume and comply with all terms and conditions of the employment preference in connection with their own project employment practices.

   j. The establishment of an Employment Preference Committee, consisting of an equal number of representatives from the Tribe and the lessee, which shall supervise, monitor, and assure compliance with the terms of the employment preference.

   k. Funding provided by the lessee to pay reasonable compensation and expenses of the Tribe's representatives on the Employment Preference Committee and of such staff and advisors as the Tribal representatives reasonably consider necessary to the performance of their responsibilities.

MITIGATION MEASURE II

Contracting and Procurement Preference

Indian entrepreneurship on the Northern Cheyenne Reservation has largely been unsuccessful. Indian entrepreneurship off the Reservation is virtually nil. There are approximately 25 businesses on the Reservation, and approximately 30 businesses in off-Reservation Ashland and Birney. About half of the Reservation businesses, including the general store in Lame Deer, are owned by non-Indians. All of the off-Reservation businesses are owned by non-Indians. Although there are several construction service firms on the Reservation owned by Northern Cheyennes, only one has achieved success in obtaining off-Reservation contracts.

There are a number of reasons for this poor record. As with off-Reservation employment opportunity, historically the Northern Cheyenne have been excluded from an equal opportunity to participate in non-Indian sponsored commercial ventures. In addition, both the Tribe and Tribal members are unable to pledge their trust property as security for the acquisition of capital. Furthermore, with a scant record of previous commercial success, lenders are reluctant to fund Northern Cheyenne entrepreneurs.

Therefore, absent special measures, the Northern Cheyenne will not participate in the entrepreneurial benefits engendered by the planned regional development.

In his Indian Policy Statement of January 24, 1983, President Reagan recognized the need for promoting Indian entrepreneurship and the many institutional barriers to that goal. He acknowledged that a "flexible approach" was needed for "creating a more favorable environment for the development of healthy reservation economies." The Northern Cheyenne propose that in formulating the second Powder River Regional sale, the Secretary implement this policy by adopting special mitigation measures to promote Northern Cheyenne participation in the entrepreneurial opportunity engendered by the resulting development.

Proposed Lease Stipulation

To provide the Northern Cheyenne with access to the commercial opportunities that will result from regional development, the Northern Cheyenne Tribe proposes the following lease stipulation as a mitigation measure:

1. Businesses controlled by the Northern Cheyenne Tribe or its members ["Preferred Businesses"] shall be given preferential consideration in the awarding of all contracts and subcontracts (a) for the conduct of operations, and (b) for the procurement of materiel and equipment for operations.

2. These preferences shall be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith. Without limitation, the written agreement shall include terms and conditions providing for the following:

a. Quantitative goals, and a timetable for their achievement, for the awarding of contracts, subcontracts and procurement contracts to Preferred Businesses.

b. A certification procedure, under which a business entity applying for the status of Preferred Business may seek certification in the following two respects:

(1) as an entity actually controlled by the Tribe or a Tribal member; and

(2) as an entity capable of competently providing particular contract services or supplying particular materiel or equipment.

c. Technical and financial assistance to Preferred Businesses designed to assist them in obtaining such certification.

d. Advance notice to certified Preferred Businesses of service or procurement contracts to be awarded for which they are qualified.

e. Where services or procurement contracts are to be awarded by competitive bid, the establishment of formulas whereby a certified Preferred Business is granted a bidding margin, i.e., a reasonable sum by which its bid may exceed all other bids.

f. A requirement that project contractors and subcontractors assume and comply with all terms and conditions of these preferences in connection with their own project contracting and procurement practices.

g. Establishment of a Contracting Preference Committee, consisting of an equal number of representatives from the Tribe and the lessee, which shall supervise, monitor, and assure compliance with the terms of the preference.

h. Funding provided by the lessee to pay reasonable compensation and expenses of the Tribe's representatives on the Contracting Preference Committee and of such staff and advisors as the Tribal representatives reasonably consider necessary to the performance of their responsibilities.

MITIGATION MEASURE III

Law and Order; Traffic

The Tribe previously has explained its profound concerns about the maintenance of the law and order of the Reservation. In recent years, regional development has led to increased use of the Reservation—its roads, recreation areas, services and facilities—by non-Indians as well as Indians. This has resulted in an increasing incidence of criminal and traffic violations that threaten the safety and tranquility of the Reservation. New leasing of federal coal reserves, bringing substantial population increases to the Reservation and the region as a whole, will multiply these problems. As the Tribe has explained, it is uniquely vulnerable to the resulting threats to law and order because of the anomalous jurisdictional status of non-Indians on the Reservation.

Proposed Lease Stipulation

To remedy this jurisdictional problem, the Northern Cheyenne Tribe proposes the following lease stipulation as a mitigation measure:

1. Each coal lessee shall obtain a covenant from each of its employees that while on the Reservation for any purpose the employee will comply with all standards of conduct generally applicable to Tribal members.
2. Each coal lessee shall obtain a covenant from each of its truckers that while operating trucks on the Reservation the trucker will comply with all laws, ordinances and rules applicable to the use of motor vehicles by Tribal members.
3. Each coal lesse shall by contract require (a) each of its contractors and subcontractors to obtain like covenanats from their employees and truckers, and (b) each of its suppliers to obtain a like covenant from their truckers.
4. The above described duties imposed on employees and truckers shall be enforced by each coal lessee, and its contractors, subcontractors and suppliers, by taking appropriate employee-related disciplinary action in the event a violation of such duties is reported by the Tribe.
5. These provisions shall be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith. Without limitation, the written agreement shall include terms and conditions providing for the following:

   a. Assumption in writing, as a condition of employment, by each employee and trucker, of the conditions set forth in 1 through 4 above.

   b. Education of employees and truckers with respect to the standards of conduct applicable on the Reservation.

   c. Appropriate employee-related disciplinary action for particular violations.

   d. Resolution of disputes concerning the occurence of violations.

   e. Notification to all involved labor unions of the existence of the writen agreement and the lessee's duty and intent to abide by its terms.

   f. Funding provided by the lessee to pay reasonable costs incurred by the Tribe in implementing the agreement.

MITIGATION MEASURE IV

Environmental Protection

The Northern Cheyenne Reservation serves as the traditional homeland of the Northern Cheyenne people. As the Department knows, the Tribe considers the preservation of the Reservation's physical environment to be of paramount importance. The Tribe has taken decisive action—in adopting a Class I air quality classification and opposing on-Reservation coal development—in pursuit of that goal. Unlike other lands to the north, east, and south, the Reservation is not a fungible piece of real estate. Its preservation is essential to the survival of the Tribe itself.

The major industrial development that will result from federal coal leasing poses a threat to air and water quality on the Reservation, the Reservation's plant and animal life, and the health and welfare of Tribal members. Because the Reservation occupies the geographic center of the planned development, it is especially vulnerable

to adverse environmental impacts. Furthermore, since the Northern Cheyenne Reservation is the only possible homeland for the Northern Cheyenne people, adverse environmental impacts on the natural resources of the Reservation—which serve as the wellspring of the Northern Cheyenne culture—are of unique concern in the region. This concern is specially relevant to actions taken by the Secretary of the Interior, who has a solemn trust obligation to safeguard the Northern Cheyenne homeland. Thus, special steps should be taken to protect the environmental quality of the Reservation.

Proposed Lease Stipulation

In order to monitor and prevent degradation of the Reservation's natural environment, the Northern Cheyenne Tribe proposes the following lease stipulation as a mitigation measure:

1. A program shall be established to monitor air quality, visibility, water quality, and biological and other resources on the Reservation which may be affected adversely by the project. The program shall provide for baseline monitoring for a reasonable period before construction of the project and ongoing monitoring thereafter throughout the life of the project.

2. The program shall be conducted under the terms of a written agreement among the Tribe, the coal lessee, and all federal and state agencies with pollution control jurisdiction over the project, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith. Without limitation, the written agreement shall include terms and conditions providing for the following:

   a. Comprehensive monitoring of Reservation sources as provided in 1 above.

   b. Utilization of state-of-the-art monitoring equipment and techniques, to be maintained in good operating condition and upgraded to reflect advances in technology.

   c. Use of qualified professional to design and conduct monitoring and analyze results.

   d. Recruitment, training (including technical education and on-the-job training), and employment of Tribal members, their children and their spouses ["Preferred Employees"] to assume responsibility to the fullest extent possible for the operation of the monitoring program.

   e. The establishment of an Environmental Monitoring Committee consisting of four representatives, one each from the Tribe, the lessee, the involved federal agencies, and the involved state agencies, which shall supervise and direct the monitoring program and assure that it is carried out according to the terms of the agreement.

   f. Remedies in the event that air or water quality standards applicable to the Reservation are violated or that Reservation resources are materially impaired as a result of the construction or operation of the project.

   g. Funding provided by the lessee to pay: (1) the costs of the monitoring program, including the acquisition, maintenance and upgrading of equipment, the salaries of program employees, and the recruitment and training of Preferred Employees; and (2) reasonable compensation and expenses of the Tribe's representative on the Environmental Monitoring Committee, and of such staff and advisors as the Tribal representative reasonably considers necessary to the performance of his responsibilities. When an environmental monitoring program established for a particular project will contribute to the environmental monitoring program required for one or more other projects, the programs shall be integrated to the fullest extent reasonably possible, and the capital and operating costs of the integrated program shall be equitably apportioned among the projects.

MITIGATION MEASURE V

Impact Assistance

The tribe has repeatedly advised the Department of its concerns regarding the increased demands that will be placed on Reservation public services and facilities as a result of regional coal development. The Reservation is in no sense immune from these demands; indeed, given its central location, it is uniquely vulnerable to them. However, as between the Tribe and its off-Reservation counterparts, there is a gross disparity in the availability of funds to satisfy these demands.

Appendix F

Off-Reservation, state and local governments can draw upon a variety of revenue sources in order to prepare for and meet the impacts of massive coal development. In addition to traditional sources of revenue, such as real and personal property taxes and the sale of tax exempt bonds, these units of government receive a significant portion of the income generated by coal mining. Fifty percent of the federal bonuses, rentals and royalties are returned to the state. In addition, 30% of mine income is collected by the state through its severence tax, and an additional percentage is collected by the counties through the coal gross proceeds tax.

These revenue sources are unavailable to the Tribe: it receives no part of the federal bonuses, rentals or royalties, it cannot collect severence, gross proceeds or any other taxes from the mines, and it has virtually no independent tax base of its own on which to draw. Although new federal legislation (which expires unless reenacted in 1984) permits Indian tribes to sell tax exempt bonds, and state law now permits tribes to apply for grants and loans from Montana's Coal Board, neither will serve as a reliable or adequate source of funding for the Tribe.

In short, off-Reservation governments receive substantial revenues as a result of development from which the Tribe is excluded. Such revenues provide off-Reservation communities with the means to mitigate negative consequences of development. Similar provision should be made for the Tribe.

Proposed Lease Stipulations

The Northern Cheyenne Tribe proposes two alternative lease stipulations as mitigation measures, either of which may enable it to mitigate adverse socioeconomic impacts on the Reservation:

Alternative A

The federal government returns 50% of coal lease bonuses, rentals and royalties to the state ["Off-Reservation Federal Impact Funds"]. By federal statute, these funds are to be used to mitigate adverse impacts of coal development. These impacts can be expected to occur in Big Horn, Rosebud and Powder River Counties [the "Three County Area"], both on and off the Reservation.

No portion of Off-Reservation Federal Impact Funds, however, is made available to the Tribe. The Tribe proposes that is be provided with a reasonably proportionate level of funding. It should be recognized that such funding will be substantially less than the total funding available to off-Reservation governments, since, as noted above, off-Reservation governments have other sources of funding that are not available to the Tribe.

Specifically, this proposed stipulation is as follows:

1. The lessee shall make contributions to the Tribe for the exclusive purpose of planning and providing public services and facilities on the Reservation.
2. Lessee contributions shall be calculated by taking the amount of Off-Reservation Federal Impact Funds generated by the lease, dividing by the non-Reservation resident population of the Three County Area, and then multiplying the resident population of the Northern Cheyenne Reservation.
3. Lessee contributions shall be provided to the Tribe at the same time that the Off-Reservation Federal Impact Funds are provided to the state.
4. This funding program will be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted therafter with diligence and good faith.

Alternative B

Through the existing taxation and impact funding regime, coal lessees will contribute substantial revenues to the increased costs of off-Reservation public services and facilities. However, they will make no significant contribution to such costs on the Reservation. Yet it is clear that development-induced increases in regional population, both on and off the Reservation, will place significant new demands on Reservation services and facilities.

If a coal project causes workforce and their families to reside on the Reservation, the project should bear some portion of the resulting costs incurred by the Tribe for Reservation services and facilities. The Tribe suggests that the Tribe and the project contribute equally to these increased costs. A per capita funding formula is suggested to achieve this.

In addition, project workforce and their families residing off-Reservation will burden Reservation services and facilities. Here, too, the project should bear some portion of these increased Tribal costs. The Tribe suggests that the project make a reduced contribution to these costs. This contribution will be based only on the number of workers, without including their families as well, and uses a per capita funding rate which is one-third of that applicable to on-Reservation residents.

This would be a most conservative measure of the impact costs to be incurred by the Tribe. First, it provides for cost sharing between the Tribe and the project. Second, the calculation is based only on Tribal expenditures from its own funds, ignoring contributions from other sources. Third, it includes only selected Tribal programs. Fourth, it will not provide to the Tribe the enormous funding which will be provided to the state and its subdivisions. In short, under this proposal a modest level of assistance will be provided to the Tribe to help it meet the service and facility demands engendered by development.

Specifically, this proposed stipulation is as follows:

1. The lessee shall make an annual contribution to the Tribe for the exclusive purpose of planning and providing public services and facilities on the Reservation.

2. Lessee contributions shall be based on the Tribe's own expenditures for Reservation services and facilities ["Tribal Expenditure"]. The Tribal Expenditure shall be calculated by determining the total amount of Tribal funds committed during the previous year to the Tribal programs listed below and dividing that sum by that year's total resident Reservation population. The programs to be included are:

   a. Education
   b. Ambulance service
   c. Health care
   d. Alcoholism and drug abuse treatment
   e. Law and order
   f. Tribal court
   g. Rural officers—game warden program
   h. Recreational facilities
   i. Transportation
   j. Shelter home for children
   k. Day care
   l. Elderly residence and care
   m. Garbage cannister program
   n. Utility commission
   o. Tribal government

3. The lessee shall contribute annually 100% of the Tribal Expenditure for each project employee, and for each member of the employee's household, who resides on the Reservation. In addition, the lessee shall contribute annually 33 1/3% of the Tribal Expenditure for each project employee who resides off the Reservation.

4. This mitigation program shall be implemented under the terms of a separate written agreement between the Tribe and each coal lessee, which will be approved by the Secretary. Negotiation of this agreement shall commence promptly after the identification of the successful bidder for the coal lease and shall be conducted thereafter with diligence and good faith.

REFERENCES

A NOTE ABOUT TRACT PROFILES

Reference is made to "the individual tract profiles." These are site-specific analyses prepared by the Bureau of Land Management or the Forest Service for each tract delineated for possible coal leasing. Copies of the following tract profiles are available upon request from the Casper District office, Bureau of Land Management.

BLM Tracts in Wyoming	Thunder Basin National Grassland Tracts in Wyoming	BLM Tracts in Montana
Youngs Creek	Thundercloud	Colstrip Maintenance
Hidden Water	Porcupine	Colstrip Area C
Calf Creek	Ridgerunner	Spring Creek
Hay Creek		North Decker I
Donkey Creek		North Decker II
Timber Creek		Wolf Mountain Maintenance
Mount Logan		Downey Coulee
Kintz Creek		Ashland (Decker-Birney)
		Northwest Otter Creek
		Hanging Woman Creek
		Mud Springs

SOURCES CITED

American Indian Technical Services

1983 "Socioeconomic Impact Assessment: Shell's Proposed Young's Creek Mine, Crow Indian Reservation, Montana." Report prepared for the Office of Surface Mining, Denver, and the Crow Tribe of Indians, Crow Agency, Montana. Broomfield, CO.

Braut, Art

1983 Personal communication with Darrel Schwilling of Casper District, BLM, on July 21, 1983, regarding pavement management program in Montana. Braut is with the Montana State Highway Department.

Briggs, Peter

1981 Personal communication with Darrel Schwilling of Casper District, BLM, regarding impacts of increased traffic on railroad company. Briggs is with Burlington Northern.

Browne, Bortz, and Coddington

1983 "The Campbell County Socioeconomic Monitoring Report." Denver.

Coenenberg, Joe

1982 "Methods for Establishment of Diverse Native Plant Communities at the Rosebud Mine." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

DePult, Edward J.

1982 "Cool Season Perennial Grass Establishment on Northern Great Plains Mined Lands: Status of Current Technology." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

Eddleman, Lee

1982 "Research on Shrub Establishment in Reclamation of Surface Mined Lands." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

References

Frison, George C.

1978 *Prehistoric Hunters of the High Plains.* New York: Academic Press.

Glass, Gary B.

1976 "Update on the Powder River Coal Basin." In *Wyoming Geological Association 28th Annual Field Conference Guidebook*, pp. 209-220. Edited by Richard Laudon. Casper, WY: Wyoming Geological Association.

1980 *Guide Book to the Coal Geology of the Powder River Coal Basin.* Publication 14. Cheyenne, WY: Wyoming Geological Survey.

Hanlin, Dave

1983 Personal communication with Darrel Schwilling of Casper District, BLM, on July 21, 1983, regarding planned highway work in Wyoming. Hanlin is with the Wyoming Highway Department.

Hasfurther, Victor R.; Akerbergs, Michael; and Shafer, Ralph G.

1982 "Hydrologic Impact of Surface Coal Mining in Northeastern Wyoming." In *Hydrology Symposium on Surface Coal Mines in Powder River Basin*, Gillette Area Groundwater Monitoring Organization. Gillette, WY.

Hooper, Douglas, and Branch, Kristi

1982 "Community Research Working Paper: Forsyth, Montana." (BLM social effects project.) Billings, MT: Mountain West Research.

Hooper, Douglas, and Jobes, Patrick

1982 "Community Research Working Paper: Ashland, Montana." (BLM social effects project.) Billings, MT: Mountain West Research.

Koch, Donald; Ringrose, Charles D.; Moore, Richard C.; and Brooks, David L.

1982 "Monitoring and Modeling of Shallow Ground Water Systems in the Powder River Basin." Prepared by Hittman Associates, Inc., for the Bureau of Mines, U.S. Department of the Interior, under contract J0265050.

Kroll, Cynthia

1983 "Social and Economic Impacts of Coal Leasing on the Northern Cheyenne Tribe: Methodology and Concerns." Report prepared for the Northern Cheyenne Tribe of Montana. Berkeley, CA.

McGowan, Ann

1983 Personal communication with Paul Myers of Denver Service Center, BLM, regarding divorce and school dropout statistics for Wyoming. McGowan is with the Wyoming Department of Economic Planning and Development.

Martin, Peter R.

1980 "Terrestrial Wildlife Habitat Inventory in Southeastern Montana." Report prepared by Montana Department of Fish, Wildlife, and Parks, which conducted research under the sponsorship of the Bureau of Land Management, U.S. Department of the Interior.

Matson, R. E., and Pinchock, John M.

1977 *Geology of the Tongue River Member, Fort Union Formation, Eastern Montana.*

Metcalf-Zier Archeologists, Inc.

1981 "A Class II Cultural Resources Inventory of the Eastern Powder River Basin, Wyoming," edited by T. C. Peebles. Report prepared for the BLM Wyoming State Office, Cheyenne. Eagle, CO.

Montana. Board of Crime Control

1981 *Annual Report.* Helena, MT.

Montana. Bureau of Mines and Geology

1973 *Quality and Reserves of Strippable Coal, Selected Deposits: Southeastern Montana*, by R. E. Matson and J. W. Blumers. Bulletin 91. Butte, MT.

1980 *Montana Coal: A Guide to Coal Geology, Resources, and Production*, by G. A. Cole, R. E. Matson, and R. T. Pederson. State Publication 83. Butte, MT.

Montana. Department of State Lands.

1982a *Draft EIS: Montco Mine, Rosebud County, Montana.* Helena, MT.

1982b *Draft EIS: Western Energy Company's Rosebud Mine, Area C, Block 1.* Helena, MT.

Montana. Department of State Lands and U.S. Office of Surface Mining.

1983 *Draft Environmental Impact Statement: Western Energy Company's Rosebud Mine.* No. OSM 83-120. N.p.

Montana Crop and Livestock Reporting Service

1980 *Montana Agricultural Statistics*, vol. 18. Helena, MT: Montana Crop and Livestock Reporting Service. Issued cooperatively by Montana Department of Agriculture and the Economics, Statistics, and Cooperative Service, U.S. Department of Agriculture.

Moore, James R.

1983 "Land Value Effects of the Proposed Decker Area Mines." Report prepared for Montana Department of State Lands and Office of Surface Mining, U.S. Department of the Interior. Billings, MT: Mountain West Research North, Inc.

Mountain West Research

1982 "Guide to Social Assessment." Report prepared for the Bureau of Land Management, U.S. Department of the Interior. Billings, MT.

1983 Decker Area Mines Comprehensive Social Science Study." Report prepared for the Office of Surface Mining, U.S. Department of the Interior, and the Montana Department of State Lands. Billings, MT.

Mulloy, William T.

1958 *A Preliminary Historical Outline for the Northwestern Plains.* University of Wyoming Publications in Science. New York: McGraw-Hill.

Myers, Paul; Davidson, Susan; and Trent, Joan

1983 Field interviews conducted in May 1983 in Broadus, Montana, by BLM employees.

References

Northern Cheyenne Tribe

1981 "Social and Economic Impact Study for the Montco EIS." Report prepared for the Montana Department of State Lands. Lame Deer, MT.

1983a "Responses to BLM Requests for Information for Second Powder River Sale EIS." A response to a request for information from the BLM, June 24, 1983.

1983b "Statement of the Northern Cheyenne Tribe: Powder River Basin Coal Region EIS Scoping Meeting." Statement submitted at scoping meeting at Ashland, Montana.

Pacifica Services, Inc.

1982 "Rocky Mountain Energy Development: Employment and Business Opportunities for Native Americans." Report prepared for the Office of Minority Economic Impact, U.S. Department of Energy. Los Angeles, CA.

Paul Nelson Associates, Inc.

1981 "Residential Subdivisions and Surface Mining: Comparative Analysis." Report prepared for the Texas Energy Services, Inc., of Gillette, Wyoming. Salt Lake City.

PEDCO Environmental, Inc.

1983 "Affected Environment Technical Report: Air Quality Report, '84 Coal Sale." Chapter 2 of a report prepared under contract to the Bureau of Land Management, Casper Wyoming. Golden, CO.

Rahn, P. H.

1976 *Potential of Coal Strip-mine Spoils as Aquifers for the Powder River Basin.* Engineering and Mining Experiment Station publication. Rapid City, SD: South Dakota School of Mines and Technology.

Rau, John G., and Wooten, David C., eds.

1980 *Environmental Impact Analysis Handbook.* New York: McGraw-Hill.

Reher, Charles A.

n.d. "The Western Powder River Basin Survey: Report of Survey Results." Report prepared for the Bureau of Land Management.

Ries, Ron

1982 "Warm Season Grasses for Revegetation in the Northern Great Plains." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

Simon, Ruth B.

1972 "Seismicity." In *Geological Atlas of the Rocky Mountain Region,* p. 48ff. By Rocky Mountain Association of Geologists. Denver: Rocky Mountain Association of Geologists.

United States. Department of Agriculture. Forest Service

1974a *National Forest Landscape Management.* Vol. 2: *Chapter 1: The Visual Management System.* Agriculture Handbook Number 462. Stock No. 0101-00358. Washington: Government Printing Office.

1974b *Rehabilitation Potential and Limitations of Surface-Mined Land in the Northern Great Plains,* by Paul E. Packer. General Technical Report INT-14. Ogden, UT: Intermountain Forest and Range Experiment Station.

n.d. *Unsuitability Criteria Assessment: High-to-Moderate Coal Potential.* Laramie, WY.

United States. Department of Agriculture. Soil Conservation Service

1981 Personal communication regarding types of agricultural land in southeast Montana, with Clarke McClung of Casper District, Bureau of Land Management. Cited in USDI, BLM, *Final Powder River Regional Coal EIS,* 1981.

United States. Department of the Interior. Bureau of Land Management

1974 *Final Environmental Statement: Proposed Development of Coal Resources in the Eastern Powder River Basin of Wyoming.* 6 vols. [Cheyenne, WY.]

1979a *Final Environmental Statement: Federal Coal Management Program.* Washington: Government Printing Office.

1979b *Final Environmental Statement: Proposed Development of Coal Resources in Eastern Powder River, Wyoming.* Washington.

1980a *Amendment to Wyoming Land Use Decisions: Eastern Powder River Basin Area Management Framework Plan: Gillette Review Area.* Casper, WY.

1980b *Supplement to Wyoming Land Use Decisions: Determinations of Unsuitability for Coal Development: Highlight Review Area.* Casper, WY.

1980c *Visual Resources Management Program.* Stock no. 024-011-00116-6. Washington: Government Printing Office.

1981a *Coal Amendment to Wyoming Land Use Decisions: Western Powder River Basin Area.* Casper, WY.

1981b *Final Powder River Regional Coal Environmental Impact Statement.* Casper, WY.

1982 *Coal Amendment to Wyoming Land Use Decisions: Eastern Powder River Basin Area: Recluse Review Area, Casper District.* Casper, WY.

1983 *Powder River Coal Region Tract Summaries.* [Cheyenne, WY.]

References

United States. Department of the Interior. Bureau of Land Management and Woodward-Clyde Consultants

1980 *Draft Environmental Impact Statement on the Energy Transportation Systems, Inc., Coal Slurry Pipeline Transportation Project.* Denver: Bureau of Land Management.

United States. Department of the Interior. Geological Survey.

1973 *Water Resources of the Powder River Basin and Adjacent Areas, Northeastern Wyoming,* by Warren G. Hodson, Richard H. Pearl, and Stanley A. Druse. Prepared in cooperation with the Wyoming State Engineer.

United States. Department of the Interior. Geological Survey; and Montana. Department of State Lands

1979 *Draft Environmental Statement: Regional Analysis: Northern Powder River Basin Coal, Montana.* N.p.

United States. Department of Transportation.

1980 *Preliminary Final Environmental Impact Statement: C&NW Coal Line Project.* N.p.

University of Wyoming. Agricultural Experiment Station

1977 *Wyoming General Soil Map.* Research Journal 117. Laramie, WY.

Van Voast, W. A., and Hedges, R. B.

1975 *Hydrologic Aspects of Existing and Proposed Strip Mines Near Decker, Southeastern Montana.* Bulletin 97, Montana Bureau of Mines and Geology. Butte, MT.

Wollenhaupt, Nyle C., and Richardson, Jim L.

1982 "The Role of Topography in Revegetation of Disturbed Lands." In *Proceedings of a Symposium: Mining and Reclamation of Coal Mined Lands in the Northern Great Plains.* Montana Agricultural Experiment Station Research Report 194. Billings, MT.

Wyoming. Game and Fish Department

1979 "Final Report: Eastern Powder River Coal EIS Contract." Report prepared for the Bureau of Land Management, U.S. Department of the Interior, under contract YA-512-CT8-126. Cheyenne, WY.

Wyoming. Office of the Attorney General

var. *Crime in Wyoming.* Cheyenne, WY. Annual publication—editions of 1978, 1979, 1980, 1981, and 1982 were consulted.

Wyoming Crop and Livestock Reporting Service

1981 *Wyoming Agricultural Statistics 1981.* Cheyenne, WY: Wyoming Crop and Livestock Reporting Service. Issued cooperatively by Wyoming Department of Agriculture, the University of Wyoming, and the United States Department of Agriculture, Statistical Reporting Service.

ERRATA

On the Regional Activity map in the back of this document, the two PRLAs that have been identified as "Thundercloud I" and "Thundercloud II" should be Thunderbird I and Thunderbird II.

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Otter Creek Rally in Helena Telephone Script

Hi, is __(first name) there please?

Hi, _____, this is _____ and I'm calling for the Montana Environmental Information Center. How are you?

I'm calling because the Montana State Land Board will be making one of its most important environmental decisions on Monday —whether or not to lease the Otter Creek coal tracts in Southeastern Montana

There will be a rally in front of the State Capitol at 8 am on Monday, December 21st, before the Land board meets at 9 am to vote on leasing state lands for a large coal strip mine. **This will be the last best chance to tell the Land** board to "SAY NO" to leasing the Otter Creek tracts.

Would you like to hear a little more background about Otter Creek?

There are 1.3 billion tons of coal contained in the Otter Creek coal tracts. The State Land board (comprised of Governor Brian Schweitzer, State Auditor Monica Lindeen, Attorney General Steve Bullock, Secretary of State Linda McCullough, and Superintendent of Public Instruction Denise Juneau), will vote *this* Monday whether or not to lease the state-owned portion of the tracts.

If the Land board votes to move forward with the leasing this coal, the strip-mining and burning this coal will destroy water quality and will release **2.5 billion tons of carbon dioxide into the atmosphere**!

Can you attend the rally?

(If yes)—Great! Thank you! We will all be meeting a little bit before 8 in front of the Capitol. You can come anytime between 8 and 9 am. You can also stay for the Land Board meeting that starts at 9 AM. Feel free to make your own sign, or just show up. If you have any questions contact Anne Hedges 461-9546 or ahedges@meic.org

(If no)—Thank you for your time. Sorry we'll miss you.

Thanks so much! Your voice is necessary so elected officials make the right decisions regarding the future of *our* state lands.

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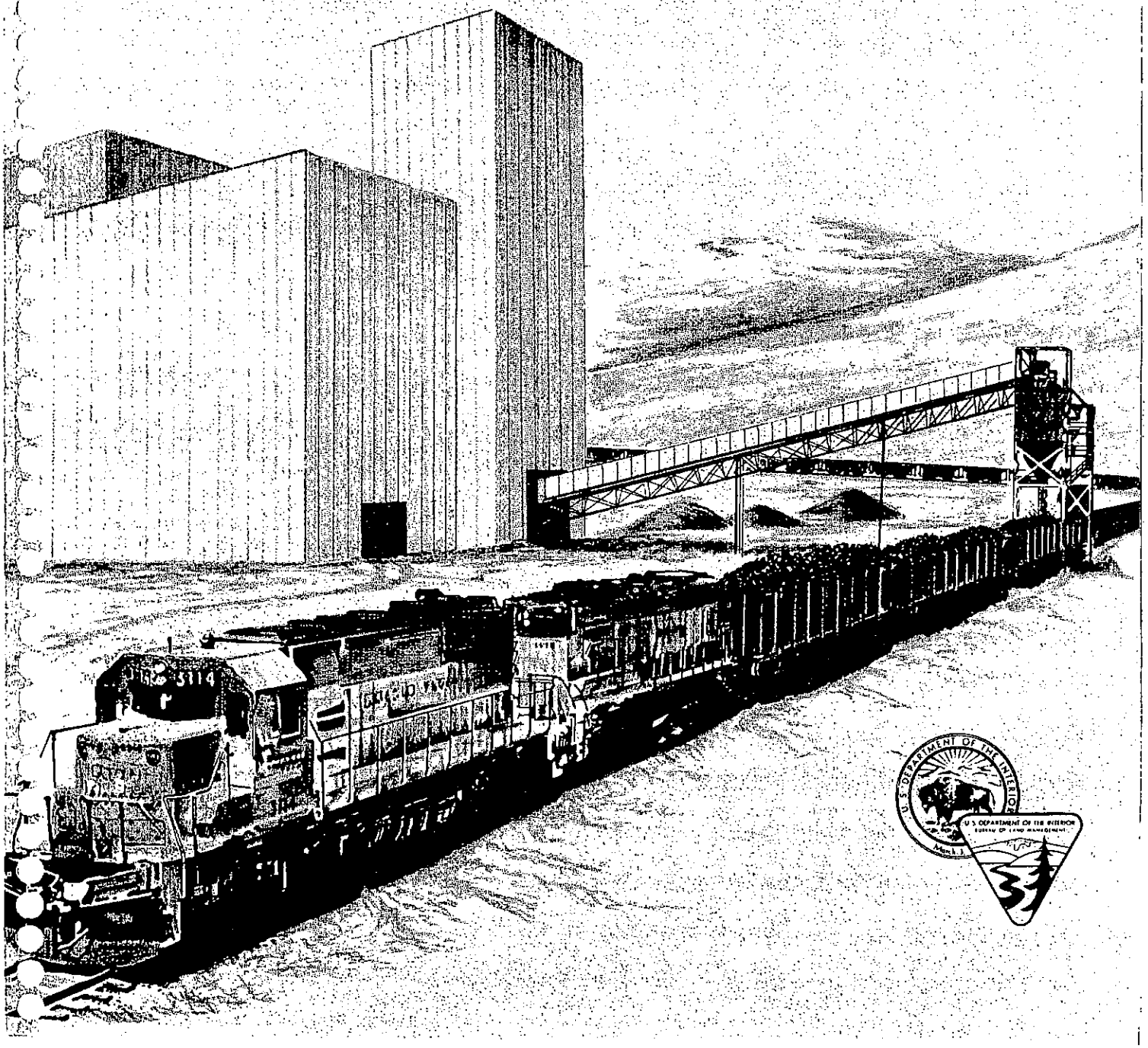
POWDER RIVER

FINAL ENVIRONMENTAL IMPACT STATEMENT
COAL

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT



POWDER RIVER COAL REGION
ENVIRONMENTAL IMPACT STATEMENT

( ) Draft (X) Final

Lead Agency
U.S. Department of the Interior, Bureau of Land Management

Cooperating Agencies
U.S. Department of Agriculture
Forest Service

U.S. Department of Interior
U.S. Geological Survey

Type of Action

1. Administrative (X) Legislative ( )

2. Abstract

This statement assesses the environmental consequences of four alternative levels of coal development. The alternatives range from leasing 19 tracts (2.6 billion tons) to leasing 13 tracts (1.5 billion tons), and also includes the No-Action Alternative. The No-Action Alternative includes three I-90 coal exchanges, two noncompetitive leases, and 67 PRLAs totaling 15 mine units. The statement assesses impacts that would occur in Big Horn, Powder River, and Rosebud counties in Montana and Campbell, Converse, Crook, Johnson, Natrona, Sheridan, and Weston counties in Wyoming, as a result of coal leasing and development; and, cumulative impacts from the I-90 exchanges, noncompetitive leases, and PRLAs.

3. The draft environmental impact statement received a 60-day public review. Comments received during this review period have been incorporated into the analysis contained in this final environmental impact statement. Comments were received from various individuals, organizations and governmental agencies and are displayed in Appendix H of this document.

4. For further information regarding this statement or proposed alternative action contact:

Mr. Charles Wilkie
Team Leader
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951 Rancho Road
Casper, WY 82601

5. The draft of this environmental impact statement was made available to EPA and the public July 24, 1981.

6. This final environmental statement will be made available to the EPA and the public December 1, 1981.

DISTRIBUTION LIST

FEDERAL AGENCIES

Department of Agriculture

- Forest Service
- Soil Conservation Service

Department of the Army, Corps of Engineers

Department of Energy

Department of the Interior

- Bureau of Indian Affairs
- Bureau of Reclamation
- Fish and Wildlife Service
- Geological Survey
- National Park Service
- Office of Surface Mining
- Bureau of Mines

Department of Justice

Department of Transportation

Environmental Protection Agency

INDIAN TRIBES

Northern Cheyenne Tribe
Crow Tribe

STATE AGENCIES

Montana State Clearinghouse
Wyoming State Clearinghouse

LOCAL AGENCIES

Big Horn County Commissioners
Campbell County Commissioners
Carbon County Commissioners
Crook County Commissioners
Johnson County Commissioners
Natrona County Commissioners
Powder River County Commissioners
Rosebud County Commissioners
Sheridan County Commissioners
Weston County Commissioners

MAJOR SPECIAL INTEREST GROUPS

American Wilderness Alliance
Friends of the Earth
National Wildlife Federation
Northern Plains Resource Council
Powder River Basin Resource Council
Sierra Club
Wilderness Society

OTHER ORGANIZATIONS AND INDIVIDUALS

Numerous other organizations and individuals expressing interest in the proposed action have been sent copies of this statement and have been invited to comment.

FINAL

POWDER RIVER
REGIONAL COAL
ENVIRONMENTAL IMPACT STATEMENT

PREPARED BY:

BUREAU OF LAND MANAGEMENT
DEPARTMENT OF THE INTERIOR

Maxwell T. Kiernan

STATE DIRECTOR

WYOMING STATE OFFICE

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SUMMARY

This Environmental Impact Statement (EIS) is intended to be a part of the decision-making process, providing information to the Secretary of the Interior and the public concerning the use of coal resources from the Powder River Region. It has been prepared to comply with the Council on Environmental Quality (CEQ) regulations issued November 29, 1978 (43 FR 55978-56007), which emphasize concentration on significant issues and impacts. This emphasis sharply defines the options and provides a clear basis for choice by the decision-maker and the public.

Tract Profiles, consisting of the tract delineation report, coal data summary and site specific analysis report, were prepared for each tract within the region. The Tract Profiles constitute the site specific analyses for the EIS although they are not physically attached to the document. These reports consider environmental, social and economic impacts that would occur on the individual tracts and may be obtained from the BLM District Office, Casper, Wyoming at no charge. Impacts identified in each of these tract profiles as well as those occurring from the No-Action Alternative are analyzed cumulatively in this EIS.

Four alternative courses of action, ranging from no new federal leasing, to offering 19 delineated tracts for lease are addressed in this document. The issue of primary concern is the impact of coal mine development and population increases to communities. Many other resource impacts are presented and analyzed here; water resources, reclamation, air quality, sociology, economics, and railroad transportation are of primary significance. Many other resource impacts are presented, but in nearly every case, they are either insignificant or are mitigated by existing regulations. Differences in impacts are mainly by degree, rather than by type.

The alternative selected by the Regional Coal Team (RCT) as the preferred alternative would offer for lease in mid-1982 15 tracts which would result in an average annual production of about 50 million tons. Eight of the 15 tracts are considered production maintenance (coal leased to sustain existing coal mines).

Other alternatives considered herein are:

Alternative 1 (No Action) includes the coal related actions that would occur with or without new competitive federal leasing. Actions within this alternative include 18 existing coal mines, 17 coal mines under construction, 67 Preference Right Lease Applications (PRLAs) organized into 15 groups, three I-90 Coal Exchanges and two non-competitve leases (Northern Cheyenne). The average annual production from this alternative would be about 369 million tons in 1990. An estimated surface disturbance of 210,000 acres would result from this alternative (see Table 2-2).

Alternative 2 considers leasing 1.5 billion tons of recoverable coal reserves from 13 tracts. The average annual production from this alternative would be about 46 million tons. An estimated surface disturbance of 57,400 acres would result from implementation of this alternative.

Alternative 3 analyzes impacts from the proposed leasing of 14 tracts including 1.5 billion tons of recoverable coal reserves. Average annual production from this alternative would be about 50 million tons. Surface disturbance would total 64,200 acres. This alternative offers the most favorable ratio of coal produced to environmental impacts generated, and is the preferred alternative.

Alternative 4 is the maximum alternative and considers leasing 2.6 billion tons of recoverable coal reserves from 19 tracts. Average annual production from this alternative would be about 90 million tons. Surface disturbance associated with this alternative would amount to 83,500 acres. This alternative would produce the most widespread environmental impacts of all federal action alternatives. Impacts would be most severe to the unicorporated community of Ashland District, Montana, where population would increase eightfold by 1990.

GENERAL CONCLUSIONS

The No-Action Alternative includes existing coal mines, coal mines under construction, PRLAs, I-90 Exchanges and non-competitive leases. It must be understood that impact from new federal leasing would add to that from the No-Action Alternative. When impacts from the No-Action Alternative is compared to impacts potentially resulting from new federal leasing, it is obvious that the No-Action Alternative has the greatest magnitude. Impacts, which can be traced to new federal leasing, are similar to those already occurring and only magnify the total.

Impacts in Wyoming center around the urbanized community of Gillette in Campbell County. Gillette has been experiencing energy-related impacts over the past ten years. Impacts in Montana would center around the rural, unincorporated community of Ashland in Rosebud County. Unlike Gillette, Ashland has experienced very little growth over the past decade. Therefore, social and economic im-

pacts, caused by increased population, would heavily affect Ashland.

All the alternatives, including the No-Action, would further diversify the economic base within the region. This trend is well established in Wyoming but would create a shift in economic base in Montana where agriculture has accounted for a significant part of the economic base to date.

HIGHLIGHTS

GEOLOGY AND OTHER MINERALS

Coal, oil and gas, and uranium in economic quantities exist within the region. Coal production would not generally interfere with extraction of other energy minerals due to land-use planning constraints that minimize resource development conflicts.

WATER RESOURCES

Impacts as a result of new federal leasing would be very small regionally. Loss of shallow local aquifers (the coal in many cases) is extensive and would reach 257,000 acres with the preferred alternative by 1990. Water from shallow aquifers is generally poor quality (3,000-5,000 mg/L DS) although water more suitable for human use is available and would be unaffected by the preferred alternative at the 1,000-1,600 foot level. Increased costs for greater pumping lifts and new well construction are associated with loss of shallow aquifers.

AIR QUALITY

Air pollution from mining and indirect development would be local and would not significantly affect air quality except in the vicinity of the coal lease tracts. Localized areas of impact would be near Colstrip and Decker, Montana, and throughout a 22-mile strip south of Gillette, Wyoming.

There are no significant impacts forecasted for the Ashland, Montana, area which adjoins the Class I air quality area on the Northern Cheyenne Indian Reservation.

SOILS, VEGETATION, AND RECLAMATION

Soils in the area are often shallow, although slopes are generally gradual on a rolling type terrain. Reclamation success has shown to be good (Packer, 1974), although some areas could require more intensive and costly management.

WILDLIFE

Leasing of all 19 tracts would have major affects on local populations of wildlife but minor affects on regional populations. Antelope would be affected heaviest south of Gillette, Wyoming, where existing mining facilities are restricting animal movement and disturbing habitat. Four hundred acres of crucial winter antelope habitat near Decker, Montana, would be lost. Populations of sharp-tailed and sage grouse would be impacted on a local basis.

CULTURAL RESOURCES

Federal and state regulations protect these resources. Historic and architectural resources on private lands may not be protected unless steps are taken by local governments and private citizens.

LAND USE

Lands within this region are administered and controlled by a variety of governmental jurisdiction, each of which exercises a different level of land-use planning, development, and resource-use control. Land ownership pattern is dominated (85 percent) by private surface ownership with federally controlled mineral estate (split-estate).

Land-use patterns are expected to shift from agriculture toward mining and urbanization without new federal coal leasing and implementation of the preferred alternative would change this very little. Forty-four ranch and farm operations would be affected. One operator would lose his total holdings and another would lose about 80 percent. All other operations would be affected to a lesser degree. Losses to the ranches that would be substantially affected would be offset by royalties or fees paid by the mines for the use of private land.

RECREATION

Funding for urban recreation facility construction and maintenance would be available. Dispersed recreational opportunities, such as camping and fishing, are restricted somewhat throughout the region and the quality of these experiences may be diminished even further because of the expected increase in population under Alternative 1 (No Action). New federal leasing would not appreciably affect dispersed recreation.

Most of the mining considered in this EIS would severely alter the landscape. These lands are not given a high visual resource classification and in most cases are seldom seen by persons not involved in mining. Thus, degradation of visual quality would not be obvious.

There are no areas of wilderness within the region. The wilderness areas that adjoin the region would be able to absorb the additional use anticipated by population growth.

TRANSPORTATION

Wyoming has adequate highway capacity to handle the increase in traffic volume. Required maintenance is expected to fall behind due to increased use by maximum-weight vehicles.

Montana's highway system is adequate in the Colstrip area but will require major upgrading in the Ashland/Decker areas. Highways of major concern include U.S. Highways 212 from Crow Agency to Ashland, and FAS 314 from Highway 212 to Decker.

Railroad traffic on the three main lines leaving the region would increase by 20 percent under the preferred alternative. This would equate to about 50 trains daily through Miles City, Montana, and about 100 each through Newcastle and Torrington, Wyoming.

SOCIOLOGY AND ECONOMICS

Increases in population are expected with or without new federal coal leasing. The fiscal impact to communities in Wyoming would not be significant. However, impacts to Montana communities, Ashland in particular, would be severe. Rosebud County would experience significant shortages of funds for county government and schools since the proposed mines are actually located across the county line in Powder River County. Most of these impacts could be mitigated but only through strong community commitment and assistance from both federal and state governments.

CHAPTER 1

PURPOSE AND NEED

INTRODUCTION

This chapter identifies the required authorizations, purpose and need for leasing within the region, review of program implementation within the region, other coal, issues and areas of concern identified through the environmental impact statement (EIS) scoping process, and tract ranking.

REQUIRED AUTHORIZATIONS

The development of federal coal resources is controlled by numerous laws and regulations imposed by federal and state authorities. Federal laws of foremost importance include the Federal Coal Leasing Amendments Act of 1976 (FCLAA), the Federal Land Policy and Management Act of 1976 (FLPMA) and the Surface Mining Control and Reclamation Act of 1977 (SMCRA).

The purpose of the FCLAA is to provide a more orderly procedure for the leasing and development of federally-owned coal than was set forth in its parent document, the Mineral Leasing Act of 1920.

FLPMA provides the BLM with a statutory framework for land-use planning on public lands and requires that BLM use the principles of multiple use and sustained yield, give priority to the protection of areas of critical environmental concern, consider present as well as future uses of public lands, and coordinate planning activities with those of federal and state agencies.

The SMCRA provides for state regulation of surface mining and reclamation on state and private lands as well as on federal lands under the terms of a cooperative agreement. Montana and Wyoming's programs for implementing the SMCRA have been approved by the Secretary of the Interior assuring that state regulations are as stringent or more stringent than federal regulation. In addition, cooperative agreements have been approved by both Montana and Wyoming, and the Department of the Interior. Thus, both states will have primary responsibility for assuring that standards are maintained for regulating surface mining and reclamation on federal, state, and private lands, and for assuring adequate protection from environmental impacts of surface mining. State regulations deal with such aspects as water and air pollution, land use, cultural and historic preservation, reclamation, wildlife and aquatic resources, and mine safety practices.

Each lease operator is required to submit a mining and reclamation plan that complies with Montana and Wyoming regulations and U.S. Geological Survey (USGS) rules (30 CFR 211) and which demonstrates that economic coal recovery is evaluated and that noncoal resources will be protected. Action on the mining and reclamation plan must be taken by the states and the Assistant Secretary for Energy and Minerals.

PURPOSE AND NEED FOR LEASING WITHIN THE REGION

In June 1979, the Secretary of the Interior adopted a new program for management of coal resources on federal lands. This program is fully described in the Final Environmental Impact Statement: Federal Coal Management Program, in the federal regulations (43 CFR 3400), and in Federal Coal Management Program-A Narrative Description. These documents are available from the Bureau of Land Management, Office of Coal Management, Department of the Interior, 18th and C Streets, N.W., Washington, D.C. 20240.

When the Secretary adopted this new coal program, he tentatively selected various leasing targets for the coal regions in terms of tons of federal coal reserves to be leased according to a selected schedule. The tonnages contained in these leasing targets were derived from Department of Energy (DOE) production goals.

Tract selection for the Powder River Region was conducted by the RCT at the January 21, 1981, meeting in Cheyenne, Wyoming. The Federal Coal Management Program calls for the selection of the EIS preferred alternative after the regional lease target level is named by the Secretary of the Interior. The RCT selects a grouping of specific tracts to meet the leasing level favored by the Secretary. This alternative then becomes the preferred alternative in the EIS. Other lease alternatives, above and below the preferred, are also selected by the RCT for EIS evaluation. Final lease decisions, and

which tracts will be offered, are made by the Secretary after completion of the EIS.

The Secretary may select, at his discretion, any combination of tracts analyzed in this EIS for final leasing. In the case of the Powder River Region, the production goal was set at 1.4-1.5 million tons. The preferred alternative as stated in this EIS meets the Secretaries production goal.

In the case of the Powder River Region, the final DOE production goals were not available to the RCT at the time of selection. Therefore, a secretarial decision naming a preferred leasing level had not been made. In order to maintain the project schedule, the RCT elected to make a selection of EIS alternatives they considered reasonable, but delay the identification of the preferred alternative.

The RCT, based on the information contained in the Tract Profiles (available from Casper District Office) and their knowledge of the development area, selected tracts that would produce specific development levels (new mining operations) in the region. They also elected to include eight tracts expected to be used for the extention of existing mining operations. Specific information on each tract within the alternatives selected by the RCT is shown on Table 1-1. A discussion of each alternative is included in Chapter 2.

REVIEW OF PROGRAM IMPLEMENTATION WITHIN THE REGION

The programmatic EIS, cited above, analyzed potential effects of alternative coal management programs (BLM, 1979b). In that same year the Secretary of the Interior selected the present Federal Coal Management Program (Secretarial Issue Document). Coal management regulations were developed and are contained in Title 43, Code of Federal Regulations, Group 3400 (43 CFR 3400). As part of his decision, the Secretary scheduled competitive coal lease sales in the Powder River Region for 1982 and 1984, and established tentative leasing target of 776 million tons for 1982.

Areas considered suitable for further consideration for coal leasing in this EIS were made available through land-use planning. The BLM, Casper District Office, Wyoming, provided a supplement to the 1977 Eastern Powder River Basin Management Framework Plan (MFP) in 1979 (Highlight Review Area Supplement), and amended that same MFP in 1980 (Gillette Review Area Amendment).

Montana tracts being considered were made available through land-use planning carried out by the BLM, Miles City District Office, Montana. The 1979 Powder River Resource Area MFP Update Report updated the 1977 MFPs for the Rosebud, Coalwood, and Decker-Birney planning units.

There may be a number of anticipated leasing actions that would take place in the future, in lease sales scheduled for 1984. The Department has determined it appropriate to state the information it now has regarding the status of these anticipated actions. One anticipated action involves federal coal located in the Hanging Woman Creek area of the Decker-Birney management framework planning area in Montana. AMOCO Minerals Company entered into agreements with Kendrick Cattle Company in 1977 regarding fee coal and surface over federal coal in this area. The fee coal reserves are insufficient to support a long-term operation, and AMOCO and Kendrick (the only affected surface owner) have expressed a strong interest in having the federal coal in the area offered for a lease sale. Because of this interest, an MFP amendment was completed in 1979 applying the unsuitability criteria. The Northern Plains Resource Council (NPRC) protested the final MFP amendment and application of the unsuitability criteria. The Montana State Director denied the protest and NPRC appealed. Due to the delay caused by consideration of this protest, the Director removed the areas covered by the protest from activity planning, and requested a new MFP amendment be prepared which would include, among other things, the exchange areas included in the No-Action Alternative, several mine extension areas, and areas of high industry interest, including Hanging Woman Creek. Coal lands found acceptable for further consideration would be scheduled for the 1984 lease sale.

The NPRC in affiliation with Tongue River Agricultural Protective, Rosebud Protective, and Tri-County Ranchers' associations filed a petition under Section 522 of SMCRA (Tongue River Petition, December 1980) alleging that certain lands in Rosebud and Powder River counties in Montana were unsuitable for surface coal mining. A Petition Evaluation Document is being prepared by OSM. The draft is scheduled to be available in September with public hearings scheduled for late October 1981. A decision is expected in late December, and distribution of the final document is scheduled for January 1982.

In addition to the planning being carried out in the Decker-Birney, Coalwood, and Rosebud planning units in Montana, planning is also being carried out in the Western Powder River Basin (Sheridan and Johnson counties), and the Recluse Review Area (northern Campbell County) in Wyoming. The Forest Service is amending its land-use plan for Thunder Basin National Grasslands in Wy-

oming. Areas found acceptable for further consideration from these planning efforts, plus those delineated tracts not sold in 1982, would be available for the scheduled 1984 coal lease sale in the region.

OTHER COAL

Public Law 95-554 dated October 30, 1978 directs the Secretary of the Interior to consider specific coal leases along Interstate 90 in Wyoming for exchange. Seven lease holders are affected by this public law. One lease holder, Texaco, was granted an exchange in 1980. Three applicants (Carter-Exxon, Gulf Oil Company, and Wyodak) will be assessed in this EIS under the No-Action Alternative. Site- specific environmental assessments (EAs) will be prepared at a later date. The remaining three I-90 exchange applicants (Belco, Big Horn, and Kerr-McGee) will be analyzed later.

There are 67 preference right lease applications (PRLAs) in Wyoming. The cumulative impacts (as depicted in the initial showings submitted by the applicants) of these are assessed under the No-Action Alternative. Site-specific EAs will be prepared on these PRLAs in 1982.

Public Law 96-401 authorizes and directs the Secretary of the Interior to negotiate a cancellation agreement between the Northern Cheyenne Indian Tribe and parties holding leases or permits on Indian land. An agreement would provide for issuance of a noncompetitive lease for lands adjacent to existing operations and/or issuance of a certificate of a coal lease bidding right for an amount equal to the investment made by each party. The deadline for an agreement on leases was November 1, 1980, and permits must be agreed upon by January 1, 1982. Peabody Coal Company is the only lessee (six leases) affected by this public law; they also hold three permits. A settlement agreement was made between the Northern Cheyenne and Peabody on October 20, 1980, for a noncompetitive lease on lands in Rosebud County, Montana, called the Greenleaf-Miller project, which is included in the No-Action Alternative. Five parties hold the remaining eight permits. AMAX (holding three permits) is negotiating for lands adjacent to their Eagle Butte Mine or one of two areas adjacent to the Belle Ayr Mine, Campbell County, Wyoming. Consolidation Coal Company (CONSOL) (holding one permit) is seeking lands adjacent to its CX Ranch property, Big Horn County, Montana. Chevron Oil Company (holding one permit) is negotiating with CONSOL for a percentage of CX Ranch and will request lands adjacent to that lease. Negotiations have not begun with the remaining permit holders--Bruce L. Ennis, and Norsworthy and Reger, Inc.

There are substantial amounts of economic coal reserves on the Crow and Northern Cheyenne Indian reservations available for leasing at each tribe's discretion.

The anticipated production from Youngs Creek Mine owned by Shell Oil Company located in Big Horn County on the Crow Indian Reservation was inadvertently left out of the No-Action Alternative (baseline). An EIS has been prepared, and coal production is projected at 4.0 million tons in 1985.

Energy production within the region is at an all-time high and rapid growth is occurring. Oil and gas exploration is proceeding at record setting levels. Feasibility studies for additional coal-fired power plants are being conducted by companies such as Tri-State Electric and Black Hills Power and Light. Construction contracts are nearing completion for a second Wyodak power plant operated by Black Hills Power and Light. Uranium exploration and production has taken a down turn and the near-term market remains uncertain.

Feasibility or permitting studies are in progress on synthetic fuel production processes including synthetic gas production and liquefaction of gasoline from coal. Most notable of this group include WyCoalGas, Mobil's liquefaction process, the Hampshire syn-gas project, and ARCO's in situ gasification project.

Energy Transportation Systems Incorporated's (ETSI) coal slurry pipeline is scheduled for completion in 1984. Coal for the pipeline will be supplied by the Ft. Union and Jacob's Ranch mines, which are in production. There is no indication that coal from new federal coal leasing would be transported by the ETSI coal slurry pipeline.

ISSUES AND AREAS OF CONCERN

A notice of intent (NOI) to prepare this EIS appeared in the *Federal Register* on October 30, 1980. This NOI sought public participation in determining the scope and significant issues to be analyzed. The NOI also announced that public meetings would be held in the areas that would be directly affected.

News releases and cards announcing the public meetings were distributed. Public meetings were held the first week in December 1980 at Douglas, Gillette, and Sheridan, Wyoming; Ashland and Col-

strip, Montana. Those attending were from industry, state, county and federal agencies, news media, and the general public. Letters requesting the public to participate were mailed prior to the meetings. Self-addressed, stamped comment cards and descriptions of the preliminary tracts were enclosed with the letters, and also handed out at the public meetings.

The majority of concerns expressed through the scoping process focused on impacts to water resources, air quality, socio-economics, and transportation. Concern was also expressed over the reclamation of the lands after mining. Several comments were made by the public stating the beneficial aspects of mining more coal, especially the increase in jobs. Property owners residing at Nickelson Little Farms, a subdivision northeast of the Rocky Butte tract, were concerned over the mining disturbances. A 1¼ mile buffer was established southwest of the subdivision by re-delineating the tract. Records of the scoping process are available for review at the Casper District Office.

TRACT RANKING

The RCT used the information presented in the Tract Profiles (BLM, 1981) to develop the tract ranking factors in the general categories of coal, environmental, and socio-economic data. Ranking factors within these categories are presented in Table 1-2.

These factors were used by the RCT to rank the tracts into low, medium, and high categories of desirability for leasing. Table 1-3 presents the results of the ranking of the tracts.

A detailed discussion of the ranking and selection processes is contained in the minutes of the RCT meetings held in January and March, which are available at the BLM Wyoming State Office in Cheyenne.

TABLE 1-1
COAL DATA

Tracts	Coal Ownership (Acres) a/					Reserves (Million Tons) b/							
Maintenance Tracts	Federal Uncommitted	Federal Leased	State	Private	Total	Reserve Base (Million Tons) Federal Uncommitted	Federal Uncommitted	Federal Leased	State	Private	Total	Percent Recovery	Yearly Prod. (Million Tons)
Colstrip A&B c/	1,632	2,240	280	3,613	7,765	65	36	59	2	56	153	90	7.8
Colstrip C c/	853	1,586	640	3,604	6,683	22	19	48	14	85	166	90	5.5
Colstrip D c/	2,300	0	0	2,811	5,111	48	43	0	0	54	97	90	3.4
Fortin Draw	320	0	0	0	320	50	45	0	0	0	45	90	5.0
Little Rawhide Creek	491	0	0	0	491	99	90	0	0	0	90	90	18.0
North Decker	2,050	1,850	0	0	3,900	77	69	67	0	0	136	90	3.0
Spring Creek	650	2,365	640	0	3,655	39	35	283	37	0	355	90	7.0
West Decker	40	3,040	640	0	3,720	6	5	143	36	0	184	90	6.1
Totals	8,336	11,081	2,200	10,028	31,645	406	342	600	89	195	1,226		55.8
New Production Tracts													
Ashland (Coalwood) d/	3,129	0	400	3,326	6,855	265	239	0	11	168	418	90	10.4
Cook Mountain e/	2,097	0	80	1,391	3,568	198	178	0	0	76	254	90	6.4
Coal Creek e/	1,032	0	320	1,935	3,287	67	60	0	11	93	164	90	4.1
Ashland (Decker-Birney)	1,949	0	640	2,939	5,528	132	119	0	56	203	378	90	9.1
Duck Nest Creek	2,642	0	0	398	3,040	351	316	0	0	49	365	90	12.0

Table 1-1 concluded

Tracts	Coal Ownership (Acres) a/					Reserves (Million Tons) b/							
New Production Tracts	Federal Uncommitted	Federal Leased	State	Private	Total	Reserve Base (Million Tons) Federal Uncommitted	Federal Uncommitted	Federal Leased	State	Private	Total	Percent Recovery	Yearly Prod. (Million Tons)
Northwest Otter Creek	1,311	0	640	3,484	5,435	154	139	0	62	210	411	90	10.3
Rocky Butte	4,874	0	240	40	5,154	494	445	0	24	3	462	90	15.4
Southwest Otter Creek	1,881	0	1,185	4,344	7,410	144	130	0	50	219	399	90	10.0
Spring Draw	4,608	0	641	40	5,289	451	383	0	42	3	428	85	14.3
Timber Creek	4,339	0	0	400	4,739	216	184	0	0	8	192	85	6.4
Kintz Creek	3,288	0	654	0	3,942	214	193	0	50	0	243	90	8.1
Keeline	3,327	0	600	0	3,927	194	174	0	29	0	203	90	6.8
Totals	31,348	0	5,000	14,971	51,319	2,615	2,321	0	314	864	3,499		102.9

a/ Acreage figures derived from master title plates.
b/ Tonnage figures received from USGS.
c/ Tonnage for the Rosebud Bed only.
d/ Tract not added into totals.
e/ Part of Ashland (Coalwood) tract.

TABLE 1-2
RANKING FACTORS

Coal Data	Environmental Data	Socio-economic Data
Economic Viability	Wildlife Habitat	Disruption of Family Farms/Ranches
Expansion of Existing Mines	Reclamation Potential	Changes to Agricultural Productivity
Land Pattern (Including State Lands)	Oil and Gas Development	Changes to Rural Quality of Life
	Air Quality	Changes to Communities & Local Services
	Cultural & Historic Values	Conflict With Other State/Local Development Plans

TABLE 1-3
TRACT RANKING

Tract	Ranking **			
	Coal	Env	S/E	Overall
Wyoming:				
Little Rawhide*	H	H	H	H
Duck Nest Creek*	H	H	H	H
Fortin Draw*	H	H	H	H
Rocky Butte*	H	M	M	H-M
Timber Creek*	H	M	H	H-M
Keeline*	H	H-M	H	H-M
Mt. Logan	H	M	M	M
Kintz Creek*	H	H-M	H	H-M
Wildcat	M	M	M	M
Calf Creek	M	M	M	M
Hay Creek	M	M	M	M
Spring Draw*	M	M	M	M
Rock Pile	M	L	M	L-M
Montana:				
Colstrip A&B*	H	M	M-H	H
Colstrip C*	M	M	M-H	H
Colstrip D*	M-H	M	M-H	H
Spring Creek*	H	M-H	H	H
North Decker*	M-H	M-H	M	H
West Decker*	H	H	M	H
Cook Mountain*	M-H	L-M	L	M
Coal Creek*	M-H	L-M	L-M	M
Ashland (Decker-Birney)*	M-H	L-M	L	M
Northwest Otter Creek*	H	L-M	L	M
Southwest Otter Creek*	M-H	L-M	L	M

H - High; M - Medium; L - Low Categories of desirability of leasing.
Env - Environmental
S/E - Socio-economic

* Tracts selected for the 1982 lease sale.

** As recommended by the RCT October 2, 1981.

CHAPTER 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

INTRODUCTION

This chapter describes the environmental impacts of three leasing alternatives and no action based on information and analyses described in Chapter 4. Site-specific analysis of the tracts included may be found in the individual Tract Profiles (BLM, 1981). Location of the tracts and interrelated projects are identified on the Regional Activity map. Alternatives as described, combined with the affected environment from Chapter 3, serves as the base for analysis in Chapter 4.

The Duck Nest Creek Tract, as described in the Tract Profile, was originally delineated as a maintenance tract; however, the large amount of coal reserves contained in the tract and the indication that the tract would cause an increase in annual production persuaded the RCT to require that the tract be analyzed in the EIS as a competitive tract. In addition, Spring Draw and Duck Nest Creek have actions of note that apply to them. Carter-Exxon, through I-90 exchange procedures, applied for 560 acres and about 43 million tons of recoverable coal in the Spring Draw tract. Shell, which also has interest in the Spring Draw tract, asked that the acreage not be deleted from the tract until the decision whether or not to lease the tract competitively was made. The RCT granted Shell this request. AMAX is negotiating with the Department for a noncompetitive lease in the northern part of Duck Nest Creek, containing 135 million tons of coal, under the provisions stated in Public Law 96-401.

In the interest of presenting a clear comparison of alternatives, we have limited the resource disciplines to water, air quality, reclamation, railroad transportation, sociology, and economics in this chapter. These resource components were identified through the scoping process as of major interest to the public. Detailed analyses of impacts to all affected resources may be found in Chapter 4. Cumulative environmental impacts are summarized in Table 2-1.

The alternatives are directed toward leasing various combinations of tracts to make specific tonnages of coal available for production. For analytical purposes it is assumed in each alternative that all tracts offered will be leased and, further, that they will be mined in the time frame covered by this analysis. However, it is recognized that in reality coal production will generally be governed by market demand, unless artificially constrained or encouraged. Over-leasing is not expected to drive coal production past market demand but will provide industry with a selection of tracts from which to produce. This will both compensate for any uncertainties in the base and encourage competition. Thus, the impact analysis for Alternative 4 represents a worst-case situation. The relationship between the leasing alternatives and the DOE projections are shown in Figure 2-1.

ASSUMPTIONS

The following assumptions were made to facilitate analysis of the environmental impacts of mining and coal-related developments considered in this EIS.

1) All relevant state and federal laws and regulations pertaining to coal mining and related activities will be followed and enforced. The most important of these are: Office of Surface Mining (OSM) Reclamation and Enforcement regulations (30 CFR parts 700-899), Environmental Protection Agency (EPA) regulations (40 CFR parts 0-1399), Department of the Interior's Coal Management Program regulations (43 CFR parts 23 and 3400 and 30 CFR part 211), 36 CFR 800, Montana Department of State Lands, and Wyoming Department of Environmental Quality (DEQ) regulations. It is recognized that while enforcement and observance of laws and regulations is fundamental, there may be emergency situations or cases of enforcement failure.

2) Counties which would receive the majority of impacts would be Powder River and Rosebud in Montana, and Campbell in Wyoming. In Montana, 40 percent of the socio-economic impacts would occur in Powder River County and 60 percent in Rosebud County.

3) Existing and proposed mines, and mines resulting from noncompetitive leases and PRLAs would be in production by 1990.

4) The maintenance tracts included in Alternatives 2, 3, and 4 would add to the mine life of the adjacent, existing mines rather than increase annual production.

5) State and privately owned coal included or adjoining federal lease tracts would be developed simultaneously with federal coal.

6) Coal production figures are recoverable reserves based on an 85 to 90 percent recovery rate.

7) Coal produced will be strip-mined and transported from the region by railroad.

8) Active mine life would be 40 years in Montana and 30 years in Wyoming.

9) A 3-year period (1982-1985) for mine and reclamation plan development and approval would follow leasing. During this time further information on cultural resources would be collected, and a permit obtained for surface mining. Facilities construction would require 2 years (1986 and 1987); the resulting mine would be in full production by 1990.

10) Reclamation will proceed concurrently with mining operations.

11) Lands used for housing or public facilities will not be reclaimed.

12) Postmining land use would be the same as the premining use, except for the lands used for housing, public facilities, transportation rights-of-way, and permanent changes due to development.

ALTERNATIVE 1

No new federal leasing would occur under this alternative. Annual production from the region will be from the 1979 level of 81 million tons of annual production to an estimated 369 million tons in the target year of 1990. While the yearly production would increase 359 percent without new federal leasing, it still would not generate the annual production required to meet the anticipated 1990 shortfall of 40.6 million tons based on the DOE high production goal. Table 2-2 shows coal development for the region under this alternative. Coal employment would reach 3,215 in Montana and 12,300 in Wyoming.

WATER RESOURCES

Water use would be about 600,000 acre-feet per year by 1990. Major uses would be for irrigation, 420,000 (unchanged from 1980); power plants, 46,000; municiple use, 34,500; uranium mining and milling, 14,320; and coal mining 7,430 acre-feet per year. New water uses anticipated include 20,200 acre-feet per year for coal slurry and 8,000 acre-feet per year for a synfuel plant.

Ground Water

Shallow aquifers would be removed in an area of approximately 210,000 acres by existing and projected mining operations. Existing mines would remove 67,000 acres of this total. Coal mining would remove about 95 percent of the affected acres.

Approximately 250 existing wells and 25 springs on the mine sites would be destroyed, but wells usually can be replaced by tapping deeper aquifers or with wells in spoil aquifers. Springs may eventually reappear, but would be in different locations.

Impacts of coal mining on ground water are restricted to an area within a few miles from the mine site. Water levels in wells near the mine would be lowered during mining but would return to near premining levels after the site is restored. Recharge would probably increase in many areas because the postmining slope of the land surface would be less steep and reclamation practices to retain moisture and prevent erosion would increase infiltration. Shale layers that may have caused springs and seeps would be destroyed; however, the increased infiltration may cause increased ground-water inflow to streams or the creation of new springs and seeps near the mine site.

Surface Water

The major sources of surface water would involve water originating outside the region; the power plants and synfuels operation would use water from the Yellowstone and North Platte rivers, respectively. The interception and use of water in mining operations and water consumption by the increased population would reduce the surface outflow from the region by about 4,500 acre-feet per year (0.5 percent) during mining. This reduction in surface outflow would be too small to measure, except possibly in the Belle Fourche River below Moorcroft, Wyoming, where flow might be reduced about 3.5 percent (Table 4-2). The flow of the Yellowstone River would be reduced about 0.3 percent; the North Platte River about 0.7 percent.

Although the quantity of water lost is less than 500 acre-feet, the loss of approximately 84 point-watering sources would be a deterrent to the use of the areas by wildlife and livestock until water sources are restored.

The dissolved-solids (DS) concentrations of streams may increase as a result of leaching from coal spoils and increased sewage effluent. The greatest potential increase in DS concentrations would range from 0.02 percent in Otter Creek to about 5 percent in the Belle Fourche River (Table 4-2). Increased DS concentrations resulting from increased sewage effluent would be about 0.5 percent in Goose Creek and 0.07 percent in the Tongue and North Platte rivers by 1990. The increases in DS concentrations would be long-term but would have no significant impact on current uses of the water or on aquatic biology downstream. The DS concentrations of the Yellowstone and North Platte rivers would be increased about 0.1 percent or less.

AIR QUALITY

Regional changes in air quality would be insignificant as a result of coal exchanges, PRLAs, uranium mining, power plants, and population increases resulting from these activities. However, the impacts would be significant in the near vicinity of each mine (generally within 1 mile of the individual mine boundary). Estimates of total suspended particulates (TSP), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2) emissions were calculated for mines, cities, major roadways, and major point sources. By 1995 in the impact areas, an estimated 69,300 tons of particulates would be generated annually by the existing coal mines.

SOILS, VEGETATION, AND RECLAMATION

The success of reclamation and revegetation would depend on the nature of the mine site and the specifics of the mine and reclamation plan. Reclamation success has shown to be good (Packer, 1974), although some areas could require more intensive and costly management. A total of 210,000 acres would be reclaimed.

TRANSPORTATION

Railroads

Appendix F (Figure F-3), and Table 4-6 show the trains per day (TPD) for this alternative. It should be noted that these are estimates based on potential production increases; actual number of trains would depend upon contracts and coal demand. Other factors that could affect the number of coal trains are the proposed coal slurry pipeline and the proposed Chicago Northwestern/Union Pacific Line from Crandall, Wyoming, to Lyman, Nebraska. These factors may also change coal destination and the route of the unit train. Capacity of the lines that would be affected is well above the existing TPD rates. The capacity could be increased by installation of additional sidings, tracks, centralized traffic control, and other systems (personal communication, Peter Briggs, Burlington Northern, 1981). Appendix F (Figure F-4) shows interruptions for at-grade crossings.

Proposed railroad lines and spurs would add approximately 340 miles of railroad lines, which would include the proposed Tongue River Railroad, the proposed Chicago and Northwestern/Union Pacific Line, the proposed WyCoalGas Electric Line, and estimated lengths of access railroad spurs to new mines and PRLAs. Only the proposed Chicago Northwestern/Union Pacific Line would have an affect on train traffic on Burlington Northern (BN) lines leaving the region.

The Tongue River Railroad has not been constructed although definite plans have been prepared. The mining and reclamation plan for the Montco-Nance coal mine south of Ashland estimates coal production in 1985. The coal would be moved on the Tongue River Railroad. Impacts from the railroad will occur prior to those related to this round of coal leasing. It is assumed that these impacts will be assessed in an objective, comprehensive environmental impact statement being prepared by the Interstate Commerce Commission.

Based on these facts, and because BLM has no authority to assess impacts from transportation routes, no further analysis of the railroad is made in the EIS.

Table 4-6 gives a breakdown of TDP and at-grade crossing effects for Miles City, Montana (Northern Route); Gillette and Newcastle, Wyoming (Central Route); and Torrington, Wyoming (Southern Route).

SOCIOLOGY

Community Services and Facilities

Rosebud would be the most affected county in Montana under this alternative requiring 7 additional law officers, 67 teachers, 1 physician, 2 dentists,

and 13 hospital beds by 1990. Additional population is not expected in Powder River County without additional federal leasings; however, because there is presently no hospital in the county, a need will exist for hospital capacity of 10 beds, based on a standard requirement of 4 beds per 1,000 population (See Table 4-8).

Additional requirements by 1990 for Campbell County would be 53 law officers, 394 teachers, 19 physicians, 5 dentists and 29 hospital beds. Natrona County additional requirements are 26 law officers, 201 teachers, 20 physicians, 8 dentists, and 58 hospital beds (see Table 4-8).

Housing

Counties requiring a significant level of additional housing without new federal leasing would be Big Horn: 1,333; Rosebud: 1,813; and Campbell: 8,650 (Table 4-9).

ECONOMICS

Table 2-3 summarizes the possible 1990 budget levels for the counties, schools and towns that would be impacted most heavily by additional federal leasing. For a wider perspective of the region see Table 4-12. It is assumed that the budgets that would exist without additional leasing would be balanced through taxation, user fees, grants, or debt.

The exact magnitude of potential deficits or surpluses should not be overemphasized. The importance of the magnitudes derives only from their ability to provide a comparison of the relative impacts and to point out where potential costs may exceed potential benefits, or vice-versa, where potential benefits may exceed potential costs. Assumptions and methodology are implicit in the footnotes to the table.

The unincorporated community of Ashland would receive the heaviest population impacts within the region. The population in Ashland is projected to be 800 in 1990 without additional leasing in the region.

ALTERNATIVE 2

Table 1-1 shows acres of coal ownership and reserves for the maintenance and new production tracts. Table 2-4 shows coal tracts and recoverable reserves by alternative.

Under Alternative 2, Interior would lease 1.5 billion tons of recoverable coal reserves on 13 competitive lease tracts, eight of which would be used to extend the life of existing mining operations (production maintenance). Five new mining operations producing 46.2 million tons of annual production above baseline levels will result from leasing of this alternative. Based on mine life assumptions, this would support an annual production of about 421 million tons by 1990. Leasing at this level will satisfy the DOE annual production shortfall of 40.6 million tons.

Subalternatives apply entirely to the Ashland (Coalwood) tract or the two parts of this tract called Cook Mountain and Coal Creek. This format became necessary when the RCT requested delineation and a separate detailed analysis of the Cook Mountain and Coal Creek tracts in March 1981.

Assessment for Alternative 2 was based on worst-case, which is Subalternative 2A. However, impacts are not noticeably different between the subalternatives within any of the resource components, except economics (see Economics section). The largest increase in coal employment would bring total coal employment to 3,985 in Montana and 13,300 in Wyoming.

SUBALTERNATIVE 2A

This subalternative considers leasing the maintenance tracts (Colstrip A&B, Colstrip C, Colstrip D, West Decker, North Decker, Spring Creek, Little Rawhide Creek, and Fortin Draw), Ashland (Coalwood), Northwest Otter Creek, Timber Creek, Duck Nest Creek, and Spring Draw. Maintenance tracts are adjacent to existing mines (Colstrip, Decker, Spring Creek, Eagle Butte, and Wyodak). These tracts contain smaller coal reserves than the competitive tracts and it is reasonable to assume that existing mines would acquire these leases. Coal production would reach 421 million tons annually within the region. Approximately 267,000 acres would be disturbed by mining within the region. The Ashland (Coalwood) tract would be considered for large or small business leasing. Timber Creek tract would be considered for small business development.

SUBALTERNATIVE 2B

This subalternative includes the maintenace tracts listed in Subalternative 2A, Coal Creek,

Northwest Otter Creek, Timber Creek, Duck Nest Creek, and Spring Draw. Coal production would reach 415 million tons annually. Approximately 264,000 acres would be disturbed by mining within the region. The Coal Creek tract (the smaller part of Ashland (Coalwood)) would be considered for leasing to small business.

SUBALTERNATIVE 2C

In addition to the maintenance tracts described in Subalternative 2A this subalternative also includes Cook Mountain, Coal Creek, Northwest Otter Creek, Timber Creek, Duck Nest Creek, and Spring Draw. Coal production would reach 421 million tons annually. Approximately 267,000 acres would be disturbed by mining within the region. The Ashland (Coalwood) tract would be divided and leased as the Cook Mountain and Coal Creek tracts. Cook Mountain would be a large business lease and Coal Creek a small business lease.

WATER RESOURCES

Ground Water

Impacts on ground water resources under this alternative would add to those under Alternative 1; however, the increased coal production would cause little conflict with other uses of ground water.

Coal mining for this alternative would consume 925 acre-feet of water per year; however, most of this water would be supplied by rainfall on the mine area and ground water seepage into the pit. Forty-seven wells would be destroyed, including 28 stock and wildlife wells, 12 domestic wells, and 7 wells not currently in use. About 58 wells near the tracts would be impacted to varying degrees but would not be destroyed. The destroyed wells could be replaced at approximately their original depth in the soil aquifer after reclamation, but the quality of the water would be poorer in most cases (3,000-5,000 mg/L average). Better quality water would be obtained at greater depths in most areas, but the static water levels in the deeper wells would be lower and pumping lifts would be greater.

Eight small springs would be destroyed thus reducing water available for stock and wildlife. These water supplies could be replaced by wells 200 to 300 feet deep equipped with windmills but would result in additional expense to install and maintain the wells and equipment.

Approximately 35,000 acres of shallow aquifer would be removed to depths of 100 to 400 feet and would eventually be replaced by spoil aquifers. The quality of the water in the spoil aquifers would be poorer (DS increase by a factor of 2 to 3) than the original aquifers but would be adequate for stock and wildlife (3,000-5,000 mg/L DS). The quality would be inadequate for domestic use, but better quality water is available at depths of 600 to 1,300 feet.

Population increase associated with this alternative would require 1,400 acre-feet of water. Most of the people would live in nearby towns and municipal water use would increase by about 4 percent. This increase would not have significant impact on the region as a whole, but could have considerable impact on Broadus, Ashland, and Gillette, since it is anticipated that these towns would have the largest increases in population.

Surface Water

Surface outflow from the region would be reduced by about 350 acre-feet per year (0.05 percent) during mining. The greatest effect would be in Otter Creek at Ashland, Montana, where flow might be reduced 1.3 percent (Table 4-2). Twenty point-watering sources would be destroyed but the quantity of water lost would be insignificant. However, the loss of point-watering sources would be a temporary deterrent to the use of the areas by wildlife and livestock.

The potential increase in DS concentrations in streams would range from 0.1 percent in Rosebud Creek to 4.0 percent in Armells Creek (Table 4-2). However, these increases would have no significant impact on current uses of the water or on aquatic biology downstream and no measurable affect on the salinity of the Yellowstone River.

AIR QUALITY

TSP levels would increase significantly on a localized basis. About 4,800 tons per year would be added to the Colstrip area (however this increase would be effectively offset by the completion of mining at other locations within the area), 2,200 tons per year to the Decker area, 2,900 tons per year to the Custer National Forest, and 5,500 tons per year to the Gillette area. Some potential exists for violations of National and State Ambient Air Quality Standards (NAAQS) and Prevention of Significant Deterioration (PSD) standards near existing and proposed mines. Population and transportation

emissions would cause increases of 70 percent above existing levels in the Custer National Forest and 5 percent in the Gillette area.

SOILS, VEGETATION, AND RECLAMATION

A total of 267,400 acres would need to be reclaimed which is 57,400 acres more than the baseline.

TRANSPORTATION

Railroads

Approximately 6 miles of new railroad spur would be needed. Appendix F (Figure F-3), and Table 4-6 show TPD and train interruptions for at-grade crossings.

SOCIOLOGY

Community Services and Facilities

Additional requirements to Rosebud and Powder River counties over 1990 baseline would be very similiar. These requirements are law officers: 2, 2; teachers: 23, 21; physicians 1, 1; dentists: 1, 1; and hospital beds: 4, 5; respectively (Table 4-8).

Campbell County would receive all major impacts in Wyoming with the additional requirements over 1990 baseline as follows: law officers: 6; teachers: 39; physician: 2; dentist: 1; and hospital beds: 3 (Table 4-8).

These additional requirements would be the same for Alternative 3.

Housing

Additional housing requirements in Powder River County would be 500; 280 of this amount would be located in the town of Broadus. Rosebud County would require 750 additional dwellings, which would all be located in the Ashland district. Campbell County would require 900 additional dwellings; 460 would be located in Gillette (see Table 4-9). These additional requirements would be the same for Alternative 3.

ECONOMICS

The fiscal impacts of Alternatives 2 and 3 would be the same. See Table 2-3. A negative balance in the table implies the potential of a budget deficit that would require tax levies or charges for services. The potential for budget deficits in Powder River and Rosebud counties would be least under Subalternative 2B or 3B.

Alternative 2 or 3 would add about 1,700 to Ashland's projected 1990 population of 800. Subalternative 2B or 3B would add about 1,200.

Agricultural Impacts

The impacts to agricultural economics under Alternative 2, 3, and 4 are considered insignificant. Tables G-1 and G-2 in Appendix G contain the logic and methodology used in arriving at that conclusion for the Montana Region. The Tract Profiles for the Wyoming tracts contain the analysis that leads to that conclusion for the Wyoming tracts.

ALTERNATIVE 3

Under this alternative 1.5 billion tons of recoverable coal reserves would be leased on 14 competitive lease tracts, eight of which are considered production maintenance. Six new mining operations producing 50.3 million tons of annual production above baseline levels will result from leasing of this alternative. Based on mine life assumptions, this would support an annual production of 422 million tons by 1990. Leasing at this level will satisfy the DOE annual production shortfall of 40.6 million tons.

Subalternatives apply entirely to the Ashland (Coalwood) tract or the two parts of this tract called Cook Mountain and Coal Creek. This format became necessary when the RCT requested delineation and a separate detailed analysis of the Cook Mountain and Coal Creek tracts in March 1981.

Assessment for Alternative 3 was based on worst-case, which is Subalternative 3A. However, impacts are not noticeably different between the subalternatives within any of the resource components, except economics (see Economics section). Employment increases under the alternative would be the same as under Alternative 2.

Subalternative 3C has been selected as the RCT's preferred alternative.

SUBALTERNATIVE 3A

This subalternative considers leasing the maintenance tracts described under Subalternative 2A, Ashland (Coalwood), Northwest Otter Creek, Timber Creek, Duck Nest Creek, Kintz Creek, and Keeline tracts. Coal production would reach about 422 million tons under this subalternative. Acreage disturbed would be about 274,000 acres regionally. This subalternative is the same as 2A in Montana but substitutes Kintz Creek and Keeline tracts for Spring Draw in Wyoming. Kintz Creek would be leased for large business development and Keeline would be a small business lease.

SUBALTERNATIVE 3B

This subalternative includes the maintenance tracts described in Subalternative 2A, Coal Creek, Northwest Otter Creek, Timber Creek, Duck Nest Creek, Kintz Creek, and Keeline tracts. Coal production would reach about 415 million tons annually with this subalternative. Acreage disturbed would be about 271,000 acres regionally.

SUBALTERNATIVE 3C

This subalternative includes the maintenance tracts described in Subalternative 2A, Cook Mountain, Coal Creek, Northwest Otter Creek, Timber Creek, Duck Nest Creek, Kintz Creek, and Keeline tracts. Coal production would reach about 422 million tons under this subalternative. Acreage disturbed would be about 274,000 acres regionally.

WATER RESOURCES

Ground Water

Annual water use for coal mining would be about 880 acre-feet and municipal use about 1,400 acre-feet. About 49 wells would be destroyed, including 34 stock and wildlife wells, eight domestic wells and nine wells not currently in use. About 60 wells would be impacted to varying degrees but would not be destroyed.

Approximately 37,000 acres of shallow aquifers would be removed to depths of 100 to 400 feet but would eventually be replaced by spoil aquifers.

Surface Water

Impacts to surface water under this alternative are the same as those described under Alternative 2.

AIR QUALITY

TSP levels would increase significantly on a localized basis. About 4,800 tons per year would be added to the Colstrip area (however this increase would be effectively offset by the completion of mining at other locations within the area), 2,200 tons per year to the Decker area, 2,500 tons per year to the Custer National Forest area, and 6,900 tons per year to the Gillette area. Some potential exists for violations of NAAQS and PSD standards near existing and proposed mines. Population and transportation emissions would cause increases of 70 percent above existing levels in the Custer National Forest and 5 percent in the Gillette area.

SOILS, VEGETATION, AND RECLAMATION

A total of 274,200 acres would need to be reclaimed which is 64,200 acres more than the baseline.

TRANSPORTATION

Railroads

Impacts to the railroads would be the same as Alternative 2 except for TPD and at-grade crossing effects for Torrington, Wyoming (see Table 4-6).

SOCIOLOGY

Impacts to community services and facilities, and housing are the same as described in Alternative 2.

ECONOMICS

The fiscal impacts of Alternatives 2 and 3 would be the same, as well as the increases to Ashland's population. See Table 2-3 and the Economics section under Alternative 2.

ALTERNATIVE 4

This alternative includes the maintenance tracts described in Subalternative 2A, Cook Mountain, Coal Creek, Ashland (Decker-Birney), Northwest Otter Creek, Southwest Otter Creek, Rocky Butte, Kintz Creek, Keeline, Timber Creek, Duck Nest Creek, and Spring Draw.

This is the maximum leasing alternative being evaluated in the EIS. Under this alternative 2.6 billion tons of federal recoverable coal reserves would be leased on 19 competitive lease tracts, eight of which are considered production maintenance. Eleven new mining operations producing 89.9 million tons annually above baseline levels will result from leasing of this alternative. Based on mine life assumptions, this would support an annual production of about 470 million tons by 1990. Leasing at this level will double the DOE annual production shortfall of 40.6 million tons. Employment associated with coal production would reach about 4,675 in Montana and 14,300 in Wyoming. Acres disturbed by mining would be approximately 293,000 acres regionally.

As indicated earlier, the following impact analyses assume that all coal offered will be leased and mined on schedule. However, it should be noted that possible production under this alternative (467 million tons per year) exceeds DOE's 1990 high production goal (412 million tons per year). Production approximating DOE's high goal would result in impacts similar in type and severity to those described under Alternatives 2 and 3 rather than those presented below.

WATER RESOURCES

Ground Water

Increased coal production at this level would have more impact on the ground water resources than any of the other new leasing alternatives, but the regional impact would still be small and would cause little conflict with other uses of ground water.

Coal mining for this alternative would consume 1,920 acre-feet of water per year. However, most of the water would be supplied by rainfall on the mine area and ground water seepage into the pit. One hundred wells would be destroyed, including 60 stock and wildlife wells, 16 domestic wells, one industrial well (oil flooding), and 23 wells not currently in use. An additional 81 wells would be impacted to varying degrees but would not be destroyed. The destroyed wells could be replaced at approximately their original depth in the spoil aquifer after reclamation, but the quality of the water would be poorer (DS increase by a factor of 2 to 3). In most of the area better quality water (1,000 to 3,000 mg/L dissolved solids) can be obtained at greater depths but the static water level in the deeper wells would be lower and pumping lifts would be greater (BLM, 1979a).

Ten small springs would be destroyed and would not be re-established after reclamation, thus reducing water available for stock and wildlife. These water supplies could be replaced by wells 200 to 300 feet deep equipped with windmills; however, there would be expense to install and maintain wells and equipment.

Approximately 60,000 acres of shallow aquifer would be removed to depths of 100 to 400 feet and would eventually be replaced by spoil aquifers. The quality of the water in the spoil aquifers would be poorer (3,000 to 5,000 mg/L dissolved solids) but adequate for stock and wildlife. The quality would be inadequate for domestic use, but better quality water (1,000 to 3,000 mg/L dissolved solids) usually is available at depths of 400 to 1,300 feet.

The increase in population would require 2,700 acre-feet of water. Most of the persons would live in nearby towns and their water demands would increase municipal use about 8 percent. This amount would not have significant impact on the region as a whole, but could have significant impact on Ashland, Broadus, and Gillette since it is anticipated these towns would have the largest increase in population.

Surface Water

Surface outflow from the region would be reduced by about 700 acre-feet per year (0.1 percent) during mining. The greatest affect would be in Otter Creek at Ashland, Montana, where flow would be reduced 2.7 percent (Table 4-2). About 33 point-watering sources would be destroyed but the quantity of water lost would be insignificant. However, the loss of point-watering sources would be a temporary deterrent to the use of the areas by wildlife and livestock.

The potential increase in DS concentrations in streams would range from 0.1 percent in Rosebud Creek to 4.0 percent in Armells Creek (Table 4-2). However, these increases would have no significant impact on current uses of the water or on aquatic biology downstream and no measurable effect on the salinity of the Yellowstone River.

AIR QUALITY

TSP levels would increase significantly on a localized basis. About 4,800 tons per year would be added to the Colstrip area, (however this increase would be effectively offset by the completion of mining at other locations within the area), 2,200 tons per year to the Decker area, 6,500 tons per year to the Custer National Forest area, and 11,900 tons per year to the Gillette area. Some potential exists for violations of NAAQS and PSD standards near existing and proposed mines. Population and transportation emissions would cause increases of 139 percent in the Custer National Forest area and 5 percent in the Gillette area.

SOILS, VEGETATION, AND RECLAMATION

A total of 293,500 acres would need to be reclaimed which is 83,500 acres more than the baseline.

TRANSPORTATION

Railroads

Railroad spurs needed to serve mine facilities would add approximately 30 miles of new railroad lines. Appendix F (Figures F-3 and F-4), and Table 4-6 show TPD and at-grade crossing effects.

SOCIOLOGY

Community Services and Facilities

Rosebud and Powder River counties would require the following additional services and facilities over baseline: law officers: 5, 3; teachers: 50, 42; physicians 1, 1; dentists: 1, 1; and hospital beds: 9, 9; respectively.

Additional services and facilities required for Campbell County above baseline are law officers: 11; teachers: 81; physicians: 3; dentists: 1; and hospital beds: 6 (Table 4-8).

Housing

Powder River County would require 1,000 additional dwellings; 800 of these dwellings would be located in Broadus. Rosebud County would require 1,500 additional dwellings all of which are located in the Ashland district. Campbell County would require 1,800 additional dwellings; 900 would be located in Gillette (Table 4-9).

ECONOMICS

The potential for budget deficits is the greatest under Alternative 4 (see Table 2-3). This alternative would add about 3,400 to Ashland's projected 1990 population of 800.

CONCLUSION - PREFERRED ALTERNATIVE

Subalternative 3C is the preferred alternative. This meets the target level of leasing as chosen by the Assistant Secretary Land and Water Resources, U.S. Department of the Interior, which was set at 1.5 billion tons of recoverable coal. This decision is, however, an interim one in the process of determining how much coal will ultimately be offered for sale in the region. The final decision on the tracts which will be offered will be made after review of the final EIS and and public comments received on the draft.

TABLE 2-1
CUMULATIVE ENVIRONMENTAL IMPACTS

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Water Resources				
Ground Water Number of wells destroyed or impacted (maximum through mine life)	252 wells would be destroyed, 203 wells would be impacted.	299 wells would be destroyed, 261 wells would be impacted.	310 wells would be destroyed, 263 wells would be impacted.	352 wells would be destroyed, 284 wells would be impacted.
Acres of aquifers removed (maximum)	210,000	245,000	247,000	270,000
Number of springs destroyed	25	33	35	35
Water required for coal mining (acre-feet) in 1990	7,430	8,355	8,310	9,350
Municipal water required by population (acre-feet) in 1990 * Water used by incorporated communities and light industry.	32,000 *	33,400	33,400	34,700
Domestic water required (acre-feet) in 1990 ** Water used by rural subdivisions, rural residents and livestock.	23,000 **	---	---	---

Table 2-1 continued

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Water Resources				
Surface water Reduction in surface outflow (maximum percent) through mine life)				
Yellowstone River	0.3	.303	.303	.306
North Platte River	0.7	0	0	0
Increase in dissolved-solids concentration (percent)				
Yellowstone River	.09	.12	.12	.13
North Platte River	0.07	0	0	0
Loss of point-watering source (maximum through mine life)	84 point-watering sources would be destroyed	104 point-watering sources would be destroyed.	104 point-watering sources would be destroyed.	117 point-watering sources would be destroyed.
Air Quality				
Total TSP level (tons per year) (maximum production)	69,300	84,700	86,100	94,900

Table 2-1 continued

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Soils, Vegetation & Reclamation				
Total acres to be reclaimed	210,000	267,400	274,200	293,500
Transportation				
Total unit coal trains per day	183	234	242	262
Average interruption at at-grade crossing per day at 5 miles per hour	12 hours 10 minutes	15 hours 10 minutes	16 hours 5 minutes	17 hours 30 minutes
Probability of car-train accidents at an at-grade crossing for 1,000 motor vehicle per day	10 in 100 years	12 in 100 years	12 in 100 years	13 in 100 years
Sociology				
Community service requirements in 1990				
Powder River County				
Law Enforcement	4	6	6	7
Teachers	48	69	69	90
Physicians	1	2	2	2
Dentists	1	2	2	2
Hospital Beds	10	15	15	19

Table 2-1 continued

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Sociology				
Rosebud County				
Law Enforcement	21	23	23	26
Teachers	210	235	235	260
Physicians	4	5	5	5
Dentists	6	7	7	7
Hospital Beds	39	43	43	48
Campbell County				
Law Enforcement	109	115	115	120
Teachers	811	850	850	892
Physicians	39	41	41	43
Dentists	10	11	11	11
Hospital Beds	60	63	63	66
Housing requirements in 1990				
Powder River County	1,150	1,650	1,650	2,150
Broadus	350	630	630	1,150
Rosebud County	5,600	6,350	6,350	7,100
Ashland District	350	1,100	1,100	1,850
Campbell County	17,600	18,500	18,500	19,400
Gillette	9,000	9,460	9,460	9,900

Table 2-1 concluded

Resource	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Economics				
Projected incremental net fiscal balances expected to result for local governments ($1,000)				
Powder River County, Montana	0	300	300	-900
County Schools	0	3,200	3,200	3,900
Broadus	0	100	100	-100
Rosebud County, Montana	0	-1,100	-1,100	-2,300
County Schools	0	-1,100	-1,000	-2,100
Forsyth	0	0	0	0
Ashland District Population	800	2,480	2,480	4,200
Campbell County, Wyoming	0	4,300	4,300	8,600
School District #1	0	6,700	6,700	13,400
Gillette	0	-500	-500	-1,000
Net Energy Analysis				
Energy Produced / Energy Consumed (BTUs Annually)	---	223.0 / 1	225.8 / 1	221.6 / 1

TABLE 2-2
COAL DEVELOPMENT - POWDER RIVER REGION

Location and Name	Annual Production (Million Tons) a/ 1979	1985	1990	1995
Existing Mines				
Wyoming:				
Campbell County				
Belle Ayr (AMAX)	15.0	19.0	19.0	19.0
Black Thunder (Thunder Basin Coal Co.)	6.2	20.0	20.0	20.0
Caballo (Carter-Exxon)	1.3	7.5	12.0	12.0
Clovis Point (Kerr-McGee)	.3	4.0	4.0	4.0
Cordero (Cordero Mining-Sunedco)	3.8	15.0	15.0	24.0
Eagle Butte (AMAX)	3.7	19.0	20.0	--
Ft. Union (Ft. Union Mine Partnership)	.01	1.2	1.2	--
Jacobs Ranch (Kerr-McGee)	4.7	14.0	14.0	14.0
North Rawhide (Carter-Exxon)	3.6	24.0	24.0	24.0
Wyodak (Black Hills Power & Light)	2.4	5.0	5.0	5.0
Sheridan County				
Big Horn (Peter Kiewit & Sons)	3.5	4.5	4.5	4.5
Converse County				
Dave Johnston (NERCO)	3.8	3.2	3.2	3.2
Totals	48.31	136.4	141.9	129.7
Montana:				
Powder River County				
Coal Creek	.03	.03	.03	.03
Rosebud County				
Big Sky (Peabody)	2.5	4.2	4.2	4.2
Colstrip (Western Energy)	11.4	18.6	19.1	19.1
Big Horn County				
Decker-East and West	13.2	11.8	12.2	12.2
Absaloka (Westmoreland)	5.3	10.0	10.0	10.0
Spring Creek (NERCO)	--	7.0	7.0	7.0
Totals	32.43	51.63	52.53	52.53

TABLE 2-2 continued

Location and Name	Annual Production (Million Tons) 1979	1985	1990	1995
New Mines				
Wyoming:				
Campbell County				
Buckskin (Shell Oil Co.)	--	6.2	1.5	--
Coal Creek (ARCO Coal Co.)	--	8.5	10.0	10.0
Dry Fork (Cities Services Co.)	--	2.0	8.0	15.0
East Gillette (Kerr-McGee)	--	11.0	11.0	11.0
North Rochelle (Shell Oil Co.)	--	8.0	8.0	8.0
Pronghorn (Mobil Oil Co.)	--	5.0	5.0	5.0
Rochelle (Rochelle Coal Co.)	--	5.0	11.0	11.0
Caballos Rojo (Mobil Oil Co.)	--	9.0	15.0	15.0
South Rawhide (Carter-Exxon)	--	4.0	7.0	7.0
Wildcat Creek (Gulf Oil Co.)	--	5.2	10.0	10.0
Wymo Fuels Mine (Wymo Fuels, Inc.)	--	4.4	4.4	4.4
Sheridan County				
Ash Creek (Public Service of Oklahoma)	--	.5	.5	.5
Black Mountain (Black Mountain Coal)	--	.5	.5	--
Dutchman (JMT Co.)	--	2.0	2.0	2.0
Converse County				
Antelope (NERCO)	--	8.0	10.0	12.0
Totals	--	79.3	103.9	110.9

TABLE 2-2 continued

Location and Name	Annual Production (Million Tons) 1979	1985	1990	1995
New Mines b/				
Montana:				
CX Ranch (Peter Kiewit)	--	2.0	4.0	4.0
Montco-Nance (Montco)	--	2.0	9.0	12.0
Totals		4.0	13.0	16.0
PRLAs				
Wyoming:				
Campbell County				
Bell Fourche (Wold Nuclear Co.)	--	--	c/	--
East Black Thunder (Arco)	--	--	--	--
North Antelope (Peabody)	--	--	1.6	2.3
Rochelle Area (Peabody)	--	--	d/	d/
South Gillette (Peabody)	--	--	2.0	3.2
Thunderbird Project (El Paso Energy Co.)	--	--	3.5	5.0
Thunderbird II (Wold & Jenkins)	--	--	5.2	32.0
Wildcat Creek Area (CONSOL)	--	--	4.5	24.0
Sheridan County				
Ulm Project (Woodson Oil Properties)	--	--	14.0	14.0
Converse County				
Dull Center (Peabody)	--	--	1.7	1.7
Sand Draw (Peabody)	--	--	5.0	5.0
South Antelope (Peabody)	--	--	3.6	3.6
South Powder River (Dixie Natural Res.)	--	--	2.2	2.2
Stevens North (Western Fuels)	--	--	.8	3.0
Stevens South (Western Fuels)	--	--	1.5	1.5
Totals	--	--	45.6	97.5

TABLE 2-2 concluded

Location and Name	Annual Production (Million Tons) 1979	1985	1990	1995
Exchanges e/				
Wyoming:				
I-90				
Carter-Exxon (North Rawhide & Caballo)				
Gulf (Wildcat Creek)				
Wyodak (Wyodak Mine)				
Noncompetitive Leases (Northern Cheyenne)				
CX Ranch (CONSOL)	--	5.0	8.0	8.0
Greenleaf-Miller (Peabody)	--	--	4.0	6.0
Totals	--	5.0	12.0	14.0

a/ Final figures for 1980 production unavailable for inclusion into the draft.
b/ Youngs Creek Mine (Shell) located in Big Horn County not included (see Chapter 1).
c/ Mine life of 2 years projected for 1988 and 1989.
d/ Assumed to be intended as an extension to the Rochelle Mine.
e/ These exchanges are mine extensions and do not add to annual production.

TABLE 2-3
PROJECTED 1990 BUDGET LEVELS, BY ALTERNATIVE, FOR THE COUNTIES, SCHOOLS, AND COMMUNITIES THAT WOULD BE IMPACTED MOST HEAVILY BY FEDERAL COAL LEASING IN THE POWDER RIVER REGION
(Rounded to the nearest $100,000; Includes Debt Servicing)

	Alternatives			
	1 a/	2 b/	3 b/	4 b/
	($1,000)	($1,000)	($1,000)	($1,000)
Powder River County				
Revenues	3,800	5,200	5,200	6,300
Expenditures	3,800	5,500	5,500	7,200
Balance	0	-300	-300	-900
Powder River County Schools				
Revenues	2,000	6,100	6,100	7,600
Expenditures	2,000	2,900	2,900	3,700
Balance	0	3,200	3,200	3,900
Broadus				
Revenues	200	400	400	500
Expenditures	200	300	300	600
Balance	0	100	100	-100
Rosebud County				
Revenues	9,800	9,800	9,800	9,800
Expenditures	9,800	10,900	10,900	12,100
Balance	0	-1,100	-1,100	-2,300
Rosebud County Schools				
Revenues	9,100	9,100	9,100	9,100
Expenditures	9,100	10,100	10,100	11,200
Balance	0	-1,000	-1,000	-2,100
Ashland c/				
Revenues	--	--	--	--
Expenditures	--	--	--	--
Balance	--	--	--	--
Campbell County				
Revenues	26,600	32,300	32,300	37,900
Expenditures	26,600	28,000	28,000	29,300
Balance	0	4,300	4,300	8,600
School District #1				
Revenues	69,800	80,100	80,100	90,200
Expenditures	69,800	73,400	73,400	76,800
Balance	0	6,700	6,700	13,400

Table 2-3 concluded

	Alternatives			
	1 a/	2 b/	3 b/	4 b/
	($1,000)	($1,000)	($1,000)	($1,000)
Gillette				
Revenues	19,800	20,300	20,300	20,800
Expenditures	19,800	20,800	20,800	21,800
Balance	0	-500	-500	-1,000

a/ These are the baseline budget levels that are expected to exist without additional Federal Competitive Leasing. Expenditures were projected from actual FY 1979/1980 budgets (including debt servicing) on a per capita basis in order to maintain the per capita spending levels of FY 1979/1980. It is assumed that revenues will equal expenditures through additional taxes, user fees, grants, royalties, or debt.

b/ The additional expenditures above baseline expenditures, which are required to maintain FY 1979/1980 per capita spending levels for additional populations, were projected from actual FY 1979/1980 budgets (including debt servicing) on a per capita basis. Additional revenues above baseline revenues for Powder River and Rosebud counties are based on revenue to coal production ratios derived from a baseline run of the coal town model, which was generated by Keith Bennett. Additional revenues for Campbell County were generated by a coal revenue model developed by Thomas F. Stinson at the University of Minnesota.

c/ Because Ashland is an unincorporated community without a formal budget it is difficult to make reliable budget projections.

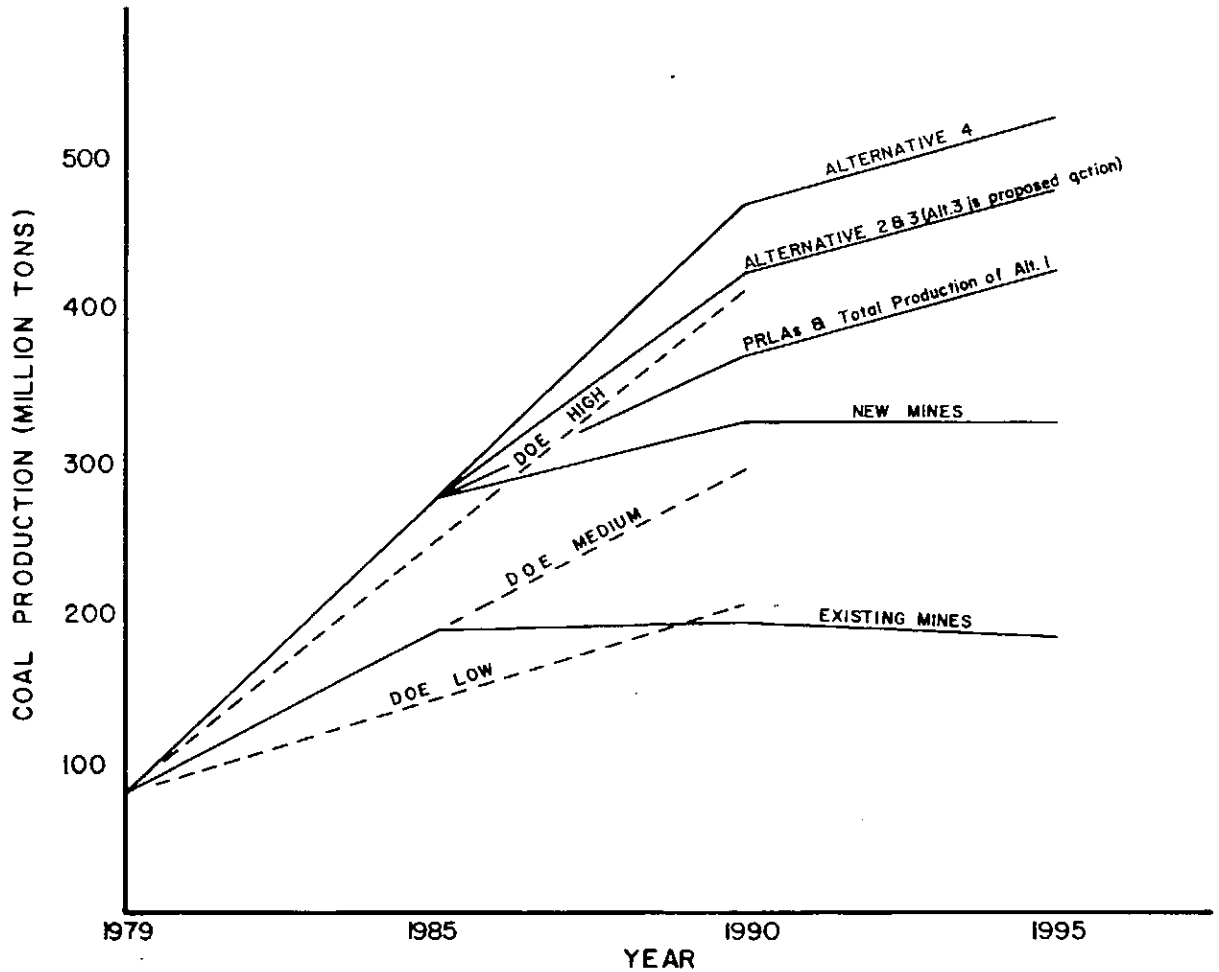
TABLE 2-4
COAL TRACTS AND RECOVERABLE RESERVES BY ALTERNATIVE

Alternative 2			Alternative 3		Alternative 4	
Maintenance Tracts a/		342 b/	Maintenance Tracts	342	Maintenance Tracts	342
Colstrip A&B	(36)		Cook Mountain	178	Ashland (Coalwood) (239)	
Colstrip C	(19)		Coal Creek	60	Cook Mountain	178
Colstrip D	(43)		Northwest Otter Creek	139	Coal Creek	60
Fortin Draw	(45)		Timber Creek	184	Ashland (Decker-Birney)	119
Little Rawhide	(90)		Duck Nest Creek	316	Northwest Otter Creek	139
North Decker	(59)		Keeline	174	Southwest Otter Creek	130
Spring Creek	(35)		Kintz Creek	193	Spring Draw	383
West Decker	(5)				Timber Creek	184
Cook Mountain		178			Rocky Butte	445
Coal Creek		60			Duck Nest Creek	316
Northwest Otter Creek		139			Keeline	174
Timber Creek		184			Kintz Creek	193
Duck Nest Creek		316				
Spring Draw		383				
Total Coal Leased Alternative 2		1,603	Total Coal Leased Alternative 3	1,586	Total Coal Leased Alternative 4	2,663
Total Coal Leased to Count Against Lease Target		1,261	Total Coal Leased to Count Against Lease Target	1,244	Total Coal Leased to Count Against Lease Target	2,321

a/ Maintenance tracts will not count against regional lease target.
b/ All figures represent uncommitted federal coal reserves in millions of tons.

FIGURE 2-1

POWDER RIVER REGIONAL COAL ANNUAL PRODUCTION TO 1995



CHAPTER 3

DESCRIPTION OF THE AFFECTED ENVIRONMENT

INTRODUCTION

This chapter describes the affected environment for the area of the Powder River Region that is necessary for assessing effects of the No-Action Alternative in Chapter 4. Climate, physiographic province, geologic structure, fisheries, prime farmland, wetlands, floodplains, and threatened or endangered plant species either would not be regionally affected or do not occur within the region. Therefore, no assessments on these elements were deemed necessary.

Areas of land have been identified as possible alluvial valley floors (AVFs). Although these possible AVFs are not excluded from consideration for leasing, the OSM would make a final determination prior to the mine and reclamation plan approval regarding their existence and whether mining would be permitted in that area of the tract. Individual tract profiles (Northwest Otter Creek, Southwest Otter Creek, Ashland (Decker-Birney), Keeline, Kintz Creek, and Duck Nest Creek) show location of these possible AVFs (BLM, 1981).

GEOLOGY AND OTHER MINERALS

The economic coal beds are found in the Tongue River member of the Paleocene (65 to 55 million years ago) Fort Union Formation and the Eocene (55 to 38 million years ago) Wasatch Formation. Description and relationships of the coal bearing formations may be found in Brown (1962), and Matson and Pinchock (1977).

Faults and folds are rare and mostly confined to the west flank of the region along the edge of the Bighorn Mountains. The region is classified as aseismic (no earthquake tendency) (Simon, 1972).

The coal beds found in the region are generally thick and of very wide areal extent. Detailed discussions concerning the quantity, quality, correlations, and locations of the coal beds may be found in Glass (1976 and 1980); Matson and Blumer (1973); Matson and Pinchock (1977); Cole, Matson and Pederson (1980); and the Tract Profiles (BLM, 1981).

Abundant plant and invertebrate fossils are found in the Tertiary coal bearing rocks. Vertebrate of other significant fossils are rare and known from only a few locations. Those known fossils contained within the region have no exceptional scientific interest or value (BLM, 1979a; USGS, 1979).

Other minerals of economic importance found in the region are oil and gas, uranium, and bentonite (see discussion in Chapter 1).

WATER RESOURCES

Most of the water used in the Powder River Region comes from the Yellowstone River and its tributaries the Tongue River and Powder River; and the Cheyenne River and its tributary the Belle Fourche River; and the North Platte River. The discharge of these streams is adequate to supply present needs within the region. Total water use in 1980 was about 518,140 acre-feet. The largest use, 81 percent, was for irrigation. Coal mining used 1,700 acre-feet, and municipal water use was 23,000 acre-feet. About 70 percent of the municipal water used is discharged as treated sewage effluent (BLM, 1979a).

Ground Water

The occurrence of ground water within the Montana and Wyoming areas of the Powder River Region is similar and therefore both areas will be assessed as a single unit. Ground water is used for domestic and stock watering, municipal supplies, secondary recovery of oil, irrigation, mining, milling, and other industrial uses.

Aquifers are contained in formations with a total thickness of more than 9,000 feet. The deepest aquifers are in the Madison aquifer system that includes geologic units from Precambrian-age basement rocks to Cretaceous-age shales (BLM, 1981, pp. 3-2). The most important aquifer within this system is the Madison Group, which is present in an area of over 180,000 square miles including the Powder River Region. The Madison aquifer is composed almost entirely of carbonates that are mostly dense with low porosity and permeability. However, well developed zones of secondary porosity and

permeability and localized beds of coarsely crystalline dolomite exist. Yields of more than 1,000 gallons per minute (gpm) are available where caverns, fractures, and crystalline zones are present; where they are absent, yields are much lower.

Most of the recharge to the Madison aquifer system is in outcrop areas in the Black Hills and Bighorn Mountains. The water becomes progressively more mineralized with increasing distance from the recharge areas. Discharge is from springs, wells, and seepage into stream valleys.

Water from the Madison aquifer system is used by the towns of Douglas and Gillette, Wyoming.

A sequence of Cretaceous shale up to 5,500 feet thick with very low vertical hydraulic conductivity overlies the older rocks, including the Madison aquifer system. These shales serve to separate the Madison aquifer system from shallow aquifers. The shallow aquifers are contained in the Fox Hills Sandstone and Hell Creek, Fort Union, Wasatch, and Lance Formations. (BLM, 1979a, Figure R2-4).

Ground water in the above formations is available at relatively shallow depths in most of the region in sufficient quantity for domestic and stock watering uses. The quality of the water in shallow aquifers is highly variable. Larger yields and better quality water are usually more available in the lower part of the shallow aquifers than in the upper part. Stock and domestic wells are commonly less than 1,000 feet deep and yield about 25 gpm. Industrial and municipal wells are commonly deeper than 1,000 feet and are often 3,000 to 5,000 feet deep and open to several formations. These deeper wells can yield more than 100 gpm.

The aquifers most commonly used in the region are sandstone and coal beds in the dominantly fine-grained Fort Union Formation. (USGS, 1979, pp. II-18.) The sandstone beds are lenticular and generally do not extend more than a few miles; whereas, coal aquifers are more areally extensive. The Fox Hills-Hell Creek aquifer, which underlies the Fort Union Formation, is the most extensive unit where yields of 100 to 200 gpm can be obtained. Clinker zones in the Fort Union Formation are very permeable; however, they are usually above the water table.

Recharge to the shallow aquifer system is mainly in upland areas through sandy zones of the Fort Union Formation, coarse-grained alluvium, and clinker.

Downward movement of recharge water in the shallow aquifer system is retarded by shale layers of low permeability causing the static water level in wells in recharge areas to be progressively lower with increasing depth of the well. Pumping lifts in deep wells may be several hundred feet greater than in adjacent shallow wells. Perched zones are common, and where impermeable beds are exposed, ground water is discharged as seeps and springs.

The chemical quality of the water from the shallow aquifers is highly variable. DS concentration ranges from 100 to more than 8,000 mg/L, but Hodson and others (1973) state that the DS content of water from most wells is between 500 and 1,500 mg/L. As water moves downward through the formations, the chemical type is changed by cation-exchange softening and sulfate reduction. The water from wells less than 200 feet deep generally is hard (calcium-magnesium-sulfate type) whereas, water from deeper wells generally is soft (sodium-bicarbonate type) (BLM, 1979a, Fig. R2-12). Water from the deeper wells is typically lower in total DS, indicating that precipitation occurs as the water moves downward. Ranges of trace elements and radiochemical analyses of water from shallow aquifers in Wyoming are given in the Eastern Powder River Coal ES (BLM, 1979a, Table R2-7).

Quaternary alluvium contains the shallowest aquifers in the region. Most alluvium is too fine-grained to yield much water; however, clean, coarse-grained material along rivers may yield up to several hundred gpm. Recharge to alluvial aquifers is from precipitation, runoff, and upward seepage from underlying formations. Discharge is by evapotranspiration, seepage into streams, pumpage, or ground water flow to older formations.

The water table in alluvial aquifers can slope toward or away from a stream depending on whether the stream is gaining or losing water in that area.

The quality of the water in most alluvial aquifers is poor, with DS concentration exceeding 8,000 mg/L. The chemical type of the water is similar to that in the upper part of the shallow aquifers but may be higher in DS due to concentration by evapotranspiration

Municipal water supplies within the towns of Ashland, Broadus, and Gillette are adequate for the present population.

In some areas of Wyoming, uranium mining may result in serious and long-lasting degradation of water quality. Leachate from tailing ponds is well beyond the safe limits of radioactivity for animals or humans. Stock or humans using water from wells or streams down gradient could be exposed to dangerous levels of radioactivity. Increasing the danger is the nondegradable and cumulative character of this type of contamination. Plants, crops, and river biota accumulate and concentrate radium 226. Levels of radium 226 in some wells near uranium mines vary from less than 10 to 50 picocuries per

liter, and surface-water levels are as high as 35 picocuries per liter. U.S. Public Health Service limits are 3 picocuries per liter.

Surface Water

Montana

The major tributaries to the Yellowstone River that drain the Montana part of the region are Armells and Rosebud creeks and the Tongue and Powder rivers. Pumpkin, Otter, and Hanging Woman creeks are major tributaries to the Tongue River, and Mizpah and the Little Powder River are major tributaries to the Powder River. Streams that are perennial, or nearly so, include the Tongue and Powder rivers and Rosebud, Otter, and Hanging Woman creeks. Many streams are ephemeral (flow in response to rainfall or snowmelt). However, most stream channels have intermittent reaches that flow for long periods each year at very low rates.

The average runoff ranges from about 0.01 cubic feet per second per square mile (cfsm) to 0.06 cfsm from the larger drainages with the exception of the Tongue River which averages 0.35 cfsm at the state line near Decker, and 0.08 cfsm at Miles City. High runoff usually results from snowmelt and spring rains, and the extreme low-flow period is from October through January. Average flow for the Yellowstone River at Miles City is 11,605 cubic feet per second (cfs) (USGS, 1980a). Surface runoff is depleted by numerous stock-water reservoirs and spreader systems on small tributaries. Much of the flow that originates within the region is depleted by storage, evapotranspiration, and seepage.

The chemical quality of water in most small streams is poor most of the time (BLM, 1979a). The base-flow component (water that enters streams from the ground water system) of streams that drain the more arid areas contain DS concentrations ranging from 1,500 to 5,000 milligrams per liter (mg/L), mainly sodium sulfate. Rosebud Creek and the Tongue River are the only major streams that regularly contain DS concentrations less than 1,000 mg/L, mainly calcium bicarbonate; however, water in the Tongue River deteriorates in the downstream direction owing to irrigation return water that contains greater concentrations of DS, mainly sodium sulfate (BLM, 1979a). DS for the Yellowstone River averages about 480 mg/L below Miles City. Sediment yields range from 0 to 1.2 acre-feet per square mile per year (BLM, 1981). Fecal coliform count in colonies per 100 milliliters for October 1978 through September 1979 ranged from 960 to 30 in the Tongue River at the state line near Decker and 18 to 2 in the Yellowstone River at Forsyth (USGS, 1980a).

Wyoming

The Wyoming area of the region is drained to the east by the Belle Fourche and Cheyenne rivers, to the north by the Little Powder River, to the west by tributaries to the Powder River, and to the south by tributaries to the North Platte River. Most streams are ephemeral. However, many stream channels have intermittent reaches that flow for long periods each year at very low rates. Streams seem to be drier (closer to truly ephemeral) in the southern part of the region and become progressively wetter to the north (BLM, 1979a).

The average runoff ranges from about 0.01 to 0.02 cfsm from the larger drainages. The flow of the North Platte River at Casper, which is partially controlled by reservoirs, averaged 1,360 cfs in 1979. High runoff usually results from snowmelt and spring rains, and the extreme low-flow period is from October through January. Surface runoff from the region is depleted by numerous stock-water reservoirs and spreader systems on small tributaries (BLM, 1979a). Much of the flow that originates within the region is depleted by storage, evapotranspiration, and seepage. The quantity of flow that leaves the eastern Powder River Region via the large streams represents about 42 percent of the flow that originates on each square mile within the region (BLM, 1979a).

The chemical quality of water in most streams is poor most of the time. The base-flow component (water that enters streams from the ground water system) of most streams contains DS concentrations ranging from 1,500 to 5,000 mg/L, mainly sodium sulfate. DS for the North Platte River averages about 400 mg/L below Casper. Fecal coliform count in colonies per 100 milliliters for October 1978 through September 1979 ranged from 130,000 to 12,000 in Goose Creek below Sheridan, 10,000 to 11 in the North Platte River below Casper, 670 to less than 1 in the Cheyenne River near Riverview, 600 to 2 in the Belle Fourche River below Moorcroft, and 120 to 2 in the Little Powder River above Dry Creek near Weston (USGS, 1980b). Sediment yields range from about 0.1 to 3 acre-feet per square mile per year (BLM, 1979a).

AIR QUALITY

A detailed description of air quality in the region may be found in the Technical Report available from the Casper District BLM Office (Radian, 1980).

Background concentrations for TSP, NO_2, SO_2, non-methane hydrocarbons (NMHC), and ozone

(O_3) were generated from monitoring data obtained within the region. Data on other criteria pollutants, carbon monoxide (CO) and lead (Pb), were gathered from nearest available sites, which are Billings, Montana (about 120 miles from Ashland, Montana), and Steamboat Springs, Colorado (about 400 miles from Gillette, Wyoming), respectively (Radian, 1980).

The region is a Federal Class II PSD area. However, the Northern Cheyenne Indian Reservation, which is a Class I PSD area, is bordered by the region on the north, east, and south sides.

Appendix A (Table A-1) shows the maximum allowable increases for the PSD of air quality. Appendix A (Table A-2) shows the federal, Montana, and Wyoming ambient air quality standards.

The rural TSP annual geometric mean for the region is about 16 $\mu g/m^3$. In and near populated areas and existing industrial activities, particulate levels are significantly higher than background levels. Particulate readings near existing mining activities are higher than background levels due to fugitive dust generated by mining operations. TSP returns to rural background levels several miles downwind as a result of particulate deposition.

Violations of the annual and 24 hour TSP standard occurred in 1979. In Wyoming the east monitor site at Black Thunder Mine exceeded annual and 24 hour TSP standards (412 and 113 $\mu g/m^3$, respectively). The Belle Ayr Mine sites 4 and 5 and Eagle Butte site 4 exceeded the 24 hour TSP standard (188, 167, and 152 $\mu g/m^3$, respectively). In Montana, the Colstrip area does not meet NAAQS for particulate and has been designated a nonattainment area.

Rural annual SO_2 and NO_2 background levels are about 1 and 16 $\mu g/m^3$, respectively. The 3-hour national standard for NMHC was exceeded five times at Colstrip in 1976 with a maximum of 0.87 parts per million (ppm). These high readings are attributed to heavy vehicular traffic primarily in the early morning. CO, Pb, and O_3 concentrations were less than 50, 80, and 75 percent, respectively, of the NAAQS.

Visibility greater than 60 miles is common. Significant reductions in visibility are generally weather related.

SOILS, VEGETATION, AND RECLAMATION

Soils of the region have developed mostly with short-grass vegetative cover common to the semiarid Great Plains. Due to prevailing climate and vegetative conditions, organic matter is accumulated slowly, and soils have developed with light-colored surfaces. Light colored soils generally indicate low organic matter content and fertility levels. Subsoil colors are normally light brown or reddish brown, and are often influenced by white, powdery carbonate accumulations caused by low rainfall and insufficient leaching. Soils of the region are mostly residual (developed in place) and formed from weathered sedimentary bedrock, mostly sandstone and shale. Most soils in the region have a fairly good reclamation potential based on reclamation success of other mines in the region. The "fairly good" category means on a scale of 1 to 10 these soils rate a "7". Site-specific information on soils and reclamation potential is available in the Tract Profiles (BLM, 1981); Wyoming General Soils Map (University of Wyoming, 1977); and *Rehabilitation Potentials and Limitations of Surface-Mined Land in the Northern Great Plains* (Packer, 1974).

The major vegetation types in the Powder River Region are shown on Table 4-3, along with acreage. Refer to the Tract Profiles (BLM, 1981) for vegetation map and common species list for the vegetative types. No threatened or endangered plant species have been identified within the region (BLM, 1981; Dorn, 1980).

WILDLIFE

Physical boundaries used in assessing wildlife impacts are the Decker, Colstrip, and Otter Creek areas in Montana, and antelope (and corresponding deer) hunt areas 24 and 101 (21), 17, 18 and 19 (17 and 18) and 23 (19 and 20) in Wyoming (see Appendix B). Acres of habitat for these areas are shown on Table 3-1.

Montana

Detailed population data is not available for Montana.

In the Colstrip area big game may well be below their numbers of 1976 following the two severe winters of 1977-78 and 1978-79 (Wentland, 1980). Mule deer habitat use is heaviest in areas south and east of Colstrip. This area is fair to poor antelope habitat. Mule deer are common on the breaks along both sides of Otter Creek. Most deer appear to winter on the Custer National Forest. Antelope are common on the midslope areas between Otter Creek valley and the National Forest boundary. The heaviest yearlong concentration in the Otter Creek

area appears to be on the west side of the creek, south of the confluence of Three Mile Creek and Otter Creek (Martin, 1980). The West Decker and Spring Creek mines include or are directly adjacent to important winter mule deer and antelope range. During the severe winter of 1977-78, approximately 405 mule deer and 375 antelope used these areas (Phillips, 1979).

Sharp-tailed grouse are abundant (11 leks) in the Colstrip area. The habitat consists of pine groves which provide escape and thermal cover while native grasslands and cultivated lands provide nesting cover and food habitat. The grouse have established new leks on unmined areas near Colstrip Mine and are nesting on successfully reclaimed areas. Twenty sharp-tailed grouse leks have been located in the Otter Creek area. This amounts to .22 leks per square mile compared to .12 leks per square mile in the Colstrip area. Average male attendance was about 18 per lek in 1980 (Martin, 1980). One sage grouse lek exists on the Spring Creek lease, but under mitigation agreement between Montana Fish and Game Department and NERCO, this lek area was determined unsuitable for mining with the exception applied (personal communication, Richard Zander, BLM, Miles City, 1981).

Red-tailed hawks are the most common raptor in the Otter Creek area with eight nests known to occur. Seven golden eagle nests are in this area but only one nesting pair was observed in 1980. Two prairie falcon eyries exist with one being active in 1980 (Martin, 1980).

The bald eagle is a winter resident of the area. Peregrine falcons are likely spring and fall migrants through the area. Black-footed ferrets may occur in the area in and near black-tailed prairie dogtowns.

Wyoming

The majority of coal mining related surface disturbance is occurring in antelope hunt areas 24 and 101 with six mines operating in the area (Appendix B (Figure B-1), and the Regional Activity Map). The Gillette-Orin Junction main line railroad bisects these two areas, and because it is fenced, it severely restricts east-west movement. Access roads to the mines intersect the railroad seven times and subdivide hunt area 24 into several small pastures. Movement between these pastures is severely restricted by traffic, fences along access roads, and the railroad. Seasonal movement is southward in the fall and northward in the spring. Approximately 200 to 300 antelope have wintered in the vicinity of Keeline and Kintz Creek tracts.

Two mines are currently located in antelope hunt area 17 north of Gillette. Antelope distribute evenly throughout hunt area 17 with exceptions of the scoria hills and timbered areas along the Little Powder River which are occupied infrequently.

Mule deer use (deer hunt area 18) is heaviest in the rough scoria hills and timbered breaks along the Little Powder River. White-tailed deer are common in the Little Powder River valley. However, both species show little seasonal movement.

Population trends of big game are presented in Table 3-2. Most big game herds in northeastern Wyoming suffered heavy winter losses following the winters of 77-78 and 78-79.

Sage grouse are the most common upland game bird in Campbell County. Forty-one leks are known to exist in the county with 16 of these existing in the area southeast of Gillette (antelope hunt areas 24 and 101). Five of these leks have been abandoned and two others destroyed by coal mining related activities since 1975 (Wyoming Game & Fish, 1979c). Sharp-tailed grouse are common in the northern half of Campbell County with three lek sites known. Data for the remainder of the county are not available.

Golden eagles, red-tailed hawks, ferruginous hawks, and great-horned owls are the most common nesting raptors in Campbell County. Available data indicate a minimum of 90 pairs of nesting golden eagles, 21 pairs of red-tailed hawks, and 21 pairs of great-horned owls. There are 13 pairs of golden eagles nesting on or within ½ mile of active mines or areas leased for further development.

The bald eagle and the black-footed ferret are listed as endangered by Fish and Wildlife Service and occur within Campbell County. The bald eagle is a common winter resident. The black-footed ferret is considered rare since there have been few reported sightings. However, no habitat has been designated as critical for either of these threatened or endangered species. No other threatened or endangered animal species are known to exist in the Wyoming area.

CULTURAL RESOURCES

Cultural resources within the region include evidence of man's activities for the past 12,000 years (BLM, 1979b, pp. 4-27). Specific types of cultural resources known are stratified sites resulting from repeated occupation of a locality, bone beds from communal hunts when large numbers of animals were killed, stone circles generally known to be associated with skin-covered dwellings of late prehistoric and historic Indians, rock art, ceramic sites

where pottery is found, quarries where raw material for stone tools was collected, lithic scatters that provide evidence of short-term subsistence activities, rock shelters, burials, rock cairns or piles of rocks of debatable function, battlefields, homesteads, mines, and trails (BLM, 1979a; USGS, 1979). Appendix C shows the identified cultural sites for the Powder River Region.

VISUAL RESOURCES

Intrusions in an area affect the form, line, color, and texture of the landscape. Intrusions are classified as high, medium and low depending upon the amount of contrast with the existing landscape. Intrusions of high contrast would include open pits, coal silos and conveyors, structures on the skyline, large reflective surfaces, and large areas of surface disturbance. Intrusions of medium contrast would include access and haul roads, railroad lines, power lines, drilling rigs, and oil wells. Intrusions of low contrast would include fence lines, pipelines, and small areas of surface disturbance.

Montana

This area is characterized by rolling uplands dissected by steep-sided valleys. Local rugged hills and ridges are capped by resistant sandstone and clinker. Badlands have been formed in easily eroded shales. The region is drained by northward flowing tributaries of the Yellowstone River (see Regional Activity Map). Scenic quality ratings and management classes have not been established for this area of Montana; however, potential is for scenic quality Classes B and C, and management Classes III and IV with some areas of Class II possible (VRM Manual 8400 and Appendix D).

Wyoming

This area is characterized by low rolling hills and flat plains sometimes broken by canyons, buttes, and breaks. Scoria outcrops provide some reddish contrast to the landscape. Water is scarce and rarely a dominant feature. This area is largely scenic quality Class B or C and management Class III or IV. A management class map for Campbell and Converse counties is included in the Eastern Powder River Coal ES (BLM, 1979a).

LAND USE

Agriculture is the primary land use in the region (USGS, 1979). Most of the land is used as range for cattle and sheep. Farming consists mainly of dryland hay, both grass and alfalfa, or grain. Some flood irrigation of hay and grain fields occurs along stream bottoms. Other land uses and designations include mining, oil and gas, transportation networks, national forest, Indian reservations, recreation areas, and urban areas.

Agriculture

In Montana 87 percent of the land in the counties within the region is used for agricultural purposes (USDA, Montana Department of Agriculture, 1978). Of that total land, 88 percent is rangeland, 6 percent dryland farming, 1 percent irrigated and the remainder miscellaneous agricultural uses. The acres within these types of land uses are shown on Table 3-3 by county. Productivity on these lands can only be estimated because of flucuations caused by climate, markets, and operational decisions. In 1979 there were about 279,000 cattle within the region. Cropland productivity average is 1.9 tons per acre for hay, 25.0 bushels per acre for wheat, 35.8 bushels per acre for barley, and 45.3 bushels per acre for oats based on 1979 crop production figures.

Also, in Wyoming 87 percent of the land in the counties within the region is used for agricultural purposes (USDA Wyoming Crop Production Reporting Board, 1978). Of that, rangeland for cattle and sheep accounts for 90 percent, dryland farming 5 percent, irrigated land 1 percent and the remainder is in miscellaneous agricultural uses. The acres within these types of land uses are shown on Table 3-3 by county. Productivity on these lands can only be estimated because of flucuations caused by climate, markets, and operational decisions. In 1979 there were approximately 438,000 cattle in Wyoming. Cropland productivity average is 1.48 tons per acre for hay, 22.5 bushels per acre for wheat, 30.2 bushels per acre for barley and 44.2 bushels per acre for oats based on 1979 crop production figures.

There are no prime farm or wet lands (USDA, SCS, 1981).

Other Land Uses

Land use for oil and gas, power plants, refineries, and mining of coal, bentonite and uranium is increasing in the region. In 1980, 76,338 acres in Wy-

oming and 23,519 acres in Montana were included in these types of activities.

RECREATION

The Powder River Region is comprised mostly of privately owned surface, which limits public access and use. Recreational use is confined to the developed sites in the region or the national forests on the fringes of the region. The present number of facilities are adequate to meet current use or demand.

Montana

Hunting occurs throughout the area and receives more participation than any other single recreational activity. Big game hunter success is high (see Appendix E); approximately 75 percent for antelope (Montana Fish and Game, 1978). Other outdoor recreation opportunities include fishing, water sports, camping, picnicking, hiking, winter sports, historic interpretation, and municipal parks (Montana Fish and Game Department, 1978; USDA, Committee for Rural Development, 1975; USDA, Big Horn County Committee for Rural Development, 1976; USDA, Soil Conservation, 1976; USGS, 1979).

Although there are no designated wilderness areas, the Forest Service (FS) has a wilderness proposal, the Tongue River Breaks Roadless Area, in Custer National Forest (USDA, RARE II, 1979). Also, BLM has three proposed wilderness areas: the Tongue River Breaks Contiguity (adjacent to the FS proposal), Zook Creek, and Buffalo Creek (both located between Ashland and Decker) (BLM, 1980a).

Wyoming

Like Montana, hunting is the major recreational activity with high success ratio of hunters to harvest (over 90 percent for antelope) (see Appendix E). A like variety of outdoor recreation opportunities are also available (BLM, 1979a; Wyoming Recreation Commission, 1975 and 1980; Wyoming Game and Fish, 1977a and b, 1978a and b, 1979a and b, Campbell County Recreation Board, 1974; City of Gillette, 1978).

The FS has proposed the Laramie Peak (Medicine Bow National Forest) and the Seven Brothers (Bighorn National Forest) wilderness areas (USDA, RARE II, 1979). The Cloud Peak primitive area is managed by the FS (Bighorn National Forest). BLM has three areas under study for possible wilderness designations: Fortification Creek (west of Gillette), Gardner Mountain and the North Fork of the Powder River (both located south of Buffalo) (BLM, 1980b). BLM also has a special management unit: the Middle Fork of the Powder River.

TRANSPORTATION

Railroads

BN operates three main lines on which unit trains travel within the Powder River Region. The northern line runs through Billings and Miles City, Montana, and into North Dakota and Minnesota. The central route runs through Sheridan and Gillette, Wyoming, and into Nebraska, Iowa, Missouri, and Illinois. The southern route runs through Orin Junction and Guernsey, Wyoming and into Nebraska and Colorado. The number of TPD along these lines in 1981 are shown on Table 3-4. These trains reflect both freight/passenger and unit coal train traffic loaded and empty.

A unit train, which contains 100 cars with a capacity of 100 tons each, is approximately 1 mile in length. At any given crossing it would take a unit train 3 minutes to pass traveling at 20 miles per hour and 12 minutes at 5 miles per hour (BLM, 1979a). At these two speeds, a crossing on the central route leaving the region would be interrupted for 1 hour 12 minutes and 4 hours 48 minutes, respectively. Data are unavailable for car-train accident rates for specific at-grade crossings. An average rate for a crossing with flashing lights has been predicted for a traffic volume of 1,000 motor vehicles per day. Table 3-4 shows the existing situations at four selected cities located along BN main lines.

Two proposed railroad lines, the Tongue River Railroad along the Tongue River in Montana and the Chicago Northwestern/Union Pacific line in southeast Wyoming, would also handle coal traffic.

Highways

In Montana, the major trafficways are Interstate 94, U.S. Highway 212, Federal Aid Primary (FAP) 39, U.S. Highway 312, and FAP 92. Outlying areas are connected by a system of county, FS, Indian reservation, and private roads. Appendix F (Figure F-1) shows the interstate, state, and federal aid primary and secondary road systems, and average daily traffic (ADT). Highway 212 from Ashland through the Northern Cheyenne Indian Reservation

contains potholes, ruts, and shoulder deterioration creating traffic safety and nuisance problems. The Native Americans along with other local residents are concerned about the problems caused by heavy truck traffic along this route. The same situation exists along FAS 314 between 212 and Decker. This road was once surfaced but large traffic volumes and heavy loads have deteriorated it. This road is also a traffic safety and nuisance problem (Northern Cheyenne and Crow tribal councils).

In Wyoming, the major north-south trafficways are Interstate 25 and State Highway 59 (Regional Activity Map). East-west travel is largely on Interstate 90, U.S. 16, State Highway 387, and State Highway 20/26. Appendix F (Figure F-2) shows interstate, U.S., and state highways, and the ADT for the Wyoming area. A network of county and private roads connect outlying areas to these major transportation routes. There are grade separations along the BN line in Gillette, Casper, and along State Highway 59 (between Douglas and Wright), which allow train interruptions to avoid highway traffic. Roads in the region are often rutted and deteriorated from extensive use of heavy, energy-related equipment. Highways 59 and 387 are being upgraded.

NOISE

Noise was calculated by using the equations discussed in "Noise Impact Analysis" (Rau and Wooten, 1980). The affected zone encompasses areas in which the Ldn (decibels weighted on a day-night basis) exceeds 55 dBA ("A" weighted decibels). The 55 dBA is a standard set by the U.S. Environmental Protection Agency as a long-term limit for protection of health and welfare. A normal conversation is equivalent to 50 to 60 decibels.

Railroads

The distances from railroad track center line to the 55 dBA contour zone

Miles City, Montana (Northern Route)	2,500 feet
Gillette, Wyoming (Central Route)	2,100 feet
Newcastle, Wyoming (Central Route)	4,000 feet
Torrington, Wyoming (Southern Route)	3,400 feet

Highways

Noise levels were calculated using the equations discussed in "Noise Impact Analysis" (Rau and Wooten, 1980). The distance to the 55 dBA contour from the road center line has been calculated for the following cities within the

Gillette, Wyoming	250 feet
Sheridan, Wyoming.	1,000 feet
Ashland, Montana	100 feet
Colstrip, Montana	100 feet
Decker, Montana	800 feet

SOCIOLOGY

Social Organization

Social organization is discussed for the three communities, Ashland (Rosebud County), Broadus (Powder River County), and Gillette (Campbell County), that would be affected from any of the alternatives described in Chapter 2.

Ashland and Broadus, Montana, (see Regional Activity Map) are rural communities and have received very little population increase over the past decade. Also, Ashland is an unincorporated community. In both communities interpersonal relationships are on an informal basis. Friendship networks are dense, which means a community resident knows just about everyone else in the community.

The Northern Cheyenne and Crow Indian reservations are located in the northwestern part of region (see Regional Activity Map). Since Ashland is located adjacent to the eastern boundary of the Northern Cheyenne Reservation, most of the town's occupants are Native Americans.

Gillette, Wyoming, has grown rapidly since the 1960s which has already changed the social organization considerably. Interpersonal relationships are formal. A community resident knows relatively few others in the community, and friendship ties are made on the basis of occupation, age, and religion (Laumann, 1973; Wellman, 1979).

Community Services and Facilities

Table 3-5 shows the existing levels of community services and facilities. Water and sewage facilities are adequate to support the present population (see Water Resources). Fire protection throughout

most of the region is gained through a volunteer force.

Ashland (Rosebud County) does not currently have a public high school for non-Native Americans. Students from the area attend public school in Colstrip and Broadus.

Housing

See Table 3-6 for the existing number of dwelling units in the Powder River Region.

Attitudes

Overall, people who were interviewed within the region favored coal development. There was a higher level of unqualified support for coal development in Wyoming than Montana. Some residents stated they would be in favor only if it was certain the coal was needed to help meet the nation's energy requirements. The main reasons given for favoring coal development were the economic benefits and the need to develop domestic energy resources. Economic benefits stated pertained to increased employment and increased tax base. A common response was that the coal is needed to help reduce the amount of imported fuel. Environmental concerns expressed were regarding reclamation of the land, and water quantity and quality. Concern was also expressed regarding the impacts from the influx of population (especially in Montana). A more detailed description of attitudes within specific areas is given in the individual Tract Profiles (BLM, 1981).

ECONOMICS

Montana

Table 3-7 presents a synopsis of the existing 1980 economic environment for the Montana area of the region. Coal employment numbered 950 in Big Horn County, and 380 in Rosebud County, as reported by the Montana Employment Security Division of the Department of Labor and Industry. Actual coal employment for Powder River County is not discloseable; however, a baseline run from the Coaltown model, developed by Lloyd Bender and others at Montana State University, estimated Powder River County coal employment to be 15.

Wyoming

Table 3-8 presents a synopsis of the existing 1979 economic environment for the Wyoming area of the region. Coal employment numbered 1,672 in Campbell County, 155 in Converse County, and 302 in Sheridan County, as reported by the Wyoming Department of Economic Planning and Development (DEPAD).

TABLE 3-1
ACRES OF WILDLIFE HABITAT

Location	Acres
MONTANA	
Colstrip Area	288,000
Decker Area	256,000
Otter Creek Area	59,000
WYOMING	
Hunt Areas:	
Antelope 24 & 101	750,080
(Deer 21)	750,080
Antelope 17	1,099,520
(Deer 17 & 18)	1,758,020
Antelope 23	851,840
(Deer 19 & 20)	1,158,400

TABLE 3-2
POPULATION TRENDS
BIG GAME - CAMPBELL COUNTY, WYOMING

Antelope	1975	1976 (% change)	1977 (% change)	1978 (% change)	1979 (% change) 75-79
Area 24					
Area Harvest	1,981	2,545 (+28.5)	1,937 (-23.9)	1,893 (-2.3)	1,226 (-38.2)
Pumpkin Buttes Herd Unit Harvest	5,821	6,391 (+9.8)	5,264 (-17.6)	6,305 (+19.8)	5,915 (0)
% Area Harvest of Herd Unit	34%	39.8	36.8	30	20.7
Area 17					
Area Harvest	3,018	2,983 (-1.2)	1,716 (-43.5)	1,627 (-5.2)	1,071 (-64.5)
Powder River Herd Unit Harvest	3,849	4,044 (+5.0)	2,687 (-33.6)	2,690 (0)	2,156 (-44)
% Area Harvest of Herd Unit	78.4	73.7	63.8	60.4	49.6
Mule Deer					
Area 21					
Area Harvest	978	878 (-10.2)	736 (-16.2)	498 (-22.3)	316 (-67.7)
Black Hills Herd Unit Harvest	4,404	3,759 (-14.6)	3,003 (-20.1)	1,807 (-39.8)	1,349 (-69.4)
% Area Harvest of Herd Unit	22.2	23.4	24.5	27.6	23.4
Area 18					
Area Harvest	3,828	2,178 (-43.2)	1,876 (-13.9)	1,069 (-43.1)	749 (-80.5)
Powder River Herd Unit Harvest	9,418	8,489 (-9.9)	6,206 (-26.9)	4,790 (-22.8)	3,671 (-62.1)
% Area Harvest of Herd Unit	34.3	25.6	30.2	22.3	20.4

TABLE 3-3
AGRICULTURAL LAND USE ACRES

County	Total Acres	Cropland	Range	Irrigated	Woodland	Miscellaneous a/
Wyoming						
Campbell	3,034,614	157,490	2,676,971	4,176	31,056	11,985
Converse	2,653,284	76,794	2,351,058	53,364	15,280	21,034
Sheridan	1,598,195	124,590	1,213,733	54,448	11,129	13,580
Johnson	2,620,817	43,768	1,861,688	40,495	8,683	17,977
Natrona	3,713,764	57,320	3,023,890	37,493	3,073	26,147
Crook	1,804,338	165,176	1,193,768	8,712	150,685	16,721
Weston	1,478,109	53,828	1,311,350	6,427	83,040	16,511
Total	16,903,121	678,966	13,632,458	205,115	302,946	123,955
Montana						
Big Horn	3,214,720	286,739	2,329,017	49,275	b/	b/
Rosebud	3,223,424	182,827	2,778,398	38,838	63,890	43,869
Powder River	2,104,128	165,988	1,353,409	9,106	13,737	11,777
Total	8,542,272	635,544	6,460,824	92,219	77,627 c/	55,646 c/
REGION TOTAL	25,445,393	1,314,520	20,093,282	297,334	380,573 c/	179,601 c/

a/ Includes farm buildings, pig lots, ponds, etc.
b/ Information Withheld.
c/ Big Horn County not included.

Sources: USDA, Wyoming Crop Reporting Board, 1978.
USDA, Montana Department of Agriculture, 1978.

TABLE 3-4
EXISTING TPD AND AT-GRADE CROSSING INFORMATION

Location	Trains Per Day	At-Grade Crossings Daily Interruptions 5 mph	At-Grade Crossings Daily Interruptions 20 mph	At-Grade Crossings Car/Train Accidents a/ Per 100 Years
Miles City, MT	11	2 hrs 12 min	33 min	1
Gillette, WY	10	2 hrs	30 min	1
Newcastle, WY	24	4 hrs 48 min	1 hr 12 min	3
Torrington, WY	17	3 hrs 24 min	51 min	1 to 3

a/ Based on 1,000 vehicles daily.

Source: Trains per day information obtained from Peter Briggs, Burlington Northern (personal communication, 1981).

TABLE 3-5
EXISTING LEVELS OF COMMUNITY SERVICES AND FACILITIES

Service/Facility	Montana		Wyoming	
	Rosebud County	Powder River County	Campbell County	Natrona County
Law Enforcement (Sworn Officers)	14	4	56	124
Teachers	143	48	417	973
Physicians	3	1	20	96
Dentists	4	1	5	38
Hospital Beds	26 a/	0 b/	31 c/	282

a/ One hospital located in Forsyth.
b/ There is no hospital in Powder River County.
c/ Hospital operating at 52 percent capacity.

Sources: Powder River Comprehensive Plan (draft), 1981.
Rosebud County Plan, 1979.
Department of Economic Planning and Development.
Wyoming Department of Education, Wyoming Public Schools Fund Accounting and Reporting (1979-80).

TABLE 3-6
EXISTING NUMBER OF DWELLING UNITS a/

Montana b/	
Big Horn County	3,867
Hardin	1,360
Powder River County	1,123
Broadus	336
Rosebud County	3,787
Ashland District c/	248
Wyoming d/	
Campbell County	8,950
Gillette	4,650
Converse County	5,050
Douglas	2,210
Crook County	2,340
Moorcroft	415
Johnson County	2,960
Buffalo	1,635
Natrona County	27,200
Casper	19,400
Sheridan County	10,500
Sheridan	6,380
Weston County	2,830
Newcastle	1,420

a/ Includes mobil homes and multi-family housing.
b/ Estimate based on information from 1980 final census.
c/ Because Ashland is a small unincorporated town, census figures collected are for the surrounding district.
d/ Estimates based on the housing count from the 1980 preliminary census.

TABLE 3-7
THE EXISTING ECONOMIC ENVIRONMENT
FOR THE MONTANA COUNTIES IN 1980

	Coal a/ Production (million tons)	Total b/ Employment	c/ Population	Local Expenditure Levels d/ County ($1,000)	Schools ($1,000)	Towns ($1,000)
Big Horn County	18.5	5,583	11,088	6,109.5		
School					9,892.3	
Hardin			3,288			778.1
Powder River County	.03	1,245	2,523	3,887.5		
School					2,025.8	
Broadus			715			162.3
Rosebud County	24.8	5,021	9,965	6,392.5		
School					5,911.7	
Forsyth			2,550			1,341.0
Ashland District			569			e/

a/ Miles City District Office, Miles City, Montana.
b/ Research and Analysis Section, Employment Security Division, Department of Labor and Industry, Helena, Montana.
c/ Preliminary 1980 census.
d/ Obtained from the respective counties, schools and towns. Includes debt servicing.
e/ Ashland is an unincorporated community without a formal budget.

TABLE 3-8
THE EXISTING ECONOMIC ENVIRONMENT
FOR THE WYOMING COUNTIES IN 1979

	Coal a/ Production (million tons)	Total b/ Employment	c/ Population	Local Expenditure Levels d/ County ($1,000)	Schools ($1,000)	Towns ($1,000)
Campbell County	41.0	12,453	23,200	13,681.1		
School District #1					35,885.2	
Gillette			11,500			10,122.0
Converse County	3.8	5,056	13,200	8,304.0		
School District #1					15,279.5	
Douglas			5,680			6,690.0
Crook County	-0-	1,461	5,200	3,467.4		
School District #1					4,578.5	
Moorcroft			1,010			384.0
Johnson County	-0-	2,099	6,600	2,062.3		
School District #1					5,646.8	
Buffalo			3,700			1,902.3
Natrona County	-0-	36,293	69,600	35,668.5		
School District #1					30,908.8	
Casper			49,300			41,792.5
Sheridan County	3.5	8,115	24,300	14,724.3		
School District #2					9,898.8	
Sheridan			14,700			7,143.8
Weston County	-0-	2,479	7,020	3,806.8		
School District #1			3,550		3,671.2	
Newcastle						1,662.8

a/ Published by the Wyoming Department of Economic Planning and Development.
b/ Published by the Wyoming Security Employment Commission.
c/ Estimate based on the 1980 population to employment ratio derived from the preliminary census from the U.S. Census Bureau. City estimates based on the 1980 town to county ratio.
d/ Obtained from the respective counties, schools and towns. Includes debt servicing.

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter presents the scientific and analytic basis used in the comparison of alternatives described in Chapter 2. Site-specific effects of the individual tracts are contained in the Tract Profiles (BLM, 1981), which are available from the Casper District Office upon request. Description of the affected environment was used in assessing the No-Action Alternative (Alternative 1) which was, in turn, then used as the new baseline to assess Alternatives 2, 3, and 4. Analyses are focused on 1990; however, the time frame expands to 1995 when necessary for the worst-case analysis. Analyses presented in this chapter were made based on the professional judgments of the resource specialists when other sources or references were unavailable. Discussions are presented on a resource by resource basis; however, some resource discussions have been broken down further by alternative as necessary for clarity.

Also included in this chapter are adverse impacts which cannot be avoided should coal leasing occur, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and irreversible or irretrievable commitments of resources.

GEOLOGY AND OTHER MINERALS

The only major impact to geology would be the mining of the coal. The direct impact to topography is insignificant in itself, but would impact wildlife and is assessed in the Wildlife section of this chapter. Table 4-1a gives annual coal production projected for 1990 under each alternative. Table 4-1b shows production amounts for federal reserves only.

UNAVOIDABLE ADVERSE IMPACTS

Removal of the coal beds and destruction of overlying strata.

SHORT TERM VS. LONG TERM

There are no short-term impacts associated with geology. The long-term impact would be the loss of the mined coal reserves for future use.

IRREVERSIBLE/IRRETRIEVABLE

Coal once mined and consumed would be irreversible. Coal not mined and left due to lack of technology would be economically irretrievable once the mining has passed it by. Coal lost would equal 10-15 percent of the reserve base available for each alternative (Table 1-1).

ENVIRONMENTAL CONSEQUENCES

WATER RESOURCES

Ground Water

Impacts to the ground water resources would occur primarily in the vicinity of the mined area and would have little effect on the regional ground water systems. Impacts include removal or modification of aquifers, interruption of ground water flow during mining, modification of flow after reclamation, and changes in water quality.

The impacts of uranium mines on the water resources of the region are discussed in detail in environmental statements dealing specifically with individual uranium mine plans; therefore, no further discussion of the subject is included in this regional analysis.

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

Reclamation regulations require that the overburden and interburden (spoil) be replaced in the mine to restore the area to as nearly its original condition as practical. The replaced spoil is usually moderately permeable unless it is unduly compacted during emplacement. Studies by Rahn (1975) indicate that dragline-laid spoil which undergoes gravity sorting and minimal compaction by machinery may be as much as a hundred times more permeable than scraper-laid spoil which is compacted by scraper wheels. Aquifers created by dragline-laid spoil can have a higher recharge rate and yield than the combined total of the original aquifers, while scraper-laid spoil aquifers may have lower recharge rates and yield than the original aquifers. Truck-shovel-laid spoil is in between in water-bearing characteristics. Thus the impact of removing aquifers in the mined areas can be mitigated by replacing spoil in a manner to create aquifers with water-bearing characteristics equal or superior to those of the original aquifers.

Coal mining would create a hole in the ground that will act as a large well if the mine extends below the water table. Water entering this "well" would be lost through evaporation, either naturally or as it is used for dust suppression or other mine purposes, or will be discharged to streams in dewatering operations. This discharge would create a lowering of water levels (cone of depression) in the vicinity of the mine. Pumping of standard-type wells to supply additional water for mine operations would increase the cone of depression.

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

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

Modification of ground water flow after reclamation results from breakup of the layering that generally occurs in native formations of the region and from modification of the slope of the land surface. In many parts of the region relatively impermeable shale layers interbedded with sandstone and coal cause perched zones of saturation to form. Where perching layers outcrop, springs or seeps occur. The replaced spoil is relatively uniform in composition so that vertical and horizontal permeability are similar, thereby eliminating perched zones and their springs and seeps and increasing recharge to the water table. The removal of springs and seeps from their former locations would affect the plants and animals that depended on the additional water at those locations. Springs and seeps might reappear at different locations after reclamation is completed or the extra recharge to the water table might discharge into streams. The overall impacts of mining would be to permanently change the pattern of ground water flow but mining would not permanently diminish the quantity of water available in the area of the mine.

The water in the spoil aquifer would be of poorer quality than the water in the original aquifers. This is because the disturbed spoil presents many fresh surfaces to percolating water and this causes solution of soluable minerals to occur at a higher rate. The solution rate would eventually return to normal levels; however, with the low levels of precipitation and recharge prevalent in the Powder River Region, this process may take many years, perhaps centuries. Contamination of ground water in spoil aquifers can be mitigated by requiring selective placement of saline spoil above the zone of saturation. The ground water occurring naturally in the region varies greatly in mineral content both areally and with depth at a given location. Spoil aquifer water varies also, but generally is two to three times as mineralized as water from undisturbed coal aquifers but typically is no higher in mineral content than the

most highly mineralized ground water in the area (personal communication, N.J. King, USGS, 1981).

Water in spoil material typically contains calcium-magnesium-sulfate with lesser amounts of sodium and bicarbonate; whereas, water in the coal aquifers typically contains sodium-bicarbonate. Calcium-magnesium-sulfate water containing as much as 3,000 mg/L of dissolved solids generally is unsuitable for domestic use but should have no deleterious effects on livestock and wildlife. Water containing as much as 7,000 mg/L would be highly cathartic and would be marginal for use by livestock and wildlife. Ground water that is of the sodium-bicarbonate type and lower in dissolved solids usually can be obtained by developing wells in aquifers below the spoil aquifer. However, pumping lifts and costs would be greater if the mine is in a recharge area.

Because of the low sulfur content of coal in the region, no acid mine-water drainage problems are expected (BLM, 1979a). Also, trace elements and heavy metals normally are filtered out of the ground water in mined areas by coal wastes and other carbonaceous materials in the spoil.

Where spoil aquifers discharge into a nearby stream, the increased salt load from leaching of the spoil can be significant and contribute to the salinity of the stream. However, where discharge is indirect to the upper reaches of an ephemeral stream far from its confluence with a perennial stream, it may take decades or even centuries before any effects are noticed downstream. This is especially true where the natural DS concentrations of water in the alluvium underlying the stream is similar to that of the leachate from the spoil aquifer. The long-term effects of the movement of more highly mineralized water from the spoil aquifer into adjacent, undisturbed less mineralized aquifers is not clearly understood. However, a significant reduction in DS concentrations can be expected with increasing distance from the mined area as a result of the selective retention of ions on particle surfaces (Riffenburg, 1925; Qayyum and Kemper, 1962). Thus, degradation of water quality in areas adjacent to reclaimed spoil is expected to be a slow process, and it would be centuries, if ever, before deleterious effects become significant more than a few hundered feet from reclaimed areas.

Different aquifers that had poor hydraulic connection before mining would be connected through the spoil, allowing circulation if there were head differences (water pressure differences at higher and lower points) between the aquifers; however, this effect would also tend to decrease with increasing distance from the mine. Changes in hydraulic gradients in the vicinity of the mine would be insignificant when considering the total aquifer system.

Municipal water requirements due to additional population would increase up to 2,700 acre-feet per year for the region in 1990 (see Table 2-1). This increase would not have significant impact on the entire region but could have considerable impact on Ashland, Broadus, and Gillette, since it is anticipated that these towns would have the largest population increases. The following measures are being taken to mitigate these impacts. Ashland has a relatively new water system (4 years old) that has a capacity to supply more than twice the present population. The water system of Broadus is adequate to supply the present population and some increase; however, plans are being made to develop a new well field to supply the projected increased population expected by 1990. Gillette is developing a new well field (operational June 1, 1981) with the potential to supply 10 times the current municipal use. The quality of the water from this new well field is superior to that of the existing well field and would be blended to improve the quality of the present supply.

Surface Water

The surface outflow from the region would be reduced by 350 to 700 acre-feet per year (0.05 to 0.1 percent) but the impact would be negligible. Estimates of the reduction of surface outflow from the prospective lease tracts are based on field observations and are less than the projected increases in water use because much of the water intercepted and consumed by mining would otherwise be dissipated by evapotranspiration losses on site or en route downstream. Thus, use of this water for mining would, in part, merely exchange one form of consumptive use for another. The potential depletion of surface water that might result from large-scale ground water withdrawals cannot be quantified due to lack of data. Between 20 and 33 point-watering sources would be destroyed. Although the quantity of water lost would be insignificant, the loss of point-watering sources would be a deterrent to area use by wildlife and livestock until water sources would be restored.

Surface runoff from reclaimed areas may be altered slightly owing to temporary changes in infiltration rates. The effect would be relatively minor and would be short lived because infiltration on spoils would become similar to infiltration on native rangeland as root systems develop.

Discharge from coal-spoils aquifers may contain DS concentrations that are two to three times greater than those in the adjacent undisturbed aquifers (Van Voast and Hedges, 1975). This water could be cathartic and marginal for use by livestock and wildlife. Most of the discharge from spoils

aquifers would occur as small springs and seeps in ephemeral stream channels, which would delay and reduce the effect of that discharge on the quality of water in perennial streams. The possible exception would be the Tongue River which may receive spoils discharge through the clinker. The upper limit of the potential increased dissolved load of the Tongue River that would result form the leaching of mine spoils (without additional leasing of federal coal, and assuming DS concentrations of spoils discharge is twice that from undisturbed aquifers) is estimated to be about 0.5 percent. The proposed leasing and development of additional federal coal could cause the DS concentrations of the Tongue River to increase 0.4 to 0.5 percent (a cumulative increase of 0.9 to 1.0 percent) depending on the alternative selected. Because Armells Creek would have the greatest area of spoils in relation to the size of the drainage, the dissolved load of Armells Creek near Forsyth, Montana, may be increased by as much as 4 percent owing to leaching of mine spoils. However, the increase in DS concentrations in Armells Creek, the Tongue River, and other tributaries to the Yellowstone River would cause the DS concentrations of the Yellowstone River to increase by less than 0.1 percent under Alternative 1, 0.03 percent under Alternatives 2 and 3, and 0.04 percent under Alternative 4. Increases in DS concentrations would have no significant impact on current uses of water or on aquatic biology downstream. In addition to increased concentrations of dissolved solids, sewage effluents typically contain fecal coliforms, suspended solids, nitrates, nitrites, chlorine, ammonia, and orthophosphates. The sewage effluent discharged to the North Platte River would increase about 20 percent at maximum cumulative development in 1990; however, dilution would be at least 60 to 1, which is more than adequate to prevent any significant impact to the aquatic biology downstream. The sewage effluent discharged to Goose Creek would increase nearly 40 percent by 1990, and dilution would be very low during low-flow periods in Goose Creek and the Tongue River; hence, sewage effluent could have a deterious effect on aquatic life in those streams. However, dilution would prevent any impact to the aquatic biology of the Yellowstone River.

National Pollutant Discharge Elimination System (NPDES) permits for all unnatural polluting sources must be issued by the appropriate State agencies (Wyoming Department of Environmental Quality or the Montana Department of Staté Lands).

Data show that concentrations of heavy metals in some of the spoils leachate are greater than in most of the natural surface water and exceed recommended maximum concentration for irrigation on a continuous basis, livestock use, public supply, and aquatic biota (BLM, 1979a). However, the data are not adequate to allow evaluation of potential hazards related to possible heavy metal contamination of streamflow by discharge from spoils aquifers.

Sewage effluent would increase in proportion to the quantity of municipal water used. As a result, increased salinity and harmful bacterial contamination would occur in the Tongue and North Platte rivers. The increase in DS concentrations resulting from increased sewage effluent would be about 0.5 percent in the Tongue River and 0.07 percent in the North Platte River. This would cause no significant impact to the aquatic biology downstream.

Restrictions on sediment transport from areas disturbed by mining activities (30 CFR 816.42 and 817.42) would result in reduced sediment yields from those areas. However, existing regulations do not apply to disturbances resulting indirectly from coal mining such as housing construction and related urbanization. Such off-site disturbances would cause sediment yields to double for 1 to 2 years and thereafter gradually decrease, returning to the predisturbance rate in 3 to 4 years. The decreased sediment yield from mined areas would offset increases resulting from urbanization; thus, impacts from increased erosion and sedimentation would be very local and short term.

UNAVOIDABLE ADVERSE IMPACTS

1) Removal of parts of certain aquifers would change the character of the aquifers in the mined area. Cumulative disturbance under Alternatives 2, 3, and 4 would affect a small (35,000 to 60,000 acres) part of the total area (25 million acres) and the effects would be only in the mined areas. At least 47 wells and eight small springs and possibly 100 wells and 10 springs (over Alternative 1) would be destroyed by mining; however, the wells could be replaced by deeper wells and new springs probably would eventually appear. There would be negligible effect on the regional ground water system.
2) Interruption of premining ground water flow would lower water levels in 58 to 81 wells (over Alternative 1) within a few miles of the mine, but the effect would be limited to the period of mining and would diminish with distance from the mine.
3) Modification of ground water flow by replaced spoil aquifer would eliminate perching conditions which created springs and seeps in cer-

tain areas. The effects would be limited to the area of the mine and would have negligible impact on the regional ground water system. Increased water use by the increased population resulting from mining new federal coal would cause a small lowering of ground water levels in the vicinity of municipal well fields.

4) Changes in ground water quality caused by leaching of spoil materials would increase DS concentrations in reclaimed areas possibly to two to three times the mining levels. The effects would be long term but would be largely local and the water would still be suitable for livestock.

5) Municipal use of water would increase up to 2,700 acre-feet (Alternative 4) per year. Increased consumptive use would decrease surface outflow by about 0.05 to 0.1 percent. The DS concentrations of streamflow in the region could increase by a maximum of about 4 percent, but the increase would be undetectable in the major rivers that carry water beyond the region.

SHORT TERM VS. LONG TERM

Ground water levels in the vicinity of the mines would be lowered during mining; however, they would return to near premining levels within a few years after reclamation. Reclaimed spoil aquifers contain two or three times the mineralization of the original aquifer and this would create a short-term impact on water quality from spoil aquifers. In the long term, the water would gradually return to approximately the same quality as the average quality in the removed aquifers.

Consumptive use of water by the increased population, which is assumed to be permanent, would reduce water yield from the region by less than 0.025 or up to 0.05 percent.

IRREVERSIBLE/IRRETRIEVABLE

Removal of aquifers and other strata in the mined areas would permanently destroy 35,000 to 60,000 acres of aquifers (.002 percent of total aquifers within the region) and alter conditions of ground water occurrence. Removal of perching layers would destroy eight to ten springs and several seeps. Forty-seven to 100 shallow wells would be permanently destroyed (Van Voast and Hedges, 1975).

Water consumed by the increased population would be irretrievable. Increased consumptive use at maximum development would be 2,700 acre-feet per year. Increased DS concentrations that result from increased sewage effluent would irreversibly increase the DS concentrations of receiving streams by as much as 0.07 percent, but water would still be suitable for all current uses.

AIR QUALITY

The direct effects from mining activities and the indirect effects of mining-related development (associated population and transportation growth) were assessed for the areas in which significant increases in concentrations above background levels are expected. These areas are the Decker area, the Colstrip area, and the Custer National Forest area and Gillette (Radian, 1981).

The significant pollutant emissions associated with the development of the proposed lease tracts and the accompanying secondary growth are TSP, NO_2, and SO_2. Impacts of emissions of the other criteria pollutants would be insignificant, and virtually unmeasurable on a regional scale (Radian, 1981). Mining activities generate significant quantities of TSP, and relatively small quantities of NO_2, SO_2, CO, NMHC, O_3, and Pb. Power plants in the affected region are significant sources of TSP, NO_2, and SO_2, while emitting smaller amounts of the other pollutants. The principal emissions from cities and towns are TSP, NO_2, and SO_2. Vehicular traffic may produce localized elevations of CO levels, but these emissions are not significant on a regional basis. Thus, the analysis of air quality will focus on the impacts on ambient levels of TSP, NO_2, and SO_2.

The models, meteorological data, receptor array, and vistas used in the air quality analyses are discussed in the Technical Report (Radian, 1981).

Characterization of the source emission is also discussed in the Technical Report (Radian, 1981). Included are the emission factors, control devices, and efficiencies. Also discussed are the major point and area sources which would be impacted by the proposed mines.

All pollutant sources must be evaluated to determine PSD applicability. Coal mines are subject to new source review for PSD only if nonfugitive emissions of any regulated pollutant exceed 250 tons per year after application of controls. Surface coal mines will seldom have the potential to exceed that level. This essentially eliminates the proposed lease tracts from the detailed PSD review process.

Therefore, PSD applicability is not discussed further.

Alternative 1

Annual TSP concentrations near existing mines in Montana and near Sheridan, Wyoming, would not exceed 25 $\mu g/m^3$ (33 percent of the Montana and federal standard and 40 percent of the Wyoming standard). In the vicinity of Gillette, Wyoming predicted concentrations would not exceed 40 $\mu g/m^3$ (53 and 67 percent of the federal and Wyoming standards, respectively). Near the Caballos Rojo and Cordero Mines, the TSP levels could be as high as 50 $\mu g/m^3$ (67 and 83 percent of the federal and Wyoming standards, respectively). Total TSP levels would be about 69,300 tons per year.

Emissions from Gillette are predicted to add less than 1 $\mu g/m^3$ to the background TSP levels in 1995. The interaction of the town, the surrounding mines, and the major roads entering Gillette would contribute less than 5 $\mu g/m^3$ to the background levels of 16 $\mu g/m^3$ outside of Gillette.

Other major source contributions include major roadways such as I-90 between Gillette and Moorcroft which adds 1 $\mu g/m^3$ or less to background levels, and the Wyodak and Neil Simpson power plants which would add less than 8 $\mu g/m^3$ to the background TSP concentration.

Predicted concentrations of NO_2 throughout the region would not exceed the state or federal ambient air quality standards in 1990 or 1995. Ambient concentrations in the vicinity of Gillette are predicted to be less than 48 $\mu g/m^3$ and regional impacts of emissions from the Wyodak and Neil Simpson power plants would be less than 35 $\mu g/m^3$. Roadways would contribute less than 3 $\mu g/m^3$ to the 16 $\mu g/m^3$ background level.

The interaction among all NO_2 sources would produce NO_2 concentrations no greater than 40 $\mu g/m^3$. Combined with the background level of 16 $\mu g/m^3$ total ambient NO_2 concentrations would reach 56 $\mu g/m^3$ which is 56 percent of the state and federal standards.

Predicted 1990 and 1995 SO_2 concentrations throughout the region are less than 26 $\mu g/m^3$ (including the 1 $\mu g/m^3$ background level), which is 32 percent of the federal standard and 43 percent of state standard. The highest concentrations would be in the vicinity of Neil Simpson and Wyodak power plants.

Alternative 2

Alternative 2 would not significantly increase the emissions from any town, roadway or power plant in the region. The impact of emissions from these sources would not noticeably change from Alternative 1 impacts.

The Colstrip tracts would increase TSP concentrations 5 $\mu g/m^3$ above Alternative 1 levels to 26 $\mu g/m^3$ vicinity of these mines. The interaction of the Colstrip tracts with nearby existing mines (i.e., Big Sky) is negligible.

Ashland (Coalwood) and Northwest Otter Creek would add 5 $\mu g/m^3$ near the mine boundaries to the 16 $\mu g/m^3$ background level 1 $\mu g/m^3$ about 1 mile from the mines. The interaction of these mines with existing Coal Creek Mine is negligible.

Spring Creek, North and West Decker mines would add 5 $\mu g/m^3$ to the Alternative 1 TSP levels. This would result in ambient concentrations of 26 $\mu g/m^3$ around the East, North, and West Decker mines.

Spring Draw would increase TSP concentrations 1 $\mu g/m^3$ within 1 to 2 miles of the mine. This would act to increase the area of 5 and 20 $\mu g/m^3$ total TSP concentrations over what was predicted in Alternative 1. Concentrations near the mine boundaries at Timber Creek and Duck Nest Creek would increase by 5 $\mu g/m^3$. Increases of 1 $\mu g/m^3$ would occur within 2 to 3 miles of these mines. These mines will act to increase the size of the concentration isopleths. Duck Nest Creek would interact with Belle Ayr to increase concentrations by 10 $\mu g/m^3$. Total TSP level would be about 84,700 tons per year.

The increase in nitrogen dioxide concentrations is predicted to be less than 5 $\mu g/m^3$ within the region in 1990 and 1995, resulting in ambient levels of 21 $\mu g/m^3$.

Sulfur dioxide levels are not predicted to increase more than 1 $\mu g/m^3$ above the background level of 1 $\mu g/m^3$ throughout the region in 1990 and 1995.

Alternative 3

The impacts of Alternative 3 are the same as for Alternative 2 except in the area of Spring Draw, Kintz Creek, and Keeline. Spring Draw is not included in this alternative. Kintz Creek and Keeline are predicted to add less than 5 $\mu g/m^3$ of TSP in their vicinity in 1990 and 1995. These two tracts would interact with existing mines to produce ambient

concentrations of less than 26 $\mu g/m^3$. Total TSP level would be about 86,100 tons per year.

The increase in nitrogen dioxide concentrations is predicted to be less than 5 $\mu g/m^3$ within the region in 1990 and 1995 resulting in ambient levels of 21 $\mu g/m^3$.

Sulfur dioxide levels are not predicted to increase more than 1 $\mu g/m^3$ above the background level of 1 $\mu g/m^3$ throughout the region in 1990 and 1995.

Alternative 4

The impacts of the maintenance tracts in Alternative 4 are identical to those of Alternatives 2 and 3. The impact of Duck Nest Creek is identical to its impact in Alternatives 2 and 3. The impacts of Spring Draw, Kintz Creek and Keeline are identical to those of Alternatives 2 and 3.

Ashland (Decker-Birney), Ashland (Coalwood), Northwest Otter Creek, and Southwest Otter Creek all produce impacts of less than 10 $\mu g/m^3$ near the mines and 1 $\mu g/m^3$1 mile from the mines. Their interaction results in ambient concentrations of 26 $\mu g/m^3$ between the two Ashland mines and an area of 17 $\mu g/m^3$ concentrations stretching 15 miles along the north-south axis of Ashland (Coalwood) and Southwest Otter Creek and 9 miles along the east-west axis of Ashland (Decker-Birney) and Northwest Otter Creek. In this alternative, Rocky Butte and Timber Creek interact with Caballo to produce maximum ambient concentrations of approximately 46 $\mu g/m^3$. This is 77 percent of the Wyoming standard and the federal secondary standard. Total TSP level would be about 94,900 tons per year.

The increase in nitrogen dioxide concentration is predicted to be less than 5 $\mu g/m^3$ within the region in 1990 and 1995 resulting in ambient levels of 21 $\mu g/m^3$.

SO_2 levels are not predicted to increase more than 1 $\mu g/m^3$ for an ambient concentration of 2 $\mu g/m^3$ throughout the region in 1990 and 1995.

Short-term (24-hour) modeling was performed for two groups of sources near the town of Gillette. One group consisted of the town of Gillette; the Neil Simpson and Wyodak power plants; and Wyodak, East Gillette, Dry Fork, South Rawhide, Buckskin, and Eagle Butte surface coal mines; and Spring Draw tract. The other group consisted of the Rocky Butte, Timber Creek, Duck Nest Creek tracts; and Caballo, Belle Ayr, Pronghorn, Caballos Rojo, and Cordero surface coal mines. Emissions from 1995 were modeled to determine maximum 24-hour TSP concentrations since emissions for 1990 would be less. Therefore, air quality impacts predicted for 1995 are a conservative estimate of maximum expected short-term concentrations.

Emissions from the mines and power plants north and east of Gillette produced several areas with ambient concentrations greater than 36 $\mu g/m^3$. The ambient concentrations exceed 116 $\mu g/m^3$ in several areas. Violations of the Wyoming 24-hour standard may occur north of Spring Draw, Buckskin, Rawhide, and Wyodak.

In the area southeast of Gillette, the mines interact to form several areas with concentrations exceeding 36 $\mu g/m^3$ the largest of which extends for about 11 miles north-south. Ambient concentrations greater than 116 $\mu g/m^3$ occur at several locations. Ambient concentrations in the following areas may exceed the 24-hour TSP standard in Wyoming: northeast of Rocky Butte, Belle Ayr and Duck Nest Creek, and southeast of Caballos Rojo.

The visibility impacts of the existing sources and the proposed mines would not be significant. Reduction of visual range in 1995 east of the Northern Cheyenne Indian Reservation would be about 3 percent and a decrease in apparent contrast 0.047. North of Gillette reduction of visual range would be about 7 percent for 1995 and decrease in apparent contrast 0.021. (The inherent contrast of the viewed object is assumed to equal -0.7, a typical value for a tree covered hill). Therefore, on a regional basis, the proposed alternatives would cause a minimal visibility impact. Visibility degradation may occur downwind of the largest proposed mines when meteorological conditions cause poor dispersion.

The Technical Report (Radian, 1981) contains a more detailed discussion of the above results.

UNAVOIDABLE ADVERSE IMPACTS

The coal cannot be produced by surface mining without generating fugitive dust. The impacts of individual mines decrease rapidly beyond the mine boundary. Annual ambient TSP levels would increase by 1 $\mu g/m^3$ over sizeable portions of the region. Localized violations of the short-term standards could occur if unfavorable meteorological conditions persist for several hours at a time.

SHORT TERM VS. LONG TERM

Anticipated air quality impacts would constitute a short-term use of the air resource. Insofar as the impacts may cause or contribute to violations of the federal and state ambient air quality standards (e.g., in the immediate vicinity of some existing and proposed mine clusters), or consume a portion of the PSD increment, there would be a potential restriction on the nearby development of other industrial activities that emit air pollutants. Near the mines, this impact would cease when mining activities are completed and the areas are reclaimed. Air pollutant emissions that result from the portion of the induced population that chooses to remain in the area after mining is completed may continue to consume a minor portion of the PSD increments, and thus may result in a small, localized long-term impediment to industrial siting opportunities.

IRREVERSIBLE/IRRETRIEVABLE

On a regional basis, the proposed leasing actions would irreversibly commit a relatively small portion of the air resource. Upon completion of the mining activities, reclamation of the leased properties and relocation of the population increments that result directly and indirectly from the mining activities, it would be possible to retrieve the air resource commitment and return air quality to the current conditions.

SOILS, VEGETATION, AND RECLAMATION

The difference in impacts to soils and vegetation between alternatives primarily is a function of the amount of soil disturbed. Table 4-3 shows the total acres disturbed through end of mine life. The impacts of these alternatives on the soils would be the alteration of existing soil characteristics and properties. These alterations would affect permeability, infiltration rates, soil/air and soil/water relationships, bulk density, nutrient level, micro-organism composition, and productivity, all of which have developed over a period of time.

All of the regional development activities would result in accelerated erosion by wind and water due to exposure and increased activity, until the soil is revegetated. The increased erosion would result from the disturbed soils not having any protective cover and inability of the soil to soak up water. Future population increase in the region would impact soils by a permanent loss of soil surface which results from the construction of housing and support facilities.

Reclaimed soils would not redevelop structural characteristics comparable to the original soil for decades (in the case of less developed soils) to many centuries (for the more developed soils) or not at all for Aridisols, which probably formed under a different climate. Though these lands would be reclaimed; in some cases they would require more intensive and costly management to be revegetated and stabilized. The success of reclamation and revegetation would depend on the nature of the mine site and the specifics of the mine and reclamation plan. Reclamation success for vegetation has been shown to be good so the impact of vegetation loss would not be long term (BLM, 1981; Packer, 1974).

UNAVOIDABLE ADVERSE IMPACTS

The residual impacts on soils would be the alteration of existing soil characteristics and properties. These alterations would affect permeability, infiltration rates, soil/air and soil/water relationships, bulk density, nutrient level, micro-organism composition, and productivity. Vegetation would be lost until reclamation and revegetation is completed.

SHORT TERM VS. LONG TERM

Return of a significant part of the disturbed land to a productive state during the life of the mine is anticipated. Several years after initial revegetation, vegetative productivity could vary from 50 to 100 percent of the premining level, which exhibits wide variation due to different soils and terrain.

IRREVERSIBLE/IRRETRIEVABLE

Soil loss resulting from disturbance would be considered irretrievable. The disturbance of natural soil profiles and the different associated vegetation types is irreversible.

WILDLIFE

Losses (death and relocation) to mule deer could be as high as 450 (net loss by end of mining equalling 4 percent of total hunt area population). Major causes for these losses would be habitat loss, and a combination of poaching, road kills, and urban development. Location of mines, access roads, and railroad spurs would disrupt local daily and seasonal movements in the Otter Creek area. Drastic topography changes in hunt areas 17 and 18 would occur due to the Thunderbird, Wildcat and Horse Creek developments. Extensive areas of ponderosa pine or juniper cover would be mined and removed for use as important thermal and escape cover.

Antelope losses (death and relocation) within the region could be as much as 2,460 animals (net loss by end of mining). These losses would occur due to habitat loss, location of railroad and access roads, and increased traffic. Up to 460 animals could be lost in the Decker and Otter Creek areas alone during a severe winter due to loss of critical habitat (USGS, 1979; Martin, 1980). The Spring Creek and North Decker Mines would remove several hundred acres of critical habitat used by about 375 antelope during the severe winters of 77-78 and 78-79. This, in turn, would cause overcrowding on nearby important winter ranges. The animals would be more vulnerable to death from disease and starvation during severely cold weather and heavy snow. Losses to antelope in hunt areas 24 and 101 would be about 560 animals (8 percent of hunt area population). Animal access to hunt areas 24 and 101 would be severely restricted because of the railroad between Gillette and Orin Junction. Seasonal or daily movements would be further restricted by active mining operations and county roads crossing the railroad which would reduce the hunt areas into smaller pastures. Duck Nest Creek tract would create the greatest restriction to movement. Range overuse, possible lack of water sources, increased road kills, and crop depredation would all result from the development of this tract. The mine pit, haul roads, and stream channel diversion would cause the north-south movement corridor between the Belle Ayr Mine and Highway 59 to be about 1 mile wide at the western edge of the pit. Additional restriction of movement in the northern portion of hunt area 24 would occur with the development of Timber Creek and Rocky Butte tracts together. Development of Kintz Creek and Keeline tracts would disrupt seasonal use in the southern portion of hunt area 24. Losses to antelope in hunt area 17 would be about 400 animals (4 percent of hunt area population). The railroad spur to Wildcat, Wildcat Creek, and Horse Creek developments would create a movement barrier to antelope in hunt area 17. Movement to favored wintering areas would further be hindered by increased traffic on Highway 14-16 and the presence of new subdivisions on the west side of the highway. Development of the Spring Draw tract in hunt area 17 would take place in an area used for staging (where animals congregate prior to movement) prior to fall migration. As mining would progress into the western third of the Spring Draw tract severe restriction of seasonal movement would occur. Contributing factors to the impact on this tract would be the presence of housing subdivisions to the west and northwest, and the Buckskin Mine access road to the south. Fall antelope movement north of Rocky Butte tract would be further hindered by new housing subdivisions.

About 13 sharp-tailed grouse leks could be affected. Four sharp-tailed grouse leks would be destroyed in the Colstrip area and nine in the Otter Creek area. Long-term population decline should not occur in the Colstrip area. As long as sufficient nesting habitat remains near the disturbed lek, the population would probably shift to undisturbed areas. If exceptions are granted on two leks overlying federal minerals in the Otter Creek area, 58 percent of the Otter Creek area population would be affected. One sage grouse lek would be destroyed in the Decker area. Within hunt area boundaries 24 and 101 two sage grouse leks would be destroyed and nesting territories for these game birds would be reduced by 20 to 50 percent.

Approximately 13 percent of the Campbell County population of golden eagles would move to new nesting locations because their nesting sites would be mined. Successful mitigation would involve establishing artificial nests or platforms within a territory being disturbed.

Table 4-4 shows wildlife habitat acreage that would be disturbed under each alternative.

No adverse impacts to threatened or endangered species are anticipated in Wyoming or Montana coal lease areas. Section seven consultation has been completed for the Montana tracts and should be completed on the Wyoming tracts by December, 1981.

UNAVOIDABLE ADVERSE IMPACTS

The short-term loss of wildlife habitat as depicted in Table 4-4 would be unavoidable. Wildlife population losses due to poaching and road kills would be unavoidable.

SHORT TERM VS. LONG TERM

On the short-term, antelope populations could be reduced by as much as 2,000 animals in Wyoming hunt areas 24 and 101 and 17; reduction in the Decker and Otter Creek areas of Montana could be up to 460 antelope. About 13 pairs of golden eagles would be manipulated into nesting away from active mining areas. Sufficient hunting habitat for these birds would exist after mining, which would allow them to reoccupy the nests they presently use. Sharp-tailed grouse population in the Colstrip and Otter Creek areas would be reduced from 15 to 48 percent during the short term due to the loss of 13 leks and adjacent nesting territories.

In the long term, antelope population would remain depressed 10 to 30 years after mining due to the long establishment time for sagebrush to invade reclaimed areas. Also, sharp-tailed grouse population would remain depressed from 10 to 20 years after mining until sufficient escape cover has regrown in reclaimed areas.

IRREVERSIBLE/IRRETRIEVABLE

Animals lost during the development of new coal mines in the region would be irretrievably lost. Loss of topographic diversity (rough topography reclaimed to gentle slopes) would support fewer deer population.

CULTURAL RESOURCES

All cultural sites will be identified on the lease tracts prior to mining. The Keeper of the National Register of Historic Places will determine significance. Any site identified as potentially eligible for listing on the National Register would be protected (National Historic Preservation Act, Section 106). The site density figures are based on the existing documented data base made up of numerous sources. However, the data base in some cases is incomplete.

Cultural resources would be committed to either destruction or data retrieval. Table 4-5 shows estimated cultural sites that could be affected by 1990. A systematic collection and analysis of information would add to the scientific knowledge of the area; however, some knowledge would be lost due to excavation of sites before improved technology is available. Also, unauthorized collection of artifacts due to population increases would result in the reduction of the integrity of the resource. Buried sites would be lost.

UNAVOIDABLE ADVERSE IMPACTS

All sites would be disturbed with mining. Some knowledge would be lost due to excavation of sites before improved technology.

SHORT TERM VS. LONG TERM

A cultural inventory for unstudied areas of the region would be performed at an earlier date with coal development taking place.

IRREVERSIBLE/IRRETRIEVABLE

Cultural resources would be disturbed. Data retrieval would not be available for future researchers. Buried cultural sites would be lost.

VISUAL RESOURCES

Coal mining would have the greatest impact on the scenic quality of the landscape than any of the other energy related activities within the region. The extraction of the coal by strip-mining changes form, line, color, and texture of the landscape. Silos, conveyors, and facility structures change line and color; access roads, railroad spurs, and power lines change line and texture.

These changes would result in a reduction of scenic quality and a change in management class. The area impacted is largely scenic quality C with some B, and VRM Class III or IV (see Appendix D). Within the region the most sensitive locations to this reduction in scenic quality would be along high-use roadways, recreation areas, and near population centers. Mines located in these areas could also provide a resource for interpretive and educational programs.

UNAVOIDABLE ADVERSE IMPACTS

Decreasing VRM Class III and IV areas to Class V through the end of mine life would be unavoidable.

SHORT TERM VS. LONG TERM

Visual contrast impacts created by access roads, railroad spurs, power lines, and facility structures would change VRM Class III and IVs to Class V on the short term.

IRREVERSIBLE/IRRETRIEVABLE

None identified.

LAND USE

Table 4-3 shows acres disturbed by mining for each alternative. Access roads, railroad spurs, and urban growth would remove an additional 11,400 acres under Alternative 1, 800 acres each for Alternatives 2 and 3, and 930 acres under Alternative 4. Underground utilities, pipelines, and overhead power lines would modify agricultural use but would not remove a significant amount of acreage from production.

Impacts to the 44 individual farm and ranch operations would be offset by compensation and royalties to the landowner (see Appendix G).

Loss in crop production would depend upon acres of each crop planted but the acreage itself represents county decreases of .2 percent in Big Horn, .5 percent in Powder River, 1 percent in Rosebud, and 2 percent in Campbell under Alternative 2. Decreases that would occur under Alternative 3 are identical except for Powder River County, which would be 1 percent. Under Alternative 4 decreases would be .2 percent in Big Horn, 1 percent Powder River, 2 percent in Rosebud, and 4 percent in Campbell.

The loss in agricultural land use would represent a loss of 7,063 AUMs of grazing under Alternative 2; 7,558 under Alternative 3; and 11,476 under Alternative 4.

Other impacts upon land use would occur by relocation of railroad lines and county roads.

UNAVOIDABLE ADVERSE IMPACTS

Conversion of existing rural land uses to mine-related and urban uses would be unavoidable. Loss of AUMs described above is also unavoidable.

SHORT TERM vs. LONG TERM

In the short term there would be a loss of agricultural productivity on tracts and in pipeline, powerline and utility rights-of-way until reclamation is completed. There would be a long-term loss of agricultural land use to urban growth.

IRREVERSIBLE/IRRETRIEVABLE

Lands used for urban expansion, access roads, and railroads would be irretrievable.

RECREATION

The present number of facilities would fall short by 1990. The regional population would increase from 180,000 to 239,000 (approximately 30 percent by 1990 for Alternative 1) and 434,000 (approximately 140 percent for Alternative 4). A corresponding increase in all recreational activities would occur. The greatest increases would be fishing in Montana and winter activities in Wyoming (Montana Game and Fish, 1978; Wyoming Recreation Commission, 1980). Hunting pressures would increase in Montana from 64,900 participation days to between 70,700 days for Alternative 1 (No-Action) and 77,000 days Alternative 4 (maximum leasing). In Wyoming the increase would be from 269,625 participation days to between 380,800 for Alternative 1 and 414,700 for Alternative 4.

While not quantifiable the impacts on recreation would be degradation of sites and areas from increased use and vandalism, and increases in operating and maintenance costs to federal, state, and local governments plus the private sector.

UNAVOIDABLE ADVERSE IMPACTS

Population increases from additional coal leasing would place high demand and use on existing facilities which have not increased in supply. Loss of public lands would decrease the areas available for recreation.

SHORT TERM VS. LONG TERM

The short-term effect would be increased use on a resource that is in short supply. The long-term effect would be a decrease in demand when the population levels off or decreases making recreation facility supply adequate.

IRREVERSIBLE/IRRETRIEVABLE

Access to public lands will be irreversibly lost. The aesthetic recreation experience would be irretrievably lost because of the increased number of users on existing recreation areas.

TRANSPORTATION

Railroads

Appendix F (Figure F-3) shows the estimated TPD for each alternative. These impacts are based on peak production and are shown on Table 4-6. The increased number of trains would have the most impact on communities along the main lines. In these communities, interruptions for at-grade crossings would increase the affect on traffic flow, emergency vehicles, yard operations, and noise levels within the communities (see Noise Section). The probability of car/train accidents would also increase as shown in Table 4-6.

Increased traffic along main lines would result in the need for upgrading switches and traffic control systems, additional sidings, and increased maintenance and repair. The capacity of these lines could be increased to keep up with mining production (personal communication, Peter Briggs, BN, 1981). New railroad spurs would be added to provide access to new mine facilities. These new railroad spurs would remove additional acres from agricultural production (see Land Use section).

Highways

Increased traffic is the major impact on road and highway systems. Both the number and type of vehicles impact roads directly. Increases in the traffic along primary and secondary roads would require the need for widening and safety improvements to expand road capacity. Increase in traffic, especially heavy trucks and equipment, would cause maintenance problems such as surface deterioration, ruts, potholes, snow and trash removal, bridge replacement, and signing. Additional increases in traffic would result from increased population. This growth is not estimated to exceed 2 percent annually (personal communication, Phil Colbert, Montana State Department of Highways, 1981). The roads connecting population centers and mines would be most affected. These would be Highway 59, Highway 387, Highway 14/16, Interstate 90 and Highway 87 in Wyoming; Highway 212, FAS 566, FAS 314, FAP 92, Interstate 90, and FAP 39 in Montana.

Increased traffic and road deterioration would cause increased accident rates. Because statistical projections are not available for specific routes, impacts are not quantified.

UNAVOIDABLE ADVERSE IMPACTS

Increases in railroad and auto traffic, delays for auto traffic at grade crossings, accident rates, and road maintenance would be unavoidable.

SHORT TERM VS. LONG TERM

None are identified.

IRREVERSIBLE/IRRETRIEVABLE

Any loss of life or property in car/train accidents.

NOISE

The noise-related impacts within the 55 dBA zone for railroads and highways would be interfer-

ence of sleep and work tasks, disruption of concentration, general annoyance, and disruption of wildlife and domestic animal activities. These impacts would be most significant in areas along new railroad lines and in small communities which do not presently experience large amounts of highway traffic. These areas would include these along the proposed Tongue River Railroad and the Towns of Broadus, Ashland, and Birney, Montana. For railroads the distance included in this zone has been calculated based on traffic projections. These distances are given in Table 4-7 are number of feet from track center line to the 55 dBA contour. Because actual ADT projections have not been calculated for highway traffic, specific estimates of zones would not be made. The 55 dBA zones for most routes; however, would fall between 500 and 1,000 feet from the road center line.

SOCIOLOGY

Social Organization

Social organization in Ashland and Broadus would change considerably with new federal coal development. Newcomers would be different from long-time residents in terms of occupations, values, and interests (Massey, 1977). Influx of newcomers would be at a rapid rate (see Table 4-11). This rapid population growth would disturb the stability of these two communities by changing their structure and functioning. Because of these two factors, the current informal system would not be able to absorb these newcomers. Thus, newcomers would establish their own independent social networks. Interpersonal relationships would become more formal. Long-time residents may feel a loss of their "sense of community." Also, in Ashland there would be the potential for conflicts between the newcomers and the Native Americans. It is likely the Native Americans would feel their lifestyle and community (both in Ashland and on the reservation) as threatened by newcomers.

Rapid population growth in the Ashland area and the Broadus area would result in visible stresses such as personal property crime, family instability, (divorce, spouse abuse, child abuse and neglict), alcohol and drug abuse, interpersonal conflict, and similar behaviors.

While it is uncertain as to whether the rate would markedly change, the increased population levels would virtually insure that their actual incidents would increase. These stresses of adaptation, affecting both long-time residents and newcomers, would be most evident and intense during the initial construction phase of the mine development under Alternative 4. However, at least until construction is completed and stability is re-established, they would also exist in the Ashland and Broadus areas under Alternative 2 and 3 development.

The social organization in Gillette would continue apace toward formal interpersonal relationships. Population increases would add to the process of urbanization and suburbanization.

Community Services

The community services and facilities that would be required by 1990 are given in Table 4-8.

Housing

Table 4-9 gives the projected number of dwelling units that would be required in 1990 under each alternative.

There is planning underway for housing in the Ashland district. A subdivision has received approval for construction of 46 dwellings and an additional 96 lots (personal communication, Eldon Price, Rosebud County Planner, 1981). Also, planning for two subdivisions near Ashland, located in Powder River County, would provide for an addition of approximately 180 dwellings. The update of the Powder River County Comprehensive Plan of 1979 discusses plans for expansion within the town of Broadus including residential areas (Powder River County Director, 1981). Since Gillette has been growing at a rapid rate, housing construction is expanding concurrently.

ECONOMICS

Table 4-12 presents a comparison of potential fiscal impacts among the alternatives. The exact magnitude of projected deficits or surpluses should not be overemphasized. The importance of magnitudes derives only from their ability to provide a comparison of the relative impacts and to point out the localities where potential costs may exceed potential benefits, or vice versa, where potential benefits may exceed potential costs. Assumptions and methodology are implicit in the footnotes to the table.

Montana

Montana counties, schools or communities do not receive a percentage of the severance tax on

mineral production from the state. However, in an effort to tie potential benefits to potential costs in the analysis of Alternatives 2, 3, and 4, additional revenues to local entities were estimated on the basis of coal production.

Big Horn County

Alternative 1 (No Action). Coal production will stimulate growth in Big Horn County even without additional federal competitive leasing. A production increase of 100 percent by 1986 would cause an equal increase in coal mining employment and a moderate increase in employment by other sectors by 1990 (Table 4-10). Population increases (Table 4-11) would result in increases in public expenditures through 1990 (Table 4-12) after which the changes would stabilize.

Alternatives 2, 3 and 4. Were it not for the slight increase in employment caused by the maintenance tract, North Decker, Big Horn County would not be affected economically by Alternatives 2, 3, or 4. Because North Decker is a component of each of Alternatives 2, 3, and 4, the economic impacts to Big Horn County would be the same under each. However, in the final analysis, a relatively insignificant increase in coal employment would not result in a notable increase in public expenditures until 1990, at which time public revenues derived from the tract would equal or slightly exceed the expenditures (Table 4-12).

Powder River County

Alternative 1 (No Action). Without additional federal competitive leasing the economy of Powder River County is expected to remain static (Table 4-12).

Alternatives 2, 3, and 4. All tracts that are expected to provide stimulus to employment, except North Decker, are located in Powder River County. However, due to the close proximity of Ashland, in adjacent Rosebud County, 60 percent of any resulting population increase is expected to reside in Rosebud County.

Even though Powder River County is expected to receive less than half of any population increase, the resulting economic impact would be significant due to the small number of residents in the county. Increases in expected public expenditures during the early phase of construction (1986) would outweigh any possible increase in revenues to the county, at that time, causing a negative fiscal impact under each of Alternatives 2, 3, and 4 (Table 4-12). By 1990, however, fiscal surpluses would occur for county schools and the community of Broadus. Powder River County would experience a fiscal surplus under Subalternatives 2B and 2C or 3B and 3C.

Rosebud County

Alternative 1 (No Action). Ongoing coal development, a new power plant, and an increase in oil and gas activity would put pressure on county, community, and school resources in Rosebud County without additional federal leasing. The heaviest impacts would be realized by 1986 as public expenditures increase by about 30 percent to provide necessary services to an increasing population.

Alternatives 2, 3, and 4. Because Rosebud County, Ashland in particular, would provide residence to 60 percent of the population increase associated with any of the action alternatives, but would not be the recipient of public revenues from the coal production, a negative net fiscal balance would result under Alternatives 2, 3, or 4 (Table 4-12). This would put added pressure on public finances as it would be occurring during a period when public expenditures are expanding due to other developments.

Ashland: It is expected that all of the additional population to Rosebud County, due to Alternatives 2, 3, or 4, would reside in Ashland District (pop. 569 in 1980). This would severely impact the community (see Table 4-11). Alternative 2 or 3 would increase Ashland District population by about 1,700 in 1990, in the worst case.

Agricultural Economics: Appendix G (Tables G-1 and G-2) presents an analysis of the relative impacts to agriculture in the Montana section of the region.

Wyoming

Alternative 1 (No Action). Increased coal production, oil and gas development, new power plants, synthetic fuel plants, and uranium development would all be contributing factors to what is expected to be a period of rapid growth for several counties of the Wyoming region even without additional federal coal leasing. In Campbell County the major force behind an 80 percent increase in population by 1985 (Table 4-11) would be a fivefold increase in coal production, as well as a new power plant. In Converse County a tripling of coal production and the construction of a synfuels plant would contribute to an approximate 50 percent increase in population by 1985. Increased coal production in Sheridan County is expected to be accompanied by moderate growth. Other counties would undergo

steady, but less spectacular, growth as they provide services or residences for commuters to the counties of high growth. Population increases in Natrona County and the city of Casper would continue apace as Casper continues to be a trade center providing wholesale and retail outlets and services to the region.

Alternatives 2, 3, and 4. In terms of the economic impacts which would result to Wyoming counties from Alternatives 2, 3, and 4 there are only two alternatives. This occurs because the effects of Alternatives 2 and 3 are the same, leaving a comparison between either of these alternatives and Alternative 4. Predictably, the impacts of Alternative 4 would be the heaviest.

Also predictable is the impact to Campbell County under any of the alternatives. Because all tracts under consideration in the Wyoming section of the region are located in Campbell County, the largest share of employment and population increases would occur in Campbell County (Tables 4-10, 4-11). Any employment or population increases to other counties, under the action alternatives, would be due to creation of secondary employment in the retail, wholesale, and services sectors or as a result of persons employed in Campbell County, but residing in another county.

Population impacts notwithstanding, Campbell County would realize a significant net fiscal surplus as the public revenues associated with Alternatives 2, 3, or 4 exceed the expected public expenditures (Table 4-12). This is true for the school district also. However, after the higher levels of sales and use tax associated with the construction period disappear, incremental expenditures by the city of Gillette resulting under these alternatives would exceed expected revenues by about 2.5 percent of the projected 1990 no-action expenditures under Alternative 2 or 3 or by about 5 percent under Alternative 4.

As the public revenues associated with the new coal production accrue to Campbell County and none to neighboring counties, the incremental net fiscal balance in other counties would be negative as public expenditures expand to serve increased populations. The largest, negative, incremental balances would occur in Natrona County and Casper at about .5 million dollars under Alternatives 2 or 3, or about 1 million dollars under Alternative 4 in 1990. The 1 million dollar level would equal about 3 percent of projected 1990 Natrona school district expenditures.

Agricultural Economics: See Section 3 "Socioeconomics" in the Tract Profiles (BLM, 1981) on the individual tracts for a discussion about the effects of coal production on Wyoming agriculture.

UNAVOIDABLE ADVERSE IMPACTS

The following unavoidable adverse impacts are presented by alternative for the purpose of comparison. Alternative 1 impacts have been added to each of the other alternatives.

ALTERNATIVE 1

1) Removal of the coal beds and destruction of overlying strata.
2) Removal of approximately 210,000 acres of aquifers.
3) Destruction of 252 wells and 25 springs.
4) DS concentrations would increase in reclaimed areas possibly two to three times the mining levels.
5) Total TSP levels would be about 69,300 tons per year.
6) Alteration of soil characteristics and properties, and loss of vegetative cover on approximately 210,000 acres.
7) Wildlife population losses due to poaching and road kills.
8) Between 1,311 and 3,733 cultural sites would be disturbed. Some knowledge would be lost due to excavation of sites before improved technology.
9) Decrease of VRM Class III and IV areas to Class V.
10) Loss of 11,400 acres for conversion of existing rural land uses to mine-related and urban uses.
11) High demand would be placed on existing recreation facilities.
12) Increases in railroad and highway traffic.
13) Increased delays for auto traffic at grade crossings.
14) Increases in road maintenance.
15) Increases in accident rates.

ALTERNATIVE 2

1) Removal of the coal beds and destruction of overlying strata.

2) Removal of approximately 245,000 acres of aquifers.
3) Destruction of 299 wells and 33 springs.
4) DS concentrations would increase in reclaimed areas possibly two to three times the mining levels.
5) Total TSP levels would be about 84,700 tons per year.
6) Alteration of soil characteristics and properties, and loss of vegetative cover on approximately 267,400 acres (Alternative 1 plus Alternative 2 acreage from Table 4-3).
7) Wildlife population losses due to poaching and road kills.
8) Between 1,882 and 4,304 cultural sites would be disturbed. Some knowledge would be lost due to excavation of sites before improved technology.
9) Decrease of VRM Class III and IV areas to Class V.
10) Loss of 1,200 acres for conversion of existing rural land uses to mine-related and urban uses.
11) High demand would be placed on existing recreation facilities.
12) Increases in railroad and highway traffic.
13) Increased delays for auto traffic at grade crossings.
14) Increases in road maintenance.
15) Increases in accident rates.

ALTERNATIVE 3

1) Removal of the coal beds and destruction of overlying strata.
2) Removal of approximately 247,000 acres of aquifers.
3) Destruction of 310 wells and 35 springs.
4) DS concentrations would increase in reclaimed areas possibly two to three times the mining levels.
5) Total TSP levels would be about 86,100 tons per year.
6) Alteration of soil characteristics and properties, and loss of vegetative cover on approximately 274,000 acres (Alternative 1 plus Alternative 3 acreage from Table 4-3).
7) Wildlife population losses due to poaching and road kills.
8) Between 1,855 and 4,277 cultural sites would be disturbed. Some knowledge would be lost due to excavation of sites before improved technology.
9) Decrease of VRM Class III and IV areas to Class V.
10) Loss of 12,200 acres for conversion of existing rural land uses to mine-related and urban uses.
11) High demand would be placed on existing recreation facilities.
12) Increases in railroad and highway traffic.
13) Increased delays for auto traffic at grade crossings.
14) Increases in road maintenance.
15) Increases in accident rates.

ALTERNATIVE 4

1) Removal of the coal beds and destruction of overlying strata.
2) Removal of approximately 270,000 acres of aquifers.
3) Destruction of 352 wells and 35 springs.
4) DS concentration would increase in reclaimed areas possibly two to three times the mining levels.
5) Total TSP levels would be about 94,900 tons per year.
6) Alteration of soil characteristics and properties, and loss of vegetative cover on approximately 293,500 acres (Alternative 1 plus Alternative 4 acreage from Table 4-3).
7) Wildlife population losses due to poaching and road kills.
8) Between 2,148 and 4,570 cultural sites would be distubed. Some knowledge would be lost due to excavation of sites before improved technology.
9) Decrease of VRM Class III and IV areas to Class V.
10) Loss of 12,330 acres for conversion of existing rural land uses to mine-related and urban uses.
11) High demand would be placed on existing recreation facilities.
12) Increases in railroad and highway traffic.
13) Increased delays for auto traffic at grade crossings.

14) Increases in road maintenance.

15) Increases in accident rates.

SHORT TERM VS. LONG TERM

The following lists of relationships between short-term uses of man's environment and the maintenance and enhancement of long-term productivity have also been presented by alternative.

ALTERNATIVE 1

1) Short-term impact of an increase in DS concentrations in reclaimed areas.

2) Ground water levels in the vicinity of the mines would be lower during the short term but would return to near premining levels after reclamation.

3) Anticipated air quality impacts would constitute a short-term use of the air resource near the mines which could place a potential restriction on the nearby development of other industrial activities that emit air pollutants.

ALTERNATIVES 2, 3, AND 4

1) Short-term impact of an increase of DS concentrations in reclaimed areas.

2) Ground water levels in the vicinity of the mines would be lower during the short term but would return to near premining levels after reclamation.

3) Anticipated air quality impacts would constitute a short-term use of the air resource near the mines which could place a potential restriction on the nearby development of other industrial activities that emit air pollutants.

4) Return of a significant part of the disturbed land to a productive state during the short term is anticipated.

5) Long-term productivity would be lowered for wildlife until sagebrush is re-established.

6) A cultural inventory of the unstudied areas of the region would be performed at an earlier date.

7) Short-term loss of agricultural productivity on the tracts until reclamation.

IRREVERSIBLE/IRRETRIEVABLE

The following types of irreversible or irretrievable commitments of resources would be the same under each alternative; differences between alternatives would be magnitude.

1) Coal once mined and consumed would be irreversible. Coal not mined due to lack of technology would be economically irretrievable.

2) Removal of aquifers and other strata in the mined areas would alter conditions of ground water occurrence.

2) Removal of perching layers would destroy springs and seeps.

3) Wells would be permanently destroyed.

4) Municipal water consumed by the additional population would be irretrievable.

6) Any soil loss resulting from disturbance would be irretrievable.

7) Disturbance of natural soil profiles and different associated vegetation types is irreversible.

8) Wildlife lost would be irretrievable.

9) Loss of topographic diversity would support fewer deer population.

10) Disturbance to cultural resources would be irreversible. Data retrieval would not be available to future researchers. Buried sites would be lost.

11) Land used for urban expansion and mine-related uses would be irretrievable.

12) The aesthetic recreation experience would be irretrievably lost.

13) Loss of life or property is irretrievable.

TABLE 4-1a
ANNUAL COAL PRODUCTION - 1990 (MILLION TONS)
(Federal, State and Private Coal)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Existing Mines	194.43	194.43	194.43	194.43
Proposed Mines	128.9	181.00	181.60	330.50
PRLAs	45.55	45.55	45.55	45.55
Total	368.88	420.98	421.58	470.48

TABLE 4-1b
ANNUAL COAL PRODUCTION - 1990 (MILLION TONS)
(Federal Recoverable Reserves Only)

	Alt. 1	Alt. 2	Alt. 3	Alt. 4
Existing Mines	194.43	194.43	194.43	194.43
Proposed Mines	128.90	166.70	169.20	201.90
PRLAs	45.55	45.55	45.55	45.55
Total	368.88	406.68	409.18	441.88

TABLE 4-2
ESTIMATED MAXIMUM POTENTIAL EFFECTS ON DISCHARGE AND DISSOLVED-SOLIDS CONCENTRATIONS OF STREAMS

	Percent reduction in flow				Percent increase in dissolved-solids concentration			
	Alternative				Alternative			
	#1	#2	#3	#4	#1	#2	#3	#4
Armells Creek	1.8	a/	a/	a/	1.2	4.0	4.0	4.0
Rosebud Creek	1.0	a/	a/	a/	1.8	0.1	0.1	0.1
Tongue River	0.4	0.07	0.07	0.1	0.5	0.4	0.4	0.5
Otter Creek	0.01	1.3	1.3	2.7	0.02	1.2	1.2	2.5
Powder River	0.1	a/	a/	a/	0.3	a/	a/	a/
Little Powder River	2.8	0.2	a/	0.2	4.0	0.2	a/	0.2
Cheyenne River	0.7	a/	0.1	0.1	1.5	a/	0.1	0.1
Belle Fourche River	3.5	0.4	0.6	0.7	5.0	0.4	0.6	0.7
North Platte River	0.7	a/	a/	a/	0.07	a/	a/	a/
Yellowstone River	0.3	0.003	0.003	0.006	0.09	0.03	0.03	0.04

a/ No additional effect.

TABLE 4-3
TOTAL ACRES DISTURBED/VEGETATION TYPES AND LAND USE a/

		RANGELAND			AGRICULTURE			
ALTERNATIVE	TOTAL	SAGE/GRASS	GRASSLAND	PONDEROSA PINE	NON-IRRIGATED	IRRIGATED	RIPARIAN/ WETLAND	MISC. b/
1	210,000 c/							
2	57,400	23,800	16,900	8,100	5,300	900	142	2,258
3	64,200	29,800	17,200	8,100	5,800	900	142	2,258
4	83,500	39,800	21,100	10,100	8,800	1,300	142	2,258

a/ Acres derived from total acres of each tract based on habitat types generated by U.S. Fish and Wildlife Service, WELUT, 1980.
b/ One or more of the following types: closed sage, mixed shrub, ranch yards, roads.
c/ Data breakdown of the total acreage is not available.

TABLE 4-4
CUMULATIVE ACRES OF WILDLIFE HABITAT DISTURBED BY 1990

Location	Alternative 1	Alternative 2	Alternative 3	Alternative 4
MONTANA				
Colstrip Area	3,564	5,088	5,088	5,088
Decker Area	6,890	6,890	6,890	6,890
Otter Creek	0	2,057	2,902	3,862
WYOMING				
Hunt Areas:				
Antelope 24 & 101 (Deer 21)	61,420	62,894	63,831	64,834
Antelope 17, 18, & 19 (Deer 17 & 18)	95,631	97,066	96,243	97,199
Antelope 23 (Deer 19 & 20)	57,400	57,454	57,544	57,544

TABLE 4-5
ESTIMATED AFFECTED CULTURAL SITES
1990

Alternative 1	1,311 to 3,733
Alternative 2	1,882 to 4,304
Alternative 3	1,855 to 4,277
Alternative 4	2,148 to 4,570

a/ Using known and predicted site density figures.

TABLE 4-6
AVERAGE TRAINS PER DAY AND AT-GRADE CROSSING EFFECTS

Location	Trains Per day	At-Grade Crossings Daily Interruptions 5 mph	20 mph	Car/Train Accidents a/ Per 100 Years
Alternative 1				
Miles City, MT	29	5 hrs 48 min	1 hr 27 min	3
Gillette, WY	20	4 hrs	1 hr	2
Newcastle, WY	79	15 hrs 48 min	3 hrs 57 min	10
Torrington, WY	75	15 hrs	3 hrs 45 min	9
Alternative 2				
Miles City, MT	49	9 hrs 48 min	2 hrs 27 min	6
Gillette, WY	21	4 hrs 12 min	1 hr 3 min	2
Newcastle, WY	99	19 hrs 48 min	4 hrs 57 min	12
Torrington, WY	86	17 hrs 12 min	4 hrs 13 min	11
Alternative 3				
Miles City, MT	49	9 hrs 48 min	2 hrs 27 min	6
Gillette, WY	21	4 hrs 12 min	1 hr 3 min	2
Newcastle, WY	99	19 hrs 48 min	4 hrs 57 min	12
Torrington, WY	94	18 hrs 48 min	4 hrs 42 min	12
Alternative 4				
Miles City, MT	60	12 hrs	3 hrs	7
Gillette, WY	22	4 hrs 24 min	1 hr 6 min	3
Newcastle, WY	100	20 hrs	5 hrs	12
Torrington, WY	102	20 hrs 24 min	5 hrs 6 min	13

a/ Based on 1,000 vehicles daily.

TABLE 4-7
RAILROAD NOISE CONTOUR ZONES
(NUMBER OF FEET FROM TRACT CENTER LINE)

Location	Alternative 1	Alternatives 1 & 2	Alternative 4
Miles City, Montana (Northern Route)	4,640	6,130	7,536
Gillette, Wyoming (Central Route)	3,981	3,981	3,981
Newcastle, Wyoming (Central Route)	8,580	10,000	11,659
Torrington, Wyoming (Southern Route)	8,580	10,000	11,659

TABLE 4-8
COMMUNITY SERVICE AND FACILITY REQUIREMENTS (1990) a/

	Montana								Wyoming							
	Rosebud				Powder River				Campbell				Natrona			
Service/Facility	Alt 1	Alt 2	Alt 3	Alt 4	Alt 1	Alt 2	Alt 3	Alt 4	Alt 1	Alt 2	Alt 3	Alt 4	Alt 1	Alt 2	Alt 3	Alt 4
Law Enforcement (sworn officers)	21	23	23	26	4	6	6	7	109	115	115	120	150	152	152	153
Teachers	210	235	235	260	48	69	69	90	811	850	850	892	1,174	1,189	1,189	1,203
Physicians	4	5	5	5	1	2	2	2	39	41	41	43	116	117	117	119
Dentists	6	7	7	7	1	2	2	2	10	11	11	11	46	46	46	47
Hospital Beds	39	43	43	48	10 b/	15	15	19	60	63	63	66	340	345	345	349

a/ Estimates of Montana requirements are based on existing levels per 1,000 population in 1980. Estimates of Wyoming requirements are based on existing levels per 1,000 population in 1979. Exceptions are noted.

b/ There is no hospital in Powder River County. This need is based on the standard of 4 beds per 1,000 population.

TABLE 4-9
PROJECTED NUMBER OF DWELLING UNITS REQUIRED IN THE
POWDER RIVER REGION IN 1990

Montana a/	Alternative 1 Baseline	Alternatives 2 or 3 Increment	Alternatives 2 or 3 Total	Alternative 4 Increment	Alternative 4 Total
Big Horn County	5,200	100	5,300	100	5,300
Hardin	1,800	0	1,800	0	1,800
Powder River County	1,150	500	1,650	1,000	2,150
Broadus	350	280	630	800	1,150
Rosebud County	5,600	750	6,350	1,500	7,100
Ashland District	350	750	1,100	1,500	1,850
Wyoming b/					
Campbell County	17,600	900	18,500	1,800	19,400
Gillette	9,000	460	9,460	900	9,900
Converse County	8,200	75	8,275	150	8,350
Douglas	3,600	35	3,635	70	3,670
Crook County	2,900	30	2,930	60	2,960
Moorcroft	510	10	520	15	525
Johnson County	3,700	40	3,740	80	3,780
Buffalo	2,050	20	2,070	40	2,090
Natrona Country	33,200	420	33,620	810	34,010
Casper	23,500	290	23,790	570	24,070
Sheridan County	14,600	170	14,770	340	14,940
Sheridan	8,800	100	8,900	200	9,000
Weston County	3,500	30	3,530	70	3,570
Newcastle	1,750	15	1,765	30	1,780

a/ Estimates based on 1980 population to housing ratio derived from 1980 final census and housing count.

b/ Estimates based on the 1980 population to housing ratio derived from 1980 preliminary census and housing count.

TABLE 4-10
PROJECTED EMPLOYMENT FOR THE POWDER RIVER REGION IN 1990

Montana a/	Alternative 1 Baseline	Alternatives 2 or 3 Increment	Alternatives 2 or 3 Total	Alternative 4 Increment	Alternative 4 Total
Big Horn County					
Coal Employment	1,900	80	1,980	80	1,980
All Other Employment	5,600	80	5,680	80	5,680
Total	7,500	160	7,660	160	7,660
Powder River County					
Coal Employment	15	690	705	1,380	1,395
All Other Employment	1,230	690	1,920	1,380	2,610
Total	1,245	1,380	2,625	2,760	4,005
Rosebud County					
Coal Employment	1,300	0	1,300	0	1,300
All Other Employment	6,100	0	6,100	0	6,100
Total	7,400	0	7,400	0	7,400
Wyoming b/					
Campbell County					
Coal Employment	9,200	1,010	10,200	2,000	11,200
All Other Employment	14,300	180	14,480	300	14,600
Total	23,500	1,190	24,680	2,300	25,800
Converse County					
Coal Employment	1,700	0	1,700	0	1,700
All Other Employment	7,200	80	7,280	170	7,370
Total	8,900	80	8,980	170	9,070
Crook County					
Coal Employment	0	0	0	0	0
All Other Employment	1,750	20	1,770	30	1,780
Total	1,750	20	1,770	30	1,780
Johnson County					
Coal Employment	0	0	0	0	0
All Other Employment	2,600	30	2,630	60	2,660
Total	2,600	30	2,630	60	2,660
Natrona Country					
Coal Employment	0	0	0	0	0
All Other Employment	43,300	540	43,840	1,100	44,400
Total	43,300	540	43,840	1,100	44,400
Sheridan County					
Coal Employment	1,400	0	1,400	0	1,400
All Other Employment	9,500	130	9,630	250	9,750
Total	10,900	130	11,030	250	11,150
Weston County					
Coal Employment	0	0	0	0	0
All Other Employment	2,900	30	2,930	50	50
Total	2,900	30	2,930	50	2,950

a/ Baseline coal employment estimates for the Montana counties were extrapolated from the Wyoming Powder River Input-Output model based on projected additional coal production. Estimates of additional coal employment under Alternatives 2, 3, and 4 were made by Keith Bennett in Tract Profiles, Miles City District Office (BLM, 1981). All secondary employment for Montana was estimated on the basis of one additional job for each permanent primary job and .5 additional jobs for each temporary primary job.

b/ All Wyoming employment estimates were generated by the Wyoming Powder River Input-Output model developed by John McKean at Colorado State University.

TABLE 4-11
PROJECTED POPULATION IN THE POWDER RIVER REGION IN 1990

Montana a/	Alternative 1 Baseline	Alternatives 2 or 3 Increment	Alternatives 2 or 3 Total	Alternative 4 Increment	Alternative 4 Total
Big Horn County	14,800	320	15,120	320	15,120
Hardin	4,400	0	4,400	0	4,400
Powder River County	2,523	1,120	3,643	2,200	4,723
Broadus	715	580	1,295	1,660	2,375
Rosebud County	14,700	1,680	16,380	3,400	18,100
Forsyth	3,800	0	3,800	0	3,800
Ashland District	800	1,680	2,480	3,400	4,200
Wyoming b/					
Campbell County	45,100	2,300	47,400	4,500	49,600
Gillette	22,500	1,150	23,650	2,250	24,750
Converse County	21,400	200	21,600	400	21,800
Douglas	9,200	90	9,290	170	9,370
Crook County	6,400	70	6,470	130	6,530
Moorcroft	1,220	15	1,235	30	1,250
Johnson County	8,300	90	8,390	180	8,480
Buffalo	4,700	50	4,750	100	4,800
Natrona Country	84,000	1,050	85,050	2,050	86,050
Casper	59,500	740	60,240	1,450	60,950
Sheridan County	33,600	400	34,000	770	34,370
Sheridan	20,300	240	20,540	470	20,770
Weston County	8,600	80	8,680	160	8,760
Newcastle	4,300	40	4,340	80	4,380

a/ Montana county estimates are based on the 1980 ratio of population to employment for permanent employment and 1.3 population to transient employment. Projections of community populations are based on the 1980 ratio of community to county.

b/ Wyoming county estimates are based on the 1980 ratio of population to employment for permanent employment and the ratio of 1970-1980 population change to the 1970-1980 employment change for transient employment. Projections of community populations are based on the 1980 ratio of community to county.

TABLE 4-12
COUNTY, SCHOOL, AND COMMUNITY BUDGET
LEVELS PROJECTED FOR 1990
(Rounded to the Nearest $100,000, Includes Debt Servicing)

Montana	Alternative 1 Baseline a/ ($1,000)	Alternatives 2 or 3 Increment b/ ($1,000)	Alternatives 2 or 3 Total ($1,000)	Alternative 4 Increment b/ ($1,000)	Alternative 4 Total ($1,000)
Big Horn County					
Revenues	8,200	200	8,400	200	8,400
Expenditures	8,200	200	8,400	200	8,400
Balance	0	0	0	0	0
Big Horn County Schools					
Revenues	13,300	400	13,700	400	13,700
Expenditures	13,300	300	13,600	300	13,600
Balance	0	100	100	100	100
Hardin					
Revenues	1,000	0	1,000	0	1,000
Expenditures	1,000	0	1,000	0	1,000
Balance	0	0	0	0	0
Powder River County					
Revenues	3,800	1,400	5,200	2,500	6,300
Expenditures	3,800	1,700	5,500	3,400	7,200
Balance	0	-300	-300	-900	-900
Powder River Co. Schools					
Revenues	2,000	4,100	6,100	5,600	7,600
Expenditures	2,000	900	2,900	1,700	3,700
Balance	0	3,200	3,200	3,900	3,900
Broadus					
Revenues	200	200	400	300	500
Expenditures	200	100	300	400	600
Balance	0	100	100	-100	-100
Rosebud County					
Revenues	9,800	0	9,800	0	9,800
Expenditures	9,800	1,100	10,900	2,300	12,100
Balance	0	-1,100	-1,100	-2,300	-2,300
Rosebud County Schools					
Revenues	9,100	0	9,100	0	9,100
Expenditures	9,100	1,000	10,100	2,100	11,200
Balance	0	-1,000	-1,000	-2,100	-2,100
Forsyth					
Revenues	2,000	0	2,000	0	2,000
Expenditures	2,000	0	2,000	0	2,000
Balance	0	0	0	0	0

TABLE 4-12 continued

Montana	Alternative 1 Baseline a/ ($1,000)	Alternatives 2 or 3 Increment b/ ($1,000)	Alternatives 2 or 3 Total ($1,000)	Alternative 4 Increment b/ ($1,000)	Alternative 4 Total ($1,000)
Ashland c/					
Revenues	---	---	---	---	---
Expenditures	---	---	---	---	---
Balance	---	---	---	---	---
Wyoming					
Campbell County					
Revenues	26,600	5,700	32,300	11,300	37,900
Expenditures	26,000	1,400	28,000	2,700	29,300
Balance	0	4,300	4,300	8,600	8,600
School District #1					
Revenues	69,800	10,300	80,100	20,400	90,200
Expenditures	69,800	3,600	73,400	7,000	76,800
Balance	0	6,700	6,700	13,400	13,400
Gillette					
Revenues	19,800	500	20,300	1,000	20,800
Expenditures	19,800	1,000	20,800	2,000	21,800
Balance	0	-500	-500	-1,000	-1,000
Converse County					
Revenues	13,500	0	13,500	0	13,500
Expenditures	13,500	100	13,600	300	13,800
Balance	0	-100	-100	-300	-300
School District #1					
Revenues	24,800	0	24,800	0	24,800
Expenditures	24,800	200	25,000	500	25,300
Balance	0	-200	-200	-500	-500
Douglas					
Revenues	10,800	0	10,800	0	10,800
Expenditures	10,800	100	10,900	200	11,000
Balance	0	-100	-100	-200	-200
Crook County					
Revenues	4,300	0	4,300	0	4,300
Expenditures	4,300	0	4,300	100	4,400
Balance	0	0	0	-100	-100

TABLE 4-12 continued

Wyoming	Alternative 1 Baseline a/ ($1,000)	Alternatives 2 or 3 Increment b/ ($1,000)	Alternatives 2 or 3 Total ($1,000)	Alternative 4 Increment b/ ($1,000)	Alternative 4 Total ($1,000)
School District #1					
Revenues	5,600	0	5,600	0	5,600
Expenditures	5,600	100	5,700	100	5,700
Balance	0	-100	-100	-100	-100
Moorcroft					
Revenues	500	0	500	0	500
Expenditures	500	0	500	0	500
Balance	0	0	0	0	0
Johnson County					
Revenues	2,600	0	2,600	0	2,600
Expenditures	2,600	0	2,600	100	2,700
Balance	0	0	0	-100	-100
School District #1					
Revenues	7,100	0	7,100	0	7,100
Expenditures	7,100	100	7,200	200	7,300
Balance	0	-100	-100	-200	-200
Buffalo					
Revenues	2,400	0	2,400	0	2,400
Expenditures	2,400	0	2,400	100	2,500
Balance	0	0	0	-100	-100
Natrona County					
Revenues	43,000	0	43,000	0	43,000
Expenditures	43,000	500	43,500	1,100	44,100
Balance	0	-500	-500	-1,100	-1,100
School District #1					
Revenues	37,300	0	37,300	0	37,300
Expenditures	37,300	500	37,800	900	38,200
Balance	0	-500	-500	-900	-900
Casper					
Revenues	50,400	0	50,400	0	50,400
Expenditures	50,400	600	51,000	1,200	51,600
Balance	0	-600	-600	-1,200	-1,200
Sheridan County					
Revenues	20,400	0	20,400	0	20,400
Expenditures	20,400	200	20,600	500	20,900
Balance	0	-200	-200	-500	-500

TABLE 4-12 concluded

Wyoming	Alternative 1 Baseline a/ ($1,000)	Alternatives 2 or 3 Increment b/ ($1,000)	Alternatives 2 or 3 Total ($1,000)	Alternative 4 Increment b/ ($1,000)	Alternative 4 Total ($1,000)
School District #2					
Revenues	13,700	0	13,700	0	13,700
Expenditures	13,700	200	13,900	300	14,000
Balance	0	-200	-200	-300	-300
Sheridan					
Revenues	9,900	0	9,900	0	9,900
Expenditures	9,900	100	10,000	200	10,100
Balance	0	-100	-100	-200	-200
Weston County					
Revenues	4,700	0	4,700	0	4,700
Expenditures	4,700	0	4,700	100	4,800
Balance	0	0	0	-100	-100
School District #1					
Revenues	4,500	0	4,500	0	4,500
Expenditures	4,500	0	4,500	100	4,600
Balance	0	0	0	-100	-100
Newcastle					
Revenues	2,000	0	2,000	0	2,000
Expenditures	2,000	0	2,000	0	2,000
Balance	0	0	0	0	0

a/ These are the budget levels that are expected to exist without additional Federal Competitive Leasing. Expenditures were projected from actual FY 1979/1980 budgets (including debt servicing) on a per capita basis in order to maintain the per capita spending levels of FY 1979/1980. It is assumed that revenues will equal expenditures through additional taxes user fees, grants, royalties, or debt.

b/ The additional expenditures above baseline expenditures, which are required to maintain FY 1979/1980 per capita spending levels for additional populations, were projected from actual FY 1979/1980 budgets (including debt servicing) on a per capita basis. Additional revenues above baseline revenues for Montana Counties are based on revenue to coal production ratios derived from a baseline run of the coal town model, which was generated by Keith Bennett. Additional revenues for Wyoming Counties were generated by a coal revenue model developed by Thomas F. Stinson at the University of Minnesota.

c/ Because Ashland is an unincorporated community without a formal budget it is difficult to make reliable budget projections.

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REFERENCES

ANDERSON, JANE L., 1980. *Preliminary Report on a Cultural Resource Inventory of the Rawhide Mine, Campbell County, Wyoming.* Longmont, Colorado: Pioneer Archeological Consultants.

BENDER, LLOYD. *Coaltown Model.* Billings, Montana: Montana State University.

BRIGGS, PETER, PUBLIC RELATIONS BN, 1981. Systems maps and ATD information for Burlington Northern in Northeast Wyoming. (Personal communication). Darrel Schwilling, Resource Specialist, Casper District Office.

BROWN, R.W., 1962. *Paleocene Flora of the Rocky Mountains and Great Plains.* USGS Professional Paper 375.

BRYANT, GEHR AND ROLLEFSON, 1980. *Analysis of Methodological Goals, Otter and Hanging Woman Creeks Class III Cultural Resource Inventory.* Eugene, Montana: Professional Analysts.

BUREAU OF LAND MANAGEMENT, 1979a. *Final Environmental Statement, Eastern Powder River Coal.* Washington, D.C.: GPO

BUREAU OF LAND MANAGEMENT, 1979b. *Final Environmental Statement, Federal Coal Management Program.* Washington D.C.: GPO

BUREAU OF LAND MANAGEMENT, 1980a. *Final Environmental Impact Statement, Montana Wilderness Inventory, Miles City and Lewistown Districts.* Montana State Office.

BUREAU OF LAND MANAGEMENT, 1980b. *Wyoming Wilderness Study Areas.* Wyoming State Office

BUREAU OF LAND MANAGEMENT, 1981. *Tract Profiles.* Wyoming State Office/Casper District Office.

BUREAU OF LAND MANAGEMENT, unpublished document by Gerald Clark. *Prehistoric Overview of Miles City District.* Miles City, Montana: BLM in-house Class I inventory.

BUREAU OF LAND MANAGEMENT MANUAL. *VRM Manual 8400.* Casper District Office

CAMPBELL COUNTY RECREATION BOARD, 1974. *Campbell County Recreation Study.* Casper, Wyoming: Gorder/South/Bechtel and Associates, P.C.

CITY OF GILLETTE, DEPARTMENT OF PLANNING AND DEVELOPMENT, 1978. *City of Gillette, Campbell County Comprehensive Planning Program.* Gillette, Wyoming.

COLE, G.A., MATSON R.E., AND PEDERSON, R.T., 1980. *Montana Coal: A Guide to Coal Geology, Resources, and Productions.* Montana Bureau of Mines and Geology, S.P. 83.

DORN, ROBERT D., 1980. *Illustrated Guide to Special Interest Vascular Plants of Wyoming.* U.S. Fish and Wildlife Service and Bureau of Land Management.

FEATHERS, MARY, 1981. Discussed site inventories with Wyoming State Archeologist. (Personal communication). Manton Botsford, Resource Specialist, Casper District Office.

FOX, RICHARD ALLEN, 1978. *Archeology of the Spring Creek Mine Area: Survey and Testing Phases.* Missoula, Montana: University of Montana, Department of Anthropology.

GLASS, G.B., 1976. *Update on the Powder River Coal Basin.* Wyoming Geologic Association Guidebook, Powder River.

GLASS, G.B., 1980. *Guide Book to the Coal Geology of the Powder River Coal Basin,* Wyoming Geological Survey PIC 14.

HARJU, H.J., 1980. *The Wyoming Viewpoint* in *Adequate Reclamation of Mined Lands? Symposium.* Soil Conservation Society of America and WRCC-21. Billings Montana.

KING, N.J., USGS HYDROLOGIST, DENVER, COLORADO, 1981. Water quality conditions of spoil aquifers in the Powder River Region. (Personal communication). Bill Lichtler, Resource Specialist, USGS, Lincoln, Nebraska.

LAUMANN, EDWARD O., 1973. *Bonds of Pluralism: The Form and Substance of Urban Social Networks.* New York City, New York: Wiley

MARTIN, P.R., 1980. *Terrestrial Wildlife Habitat Inventory in Southeastern Montana.* Billings, Montana: Bureau of Land Management.

MASSEY, GARTH, 1977. *Intersecting Careers of Work and Non-Work Among a Mobile Population.* Paper presented at the annual meeting of the American Sociological Association, Chicago, Illinois.

MATSON, R.E. AND BLUMERS, J.W., 1973. *Quality and Reserves of Strippable Coal, Selected Deposits Southeastern Montana.* Montana Bureau of Mines and Geology, Bulletin 91.

MATSON, R.E. AND PINCHOCK, J.M., 1977. *Geology of the Tongue River Member, Fort Union Formation, Eastern Montana.* Colorado Geological Survey Resource Series 1.

MCKEAN, JOHN. *Powder River I-O Model.* Ft. Collins, Colorado: Colorado State University.

MONTANA DEPARTMENT OF FISH AND GAME, 1978. *Montana Statewide Comprehensive Outdoor Recreation Plan.* Bozeman, Montana: Color World of Montana, Inc.

MONTANA DEPARTMENT OF STATE LANDS AND OFFICE OF SURFACE MINING, 1981. *Draft Tongue River, Montana, Petition Evaluation Document.*

MUNSON AND MUNSON, 1980. *Cultural Resource Investigation and Assessment in the Big Sky Mine Study Area A, Reports of Investigations No. 12.* Butte, Montana: Mineral Research Center

OFFICE OF SURFACE MINING, 1981. Discussed mine inventories in the Powder River Basin of Wyoming with Bill Killam. (Personal communication). Manton Botsford, Resource Specialist, Casper District Office.

PACKER, PAUL E., 1974. *Rehabilitation Potential and Limitations of Surface-Mines Land in the Northern Great Plains,* General Technical Report INT-14, USDA, Forest Service.

PHILLIPS, R.L, 1979. *Winter Distribution (1975-1978) of Pronghorn Antelope, Mule Deer and White-tailed Deer in the Decker Sub-region of Montana and Wyoming.* Sponsored by BLM and USGS.

POWDER RIVER BOARD OF COUNTY COMMISSIONERS, 1981. *Update of Powder River Comprehensive Plan 1979.* Broadus, Montana.

QAYYUM, M.A. AND KEMPER, W.V., 1962. *Salt Concentration Gradients in Soils and their Affects on Moisture Movement and Evaporation.* Soil Science Vol. 93, No. 5.

RADIAN, 1980. *Air Quality Assessment Study for the Powder River Basin Regional Environmental Impact Statement, Draft. Statement Component: Affected Environment.* Austin Texas.

RADIAN, 1981. *Air Quality Assessment Study for the Powder River Basin Regional Environmental Impact Statement, Draft. Statement Component: Environmental Consequences.* Austin Texas.

RAHN, P.H., 1975. *Potential of Coalstrip Mine Fill as Aquifers in the Powder River Basin.* Quarterly Progress Report and Assessment and Evaluation of Work Completed to date. Engineering and Experiment Station, South Dakota, School of Mine and Technology, Rapid City, South Dakota.

RAU, JOHN G. AND WOOTEN, DAVID C., 1980. *Environmental Impact Analysis Handbook.* San Francisco, California: McGraw-Hill Book Company.

REHER, CHARLES A., 1979. *Volume I. The Western Powder River Basin Survey.* Casper, Wyoming: BLM contracted Class II inventory.

RIFFENBURG, H.B., 1925. *Chemical Character of Ground Water of the Northern Great Plains.* USGS Water Supply Paper 560B.

SIMON, R.B., 1972. Seismicity in *Geologic Atlas of the Rocky Mountain Region.* Rocky Mountain Association of Geologists. Denver, Colorado: Hirshfield Press.

SOIL CONSERVATION SOCIETY OF AMERICA AND WRCC-21, 1980. *Adequate Reclamation of Mined Lands? Symposium.* Billings, Montana.

REFERENCES

STINSON, THOMAS F. *Coal Revenue Model.* Minneapolis-St. Paul, Minnesota: University of Minnesota.

UNIVERSITY OF WYOMING, 1976. *Campbell County Parks and Recreation Department Citizens' Survey.* Laramie, Wyoming: Human Services Project.

UNIVERSITY OF WYOMING, 1977. *Wyoming General Soils Map.* Laramie, Wyoming.

U.S. CENSUS BUREAU, 1981. Preliminary 1980 census figures. Denver, Colorado.

U.S. DEPARTMENT OF AGRICULTURE, COMMITTEE FOR RURAL DEVELOPMENT, 1975. *Situation Statement Rosebud-Treasure Counties.* Portland, Oregon: Soil Conservation Service.

U.S. DEPARTMENT OF AGRICULTURE, BIG HORN COUNTY COMMITTEE FOR RURAL DEVELOPMENT, 1976. *Big Horn County Situation Statement.* Big Horn County, Montana.

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, 1976. *Long Range Program of Resource Conservation, Powder River Conservation District.* Portland, Oregon: Soil Conservation Service.

U.S. DEPARTMENT OF AGRICULTURE, MONTANA DEPARTMENT OF AGRICULTURE, 1978. *Montana Agricultural Statistics.* Bozeman, Montana: Color World of Montana.

U.S. DEPARTMENT OF AGRICULTURE, WYOMING CROP REPORTING BOARD, 1978. *Wyoming Agricultural Statistics.* Cheyenne, Wyoming.

U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE, 1979. *RARE II, Roadless Area Review and Evaluation, Final Environmental Statement.* Washington, D.C.: Government Printing Office.

U.S. DEPARTMENT OF AGRICULTURE, 1980a. *Montana Agricultural Statistics. Vol. XVIII.* Montana Department of Agriculture and the Montana Crop and Livestock Reporting Service.

U.S.DEPARTMENT OF AGRICULTURE, 1980b. *Agricultural Statistics, 1980.* Economics, Statistics, and Cooperatives Service.

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, 1981. Types of agricultural lands in southeastern Montana. (Personal communication). Clarke McClung, Resource Specialist, Casper District Office, 1981.

U.S. FISH AND WILDLIFE SERVICE, WELUT, 1980. *Surface Cover Type Classification Overlays.* Ft. Collins, Colorado.

U.S. GEOLOGICAL SURVEY, MONTANA DEPARTMENT OF STATE LANDS, 1979. *Final Environmental Statement, Northern Powder River Basin Coal, Montana.* Washington, D.C.: Government Printing Office.

U.S. GEOLOGICAL SURVEY, 1980a. *Water Resources Data for Montana, Water Year 1979.* Water Data Report MT-79-1

U.S. GEOLOGICAL SURVEY, 1980b. *Water Resources Data for Wyoming, Water Year 1979. Volume 1.* Missouri River Basin: Water Data Report WY-79-1.

VAN VOAST, W.A. AND HEDGES, R.B., 1975. *Hydrologic Aspects of Existing and Proposed Strip Coal Mines Near Decker, Southeastern Montana.* Montana Bureau of Mines and Geology Bulletin 97.

WAITE, DON, 1981. Agricultural Economist at Montana State Office, BLM, Billings, Montana.

WELLMAN, BARRY, 1979. *The Community Question: The Intimate Networks of East Yonkers.* American Journal of Sociology 84:1201-1231.

WENTLAND, HAROLD J., 1980. *Statewide Wildlife Survey and Inventory W-130-R-11. Big Game Survey and Inventory (Antelope) Region 7.* Miles City Montana: Montana Fish and Game.

WYOMING DEPARTMENT OF ECONOMIC PLANNING AND DEVELOPMENT, 1979, 1980. Cheyenne, Wyoming.

WYOMING DEPARTMENT OF EDUCATION, WYOMING PUBLIC SCHOOLS FUND ACCOUNTING AND REPORTING, 1979-1980. Cheyenne, Wyoming.

WYOMING GAME AND FISH, 1977a. *Annual Report of Big Game Harvest.* Cheyenne, Wyoming.

WYOMING GAME AND FISH, 1977b. *Annual Report of Upland Game Harvest.* Cheyenne, Wyoming.

WYOMING GAME AND FISH, 1978a. *Annual Report of Big Game Harvest.* Cheyenne, Wyoming.

WYOMING GAME AND FISH, 1978b. *Annual Report of Upland Game & Furbearer Harvest.* Cheyenne, Wyoming.

WYOMING GAME AND FISH, 1979a. *Annual Report of Big Game Harvest.* Cheyenne, Wyoming

WYOMING GAME AND FISH, 1979b. *Annual Report of Upland Game & Furbearer Harvest.* Cheyenne, Wyoming.

WYOMING GAME AND FISH, 1979c. *Eastern Powder River Coal EIS Contract.* Cheyenne, Wyoming

WYOMING RECREATION COMMISSION, 1975. *State Comprehensive Outdoor Recreation Plan (SCORP).* Cheyenne, Wyoming.

WYOMING RECREATION COMMISSION, 1980. *State Comprehensive Outdoor Recreation Plan (SCORP).* Cheyenne, Wyoming.

WYOMING SECURITY EMPLOYMENT COMMISSION. Quarterly periodicals. Casper, Wyoming.

ZANDER, RICHARD, 1981. Wildlife inventory and problems in Montana coal areas. (Personal communication). Michael McLellan, Resource Specialist, Casper, District Office.

APPENDIX A

AIR QUALITY

TABLE A-I

FEDERAL, MONTANA, AND WYOMING MAXIMUM ALLOWABLE INCREASES (INCREMENTS)

FOR THE PREVENTION OF SIGNIFICANT DETERIORATION OF AIR QUALITY

Pollutant	Averaging Time	Maximum Allowable Air Quality Increases (Ug/m^3) Class I	Class II	Class III
Sulfur Dioxide (SO_2)	Annual Mean	2	20	40
	24-Hour a/	5	91	182
	3-Hour a/	25	512	700
Total Suspended Particulates (TSP)	Annual Mean	5	19	37
	24-Hour a/	10	37	75

a/ The increments for these averaging times are not to be exceeded more than once per year.

TABLE A-2
NATIONAL AND STATE AMBIENT AIR QUALITY STANDARDS

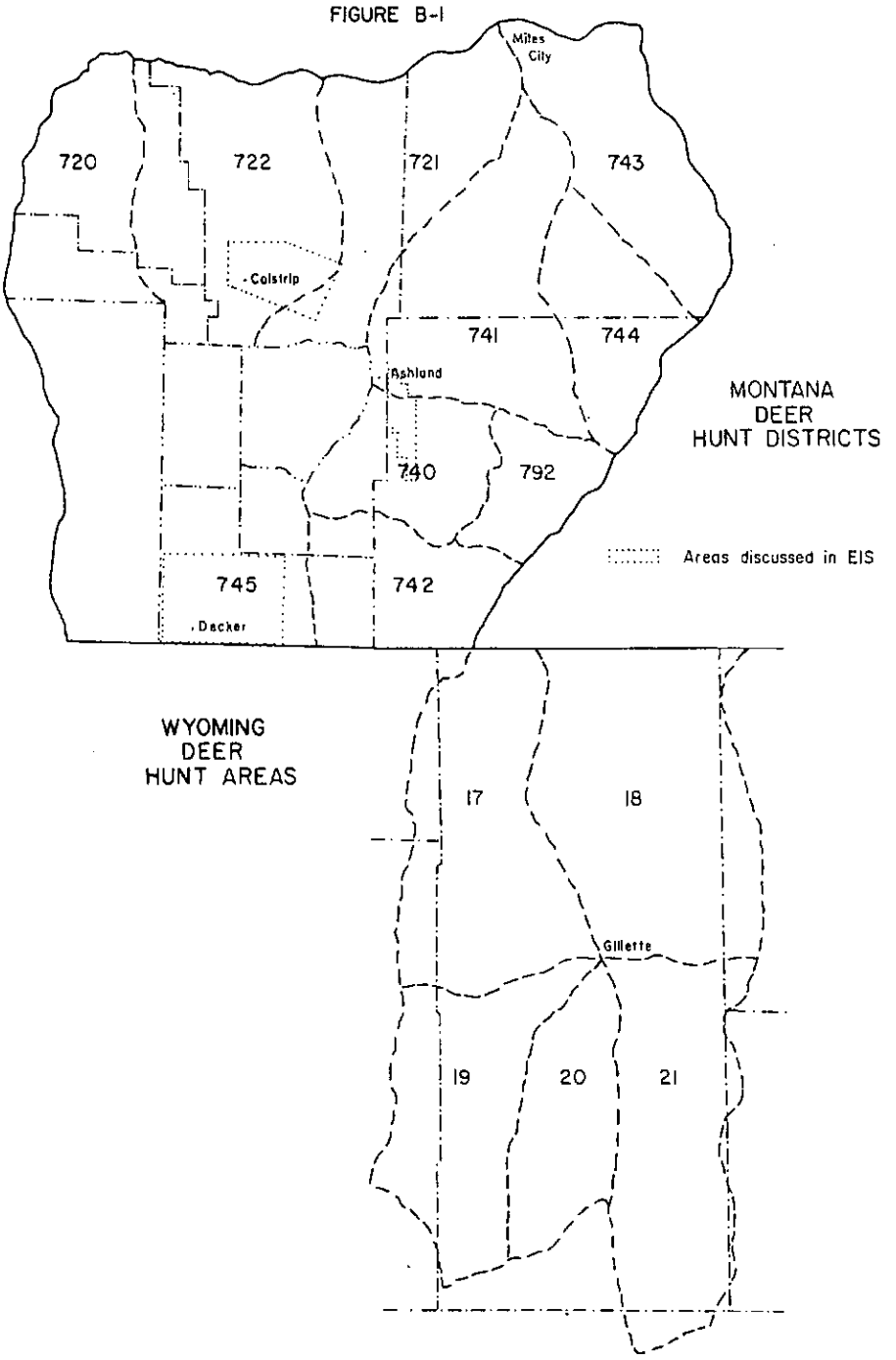
Pollutant	Average Time a/	Standards							
		Federal b/ Primary		Federal c/ Secondary		Montana State		Wyoming State	
		(ug/m^3)	(ppm)	(ug/m^3)	(ppm)	(ug/m^3)	(ppm)	(ug/m^3)	(ppm)
Total Suspended Particulate (TSP)	Annual Geometric Mean	75	-	60	-	75	-	60	-
	24-Hour	260	-	150	-	200	-	150	-
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	80	0.03	-	-	60	0.02	60	0.02
	24-Hour	365	0.14	-	-	260 d/	0.10 d/	260	-
	3-Hour	-	-	1,300	0.5	650 e/	0.25 e/	1,300	0.5
	1-Hour						0.50 e/		
Nitrogen Dioxide (NO^2)	Annual Arithmetic Mean	100	0.05	100	0.05	-	0.05	100	0.05
	1-Hour						0.30		
Carbon Monoxide (CO)	8-Hour	10,000	9.0	10,000	9.0	10,000	9.0	10,000	9.0
	1-Hour	40,000	35.0	40,000	35.0	-	23.0	40,000	5.0
Non-Methane Hydrocarbons f/ (NMHC)	3-Hour (6 a.m.-9 a.m.)	160	0.24	160	0.24	-	-	160	0.24
Ozone (O_3)	1-Hour	235	0.12	-	-	-	.10	235	0.12
Lead (Pb)	3-Month	1.5	-	1.5	-	1.5	-	-	-

a/ Standards for averaging times other than annual or 3-month are not to be exceeded more than once per year.
b/ Levels deemed necessary to protect public health with an adequate margin of safety.
c/ Levels deemed necessary to protect public welfare from any known or anticipated adverse effects.
d/ Not to be exceeded more than once/year.
e/ Not to be exceeded for more than 18 days in a 12 month period.
f/ For use as guide in achieving ozone standards.

APPENDIX B

WILDLIFE

FIGURE B-1


Miles City
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722
721
743
Colstrip
741
744
Ashland
740
792
745
742
Decker
MONTANA
DEER
HUNT DISTRICTS
Areas discussed in EIS
WYOMING
DEER
HUNT AREAS
17
18
Gillette
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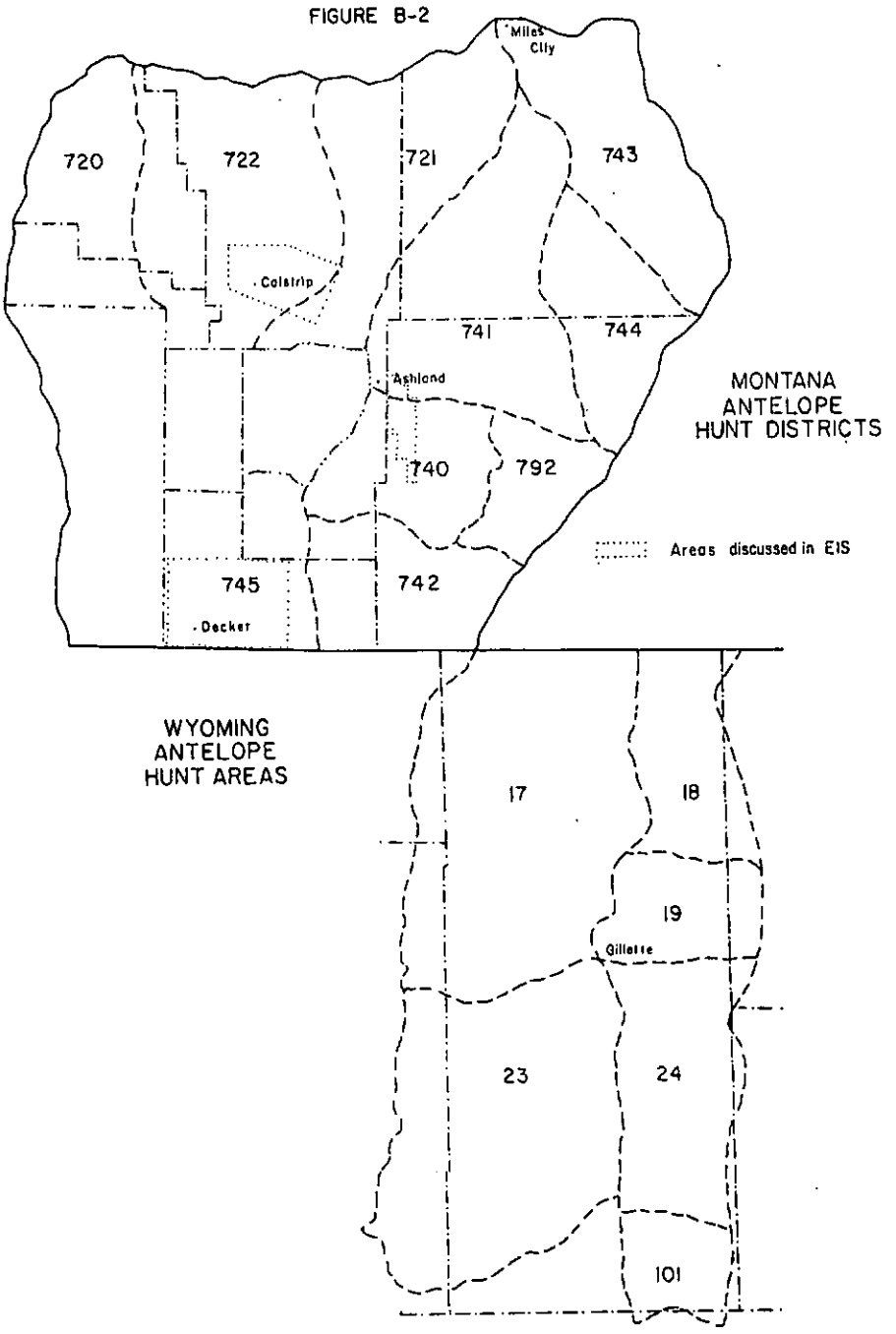
20
21

FIGURE B-2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APPENDIX C

CULTURAL RESOURCES

TABLE C-1
IDENTIFIED CULTURAL SITES FOR THE POWDER RIVER REGION

Location	Acres	Sites Located	Average Density (Mi^2)	Historic Sites: On Nat'l Reg.	Historic Sites: Recommended for Nat'l Reg.
Montana					
Otter Creek Drainage a/	9,000	120	8.5		
Pumpkin, Broadus and Foster Creeks b/	5,800	59	6.5		
Birney Area b/	9,000	98	7		
Colstrip Area c/	2,525	86	26.5		
Spring Creek d/	3,770	47	7.5		
Big Horn County				5	18
Rosebud County				1	9
Powder River County					3
Wyoming					
Rawhide Mine Lease e/			16.5		
Caballo Mine Lease f/			10		
Campbell County			2 g/		1

a/ Bryant, Oehr and Rollefson, 1980.
b/ BLM, unpublished manuscript, Clark, n.d.
c/ Munson and Munson, 1980.
d/ Fox, 1978.
e/ Anderson, 1980.
f/ Personal communication, Mary Feathers, OSM, 1981.
g/ Reher, 1979.

APPENDIX D

VISUAL RESOURCES

Scenic quality classes are defined by a system rating seven key factors - landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modification. There are three scenic quality classes:

Class A - Areas that combine the most outstanding characteristics of each rating factor.

Class B - Areas in which there is a combination of some outstanding features and some which are fairly common to the physiographic region.

Class C - Areas in which the features are fairly common to the physiographic region.

Management classes determine the amount of modification allowed to the basic elements of the landscape. There are five classes:

Class I - Very limited management activity is allowed. Created contrasts must not attract attention. This classification applies to wilderness areas, wild and scenic rivers, etc.

Class II - Changes in any of the basic elements caused by management activity should not be evident in the characteristic landscape. Contrasts are seen but must not attract attention.

Class III - Contrasts to the basic elements caused by a management activity are evident, but should remain subordinate to the existing landscape.

Class IV - Any contrast attracts attention and is a dominant feature of the landscape in terms of scale, but it should repeat the form, line, color, and texture of the characteristic landscape.

Class V - This classification is applied to areas where the natural character of the landscape has been disturbed to a point where rehabilitation is needed to bring it up to one of the four other classifications. The classification also applies to areas where there is potential to increase the landscape's visual quality. It is often used as an interim classification until objectives of another class can be reached.

APPENDIX E

RECREATION

TABLE E-1
HUNTING STATISTICS FOR THE POWDER RIVER REGION

Montana

	Deer Licenses	Harvest	Rec. Days	Antelope Licenses	Harvest	Rec. Days	Bighorn Licenses	Sheep Harvest	Rec. Days
1971-74 Average	44,200	34,600	169,000	11,650	8,500	35,000	2	1	20
1975	48,900	13,200	194,000	10,570	7,850	31,700	2	2	16
1976	15,766	8,961	69,502	8,488	6,307	25,464	2	1	10

	Game Bird Hunters	Harvest	Rec. Days	Small Game Hunters	Harvest	Rec. Days	Waterfowl Hunters	Harvest	Rec. Days
1970-74 Average	36,916	72,416	---	No Data			No Data		
1975	45,744	81,544	66,663	No Data			No Data		

Wyoming

	Deer Hunters	Harvest	Rec. Days	Antelope Hunters	Harvest	Rec. Days	Elk Hunters	Harvest	Rec. Days
1977	52,607	35,829	145,165	31,416	29,526	70,275	9,585	2,423	42,203
1978	49,260	27,679	130,344	29,097	27,293	68,502	10,211	1,738	48,287
1979	49,224	23,692	140,803	22,995	20,899	60,678	11,006	2,352	49,466

	Game Bird Hunters	Harvest	Rec. Days	Small Game Hunters	Harvest	Rec. Days	Waterfowl Hunters	Harvest	Rec. Days
1977	12,272	48,037	35,742	4,451	43,571	19,426	3,371	16,152	15,684
1978	10,641	38,680	30,245	5,064	47,194	21,542	3,292	16,082	15,635
1979	11,081	42,567	31,460	3,870	22,626	17,232	3,338	17,502	16,247

Sources: Wyoming Game and Fish Annual Reports, 177a,b; 1978a,b; 1979a,b.
Montana Fish and Game, 1978.

APPENDIX F

TRANSPORTATION

FIGURE F-1

MONTANA HIGHWAY SYSTEM AND

AVERAGE DAILY TRAFFIC (ADT) 1979

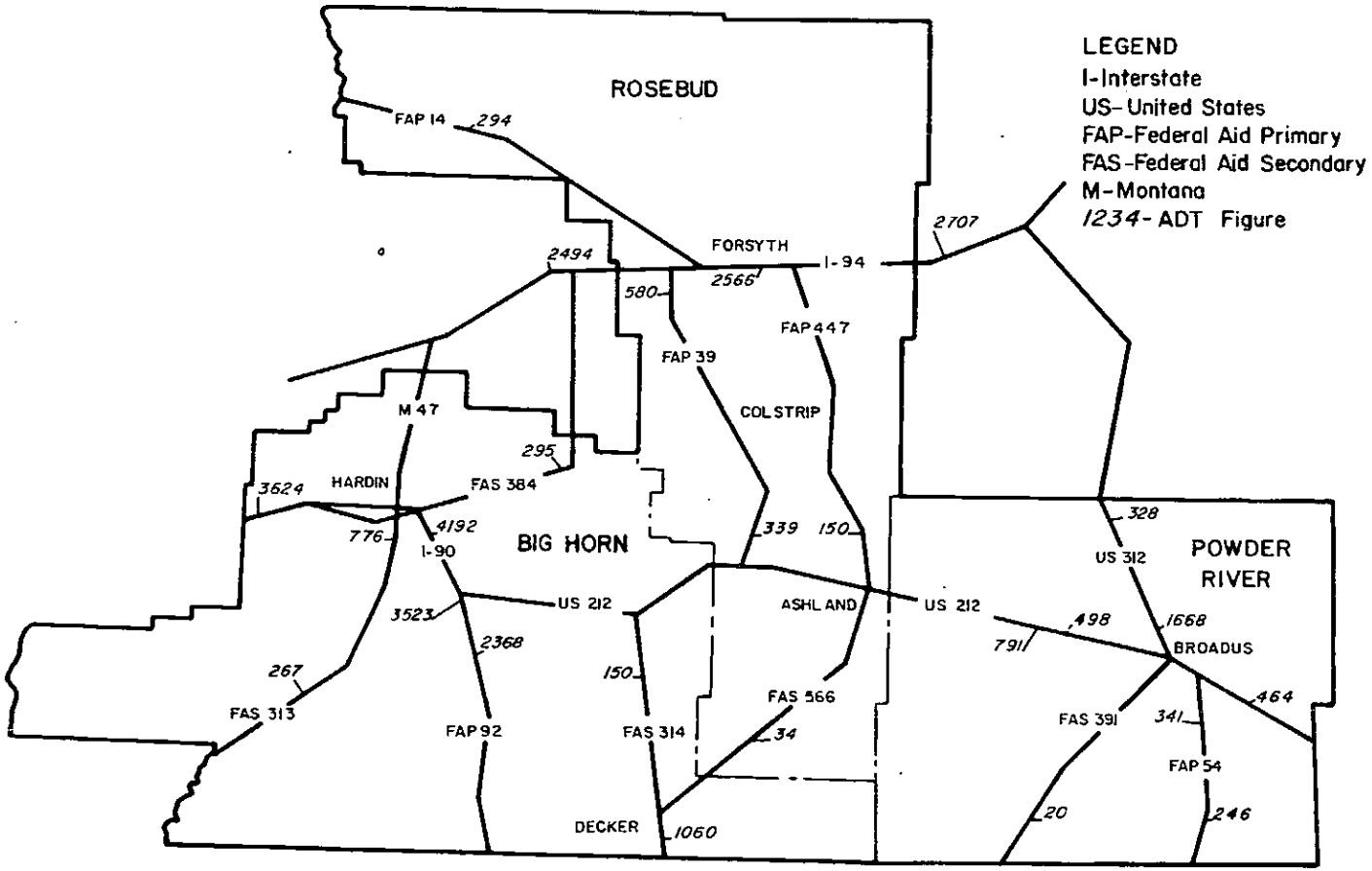
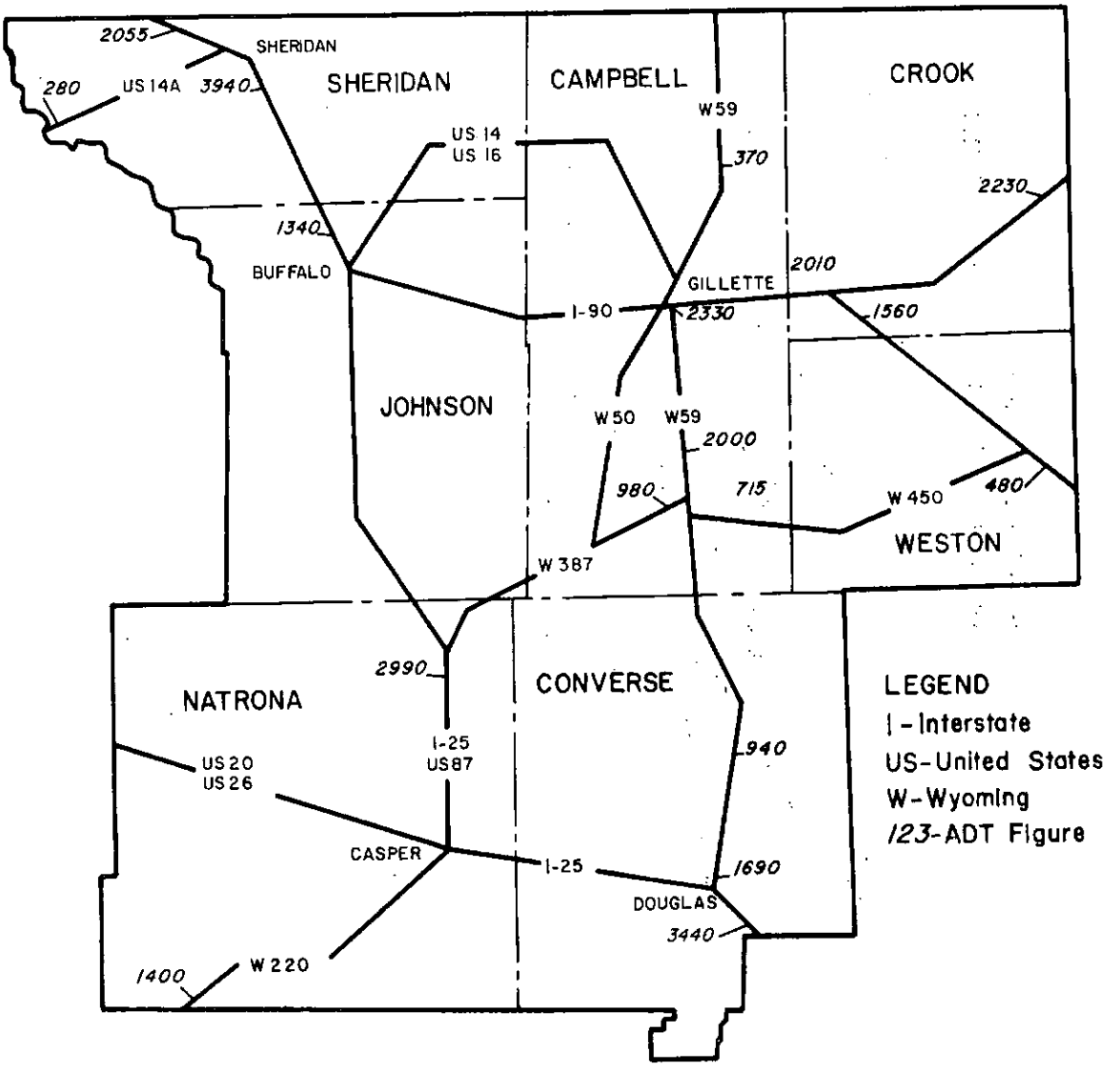


FIGURE F-2

WYOMING HIGHWAY SYSTEM

AND AVERAGE DAILY TRAFFIC (ADT) 1978



APPENDIX G

ECONOMICS

TABLE G-1
PRESENT VALUE OF FUTURE AVERAGE GROSS SALES FROM ONE ACRE
COMPARED TO POTENTIAL COAL ROYALTIES FROM ONE ACRE IN
THE MONTANA POWDER RIVER REGION

	Winter Wheat a/	Alfalfa Hay a/	Coal b/
Average Gross Value/Acre c/	$ 90.26	$122.06	$866.07
Interest Factor d/	4.3552	4.3552	.9091
Present Value	$393.10	$531.60	$787.34

a/ Assumes that coal leasing would occur on acreage devoted to one of the two most extensively harvested crops in the Montana Powder River Region. See Table G-5.

b/ From Table G-3.

c/ Based on 1979 average gross values. See Table G-6.

d/ Derived from the formula $\sum_{t=1}^{n} (1/1+k)^{t}$, where n equals 6, in the case of the crops, or 1 in the case of the coal. This assumes 1 year for mining and 5 years for reclamation. k, the costs of capital, is assumed to be 10 percent in all cases. Stated simply, the formula calls for a summation of all quantities obtained as t is changed from 1 through n.

TABLE G-2
1979 CROP PRODUCTION AND CATTLE INVENTORY IN
POWDER RIVER AND ROSEBUD COUNTIES COMPARED TO
MONTANA AND THE U.S.

	Bushels Per Acre	Total Production Million Bushels
Barley		
Big Horn County a/	40.0	.69
Powder River County a/	22.5	.11
Rosebud County a/	45.0	.29
Montana a/	39.0	40.56
U.S. b/	50.6	378.07
Corn (Grain)		
Big Horn County a/	76.0	c/
Powder River County a/	---	---
Rosebud County a/	78.0	.08
Montana a/	77.0	.39
U.S. b/	109.4	7,763.77
Oats		
Big Horn County a/	57.0	.12
Powder River County a/	31.0	.05
Rosebud County a/	48.0	.08
Montana a/	39.0	5.46
U.S. b/	54.4	534.39
All Wheat		
Big Horn County a/	25.6	2.00
Powder River County a/	24.3	0.98
Rosebud County a/	25.2	1.07
Montana a/	22.7	116.48
U.S. b/	34.2	2,141.73
All Hay	Tons Per Acre	Million Tons
Big Horn County a/	2.26	.17
Powder River County a/	1.37	.09
Rosebud County a/	2.04	.09
Montana a/	1.80	4.29
U.S. b/	2.39	145.88
Cattle Inventory	January 1, 1,000 head	
Big Horn County a/	115.6	
Powder River County a/	77.6	
Rosebud County a/	86.1	
Montana a/	2,607.0	
U.S. b/	110,864.0	

a/ USDA, 1980a.
b/ USDA, 1980b.
c/ Less than 10,000 bushels.

TABLE G-3
AVERAGE COAL RESERVES PER ACRE AND POTENTIAL COAL ROYALTIES PER ACRE IN THE MONTANA POWDER RIVER REGION

Recoverable Reserves (Million Tons) a/	2,427.3
Coal Acreage a/	56,053
Average Recoverable Reserves/Acre (Tons/Acre)	43,404
Royalty Per Ton b/	$ .02
Average Gross Royalty Per Acre	$ 866.07

a/ Derived from Table 1-1 in Chapter 1.

b/ Assumes Annual Royalty Payments of 2 cents per ton of coal mined, based on a range of 2 cents to 35 cents per ton of coal mined for regional landowner lease agreements.

TABLE G-4
GROSS RECEIPTS PER ACRE FROM LIVESTOCK AND CROPS IN THE MONTANA POWDER AND RIVER REGION

Livestock and Livestock Products

Gross Receipts a/	$73,492,900.00
Rangeland (Acres) b/	6,460,824
Average Gross Receipts/Acre	$ 11.38

All Crops

Gross Receipts a/	$22,725,000.00
Croplands (Acres) b/	635,544
Average Gross Receipts/Acre	$ 35.76

a/ USDA, Montana Department of Agriculture, 1980.
b/ From Table 3-3 in Chapter 3.

TABLE G-5
ACRES HARVESTED BY CROP IN 1979 IN THE MONTANA
POWDER RIVER REGION a/

Crop	Acres Harvested
Winter Wheat	138,500
Durum Wheat	300
Spring Wheat b/	22,000
Barley	28,400
Corn	10,500
Sugarbeets	4,810
Dry Beans	900
Oats	5,300
Alfalfa Hay	140,300
Other Hay	39,900

a/ USDA, Montana State Department of Agriculture, 1980.
b/ Excludes Durum Wheat.

TABLE G-6
AVERAGE GROSS VALUE PER ACRE FOR THE TWO MOST EXSTENSIVELY
HARVESTED CROPS IN THE MONTANA POWDER RIVER REGION IN 1979

	Winter Wheat	Alfalfa Hay
Total Value a/	$12,501,300	$17,126,100
Acreage Harvested a/	138,500	140,300
Average Gross Value/Acre	$ 90.26	$ 122.06

a/ USDA, Montana State Department of Agriculture, 1980.

APPENDIX H

COMMENTS AND RESPONSES

COMMENTS AND RESPONSES

Introduction

Copies of the Draft EIS were sent to federal, state, and local government agencies, nongovernment organizations (such as conservation groups), industry representatives and private citizens for their review and comment. Some reviewers were confused by the public hearing process, review period or hearing schedules. Notice of availability was published on July 9, 1981 in the *Federal Register*. Due to publishing delays on the DEIS a second notice of availability was published July 24, 1981 amending the former notice by extending the comment period to September 17, 1981. Hearings in Casper on July 29th and Billings on July 30th were supplemented by hearings in Gillette on August 19th and in Broadus, Montana on August 20, 1981.

Comments were received from U.S. Fish and Wildlife Service, U.S. Geological Survey, Bureau of Mines, and the Office of Surface Mining. Federal agencies which did not respond include Bureau of Indian Affairs, Bureau of Reclamation, National Park Service, and the U.S. Forest Service. Comments from U.S. Geological Survey and Office of Surface Mining were submitted in an informal, working, relationship and are not reproduced in this document.

This section includes copies of letters commenting on the DEIS and comment papers from the minutes of six public hearings. Most letters have been duplicated here in their entirety but exceptionally long attachments are available for examination at the Casper District Office, 951 Rancho Road, Casper, Wyoming.

Letters and oral comments on the DEIS were reviewed and considered by the EIS Team in preparation of the Final EIS and those that presented new data, questioned facts on analyses, and raises questions or issues bearing directly upon the DEIS were fully considered and evaluated. The public hearings were recorded verbatim by a court reporter. Copies of the full transcripts are available for public review at the BLM Casper District Office. Oral comments as reported in the transcripts have been included in this chapter and appear with the letters of comments (numbers 43-57).

The substantive issues raised in these letters and public hearings have been extracted, edited, and grouped by topic. A response to each of these issues has been given. In this way the reader may easily see how, topic by topic, the informed opinions of others agree or disagree with the assessments made by the EIS team. The issues have been numbered within these topics and appear under the name of each reviewer in the List of Reviewers given below in the Index to Appendix H. By referring to the issue numbers indicated the reader may determine what issues were raised by each reviewer and find the response given.

COMMENTS AND RESPONSES

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Policy, and the Purpose and Need for Action 1

Scoping, Baseline Analysis and Assumptions 2

Geology and Other Minerals 3

Water Resources 4

Air Quality 5

Soils, Vegetation, and Reclamation 6

Wildlife 7

Cultural Resources 8

Visual Resources 9

Land Use 10

Recreation 11

Transporation 12

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COMMENTS and RESPONSES

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United States Department of the Interior

BUREAU OF MINES

[illegible]

Denver Research Center

[illegible] Reclamation

July 20, 1981

JUL 29 1981

Mr. Charles Wilkie
Team Leader
Bureau of Land Management
951 Rancho Road
Casper, WYO. 82601

Dear Mr. Wilkie:

While recognizing the necessity for brevity to assuage the paper-work [illegible] of EIS's, I find that your draft on "Powder River Coal" is brief to the point of being cursory.

For instance, the geology portion does not give the slightest indication of the location, thickness, areal extent or economic value of the coal resource. One is simply referred to the published literature. Additionally, as a geologist, I find the opening statement to the 3rd paragraph on page 34 particularly offensive. It says, in part, that a 1500 foot Cretaceous shale section overlies the Madison aquifer. While this statement may be the literal truth, it conveys the false impression in the minds of those uninitiated in geology, that the Madison is directly overlain by Cretaceous rocks. Nothing could be further from a true description of the situation.

A brief description of the formations found in the Powder River Basin and a geologic column should be shown, as a minimum.

There is absolutely no mention made of the mining methods considered in the analysis. The only assumption is that coal will be "strip-mined and transported by railroad".

It is difficult to see how anyone could intelligently assess air quality, noise, visual resources, sociology or economics without some basic assumptions with respect to mining methods. As an example, a truck and shovel operation generates far more noise over a wider area than, for instance, a bucket-wheel and conveyor system. Also, the trucks would generate fairly high volumes of diesel smoke and dust whereas the conveyor, especially if it be powered electrically, generates only a very small quantity of dust.

While the conclusions expressed in your draft may be valid, ignorance of the assumptions upon which they are based prevents an objective evaluation.

Sincerely yours,

James E. Hawkins

James E. Hawkins
Geologist

P.S. As an after-thought, I notice that your listing of Federal Agencies on page two does not include the United States Bureau of Mines. The failure to include our agency, whose primary function is research and mining technology, may be indicative of the mind-set which led to the omission outlined above.

2

July 21, 1981

Chuck Wilkie
Project Leader
Casper District Office
951 Rancho Rd.
Casper, WY 82601

Dear Mr. Wilkie:

The EIS summary proposes alternative 3 as opposed to 4 because it would minimize environmental impacts and would inhibit population growth. I understand what the effects of increasing the population of Ashland would be environmentally and economically, but I do not think that is BLM's concern. The cumulation of resources is also important.

The increase in acreage disturbed in alternative 4 is a 23 percent increase in area as opposed to a 44 percent increase in tonnage produced.

The effects of mining on the wildlife is not as major as outlined, the animals and plants which will be affected are only localized. They will benefit from the reclamation process with increased production of food supplies.

A total of 40 wells will have to be replaced because of mining. What is the number of acre feet of water or gallons per day consumed in the 40 wells as opposed to the shallow wells. If the coal seams are the shallow aquifers then what is the water quality compared to the deeper aquifers? The increase in dissolved solids and flow reduction is not significant as shown in the table on page 69.

The alternative chosen in the EIS will not allow a maximum use of the resources of the area. The planning councils for any city affected would be better able to choose the alternative because of their knowledge of the community.

Have any polls of residents been conducted to see how they view the increase of mining activity.

The report was very informative and the preferred alternative of the EIS report is not in the best interest of utilizing energy resources which can eliminate dependence on foreign oil.

Sincerely,

[illegible] Forster

KFigh

3

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Billings Area Office
Federal Building, Room 3035
316 North 26th Street
Billings, Montana 59101

ES

August 18, 1981

Draft Powder River Regional
Coal EIS

Mr. Charles Wilkie
Team Leader
Bureau of Land Management
951 Rancho Road
Casper, WY 82601

Dear Mr. Wilkie:

We have reviewed the Draft Powder River Regional Coal Environmental Impact Statement and have found several statements and/or sections that we feel should be clarified or improved.

Page 1 - The write-up for alternative #1 (No Action) is somewhat misleading in that the statement does not make clear that development under alternatives #2, #3, or #4 will occur in addition to development which will occur with alternative #1. Subsequent impacts occurring from leasing of the selected alternative will be in addition to those impacts occurring from alternative #1 (No Action).

Page 2 - We note that Shell's proposed Young's Creek Mine was inadvertently left out of Table 2-2. We assume that data for Shell's mine will be included in the Final Environmental Impact Statement (FEIS).

Page 33 - We do not agree with the conclusion that an assessment of the effects of proposed action on wetlands is not necessary in this EIS. Wetlands and associated riparian habitats do occur within areas affected by alternatives discussed in the DEIS. The U.S. Fish and Wildlife Service in a December 19, 1980, letter identified as a part of the EIS scoping process issues which we thought were significant and should be analyzed in the Powder River Regional Coal Environmental Impact Statement. Wetlands and riparian habitats, among other habitats, were identified as being important habitats of concern. Executive Order #11990 requires consideration of practicable measures to minimize harm to wetlands. These measures should be described in the DEIS. Table 4-3 on

page 70 should include a separate listing for riparian and wetland habitat so the amount of such habitat to be disturbed can be ascertained. The National Wetland Inventory has been completed for leasing areas being considered in this DEIS in Wyoming and could be used in this analysis.

Page 37 - The statement that, "no threatened or endangered species are known to exist within the Montana area," is incorrect. The bald eagle, peregrine falcon, and the black-footed ferret were identified to the Montana State Director in a letter dated July 9, 1980, as species that may be present in proposed leasing areas. BLM Miles City District's subsequent biological assessment for the Powder River KRCRA concluded that coal leasing would not affect any of the above listed threatened or endangered wildlife species or their habitat. The Fish and Wildlife Service concurred with this biological assessment on September 23, 1980. The Fish and Wildlife Service's letter of concurrence also contained the following recommendations:

> To insure that mining at some later date does not jeopardize the ferret, we recommend the following course of action:
>
> 1. Prior to the approval of a plan for mining and reclamation, the applicant identify prairie dog towns that will be impacted and conduct ferret searches on those towns that the Federal regulatory agency and Fish and Wildlife Service mutually agree should be surveyed. Surveys should take place during the period of May 1 to October 15, preferably July through September.
>
> 2. The appropriate Federal agency (BLM or OSM) should initiate formal consultation if these surveys locate black-footed ferrets or their sign.
>
> 3. If ferret sightings or observations of their sign are made prior to leasing, BLM should initiate formal consultation.

The FWS has not yet received a biological assessment for the Wyoming area. By August 14 telephone conversation, Glen Bessinger, Casper District, indicated that a species list request was sent to FWS on May 19, 1981, and a biological assessment is in preparation. FWS never received this request and therefore did not provide BLM with a list. By way of this letter, we are informing BLM that the bald eagle, peregrine falcon, and black-footed ferret may occur in the proposed leasing areas and should be addressed in the biological assessment.

The Fish and Wildlife Service is concerned that the Wildlife Section contained in the Description of the Affected Environment Chapter is limited to references for a few highly visible wildlife species. Meaningful information on wildlife habitats is not included. A description

of existing wildlife habitats, with special emphasis on important habitat types and associated wildlife, would be preferable. A better evaluation of the "Environmental Consequences" of the various alternatives could also be displayed if this approach were used. Our letter of December 19, 1980, refers to habitats that we feel deserve attention in the subject EIS. The Fish and Wildlife Service recommends that the FEIS include an analysis of impacts on important wildlife habitats.

The statement on page 59 that 13 percent of the Campbell County population of golden eagles would move to new nesting locations because their nesting sites would be mined is probably in error. We feel that natural nesting sites in Campbell County are presently a limiting factor for golden eagles in the area. Disruption of golden eagle nest sites will likely result in population reductions unless mitigative efforts to establish artifical nests or platforms are successful.

The Fish and Wildlife Service is also concerned about the disruption of habitats of high wildlife value where existing reclamation technology has not been proven. Ponderosa pine forest, rock outcrops, wetlands, and riparian habitats are habitat types of concern. The Soils, Vegetation, and Reclamation sections of the FEIS should address these reclamation concerns.

If you have questions regarding our comments, please do not hesitate to contact us.

Sincerely,

Robert M. Ballow
Acting Area Manager

cc: Director, Montana Department of Fish, Wildlife, and Parks, Helena, MT
Director, Wyoming Game and Fish Department, Cheyenne, WY
State Director, BLM, Billings, MT
District Manager, BLM, Miles City, MT
Art Anderson, USFWS, Cheyenne, WY (ES)
Endangered Species, USFWS, Billings, MT
Regional Director, USFWS, Denver, CO (ENV)

North Central Health Services, Inc.

4

August 28, 1981

AUG 31 1981

Mr. Charles Wilkie
EIS Team Leader
Bureau of Land Management
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Wilkie:

Please accept this letter as our written support for Alternate 3B as the preference of the Alternates of the Regional Coal Team.

Let me briefly explain about our corporation, and the interest we have in this particular area.

North Central Health Services, Inc., is a not-for-profit 501(c)(3) organization, duly qualified to do business in Wyoming and South Dakota; to operate nursing homes, hospitals, and retirement facilities for senior citizens. This corporation was organized in 1948 and has provided health care since that time.

Through a bequest, the corporation received approximately 1,100 acres of Campbell County land in the Kints Creek and Keeline Tracts, and we have followed the tract ranking and selection process since it began over a year ago. At each opportunity we have expressed our strong support for small business to be set aside for this area.

Since the corporation has a royalty in coal mined in this area, which could be substantial, we feel that the royalties from the coal could help improve our facilities and the quality of our care without cost to the residents.

It is our understanding that large oil companies have argued in favor of alternatives which would exclude the small business tracts favored by the coal team. We believe large oil companies already control significant portions of the

Mr. Charles Wilkie
Page 2
August 28, 1981

Powder River Basin and strongly believe that small business should have an opportunity to participate in coal development.

We respectfully submit that you consider Alternative 3B as the preferred Alternative and strongly urge that the Keeline Tract is included in the preferred Alternative as a small business set aside. We also urge that the recommendation of the Regional Coal Team be accepted.

I will appreciate your consideration of this request.

Yours sincerely,

Blayne Pumpel
Executive Director

ge

cc Honorable James G. Watt
Senator Alan K. Simpson
Senator Malcolm Wallop
Representative Richard Cheney
Honorable Ed Herschler
Mr. Maxwell T. Lieurance
Mr. Stan McKee
Mr. Warren White
Mr. Keith Kaiser
Mr. Mike Elmore
Mr. Richard M. Davis

[illegible]
Request for Environmental Impact Evaluation

5

TO: 5 Valleys Economic Development Dist.
Areawide Clearinghouse
119 West Front
Missoula MT 59801

FROM: Montana State Clearinghouse
Office of Budget and Program Planning
Capitol Annex
Helena, Montana 59620

Environmental Impact Assessment Title: Draft Powder River Regional Coal EIS

Clearinghouse File Number: MT810721-028-E

[illegible] Sponsors: U. S. Dept. of Interior, Bureau of Land Management

[illegible] ADDRESS: 951 Rancho Road
Casper, WY 82601

[illegible] PERSON: Charles Wilkie, Team Leader

[illegible] DUE BY: September 8, 1981

[illegible] Have Need Statement

_____ is enclosed for your review and comment
_____ should have been received by your agency from the sponsor
XXXXXX is available at the Clearinghouse Office for review (only one copy was received).

Please evaluate the assessment for its consistency and fulfillment of [illegible] and local objectives related to:

1. The Environmental Impact of the proposed action.
2. Any adverse environmental effects which cannot be avoided should the proposal be implemented.
3. Alternatives to the proposed action.
4. The relationship between local short-term uses of man's environment and maintenance and enhancement of long-term productivity.
5. Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

IF YOUR AGENCY HAS COMMENTS ON THE ENVIRONMENTAL IMPACT ANALYSIS, PLEASE SEND [illegible] DIRECTLY TO THE AGENCY SPONSOR AND INCLUDE A COPY OF THE COMMENTS [illegible] STATE CLEARINGHOUSE.

IF YOUR AGENCY DOES NOT INTEND TO COMMENT, PLEASE CHECK THE BOX [illegible] AND RETURN [illegible] TO THE STATE CLEARINGHOUSE.

X NO COMMENT

Reviewer's Signature: Ethel MacDonald

Title: A-95 Coordinator Date: 8/28/81

City of Gillette

6

P. O. Box 3001 • Gillette, Wyoming 82716
Phone (307) 686-5200

September 2, 1981

Mr. Charles Wilkie
Team Leader
Bureau of Land Management
951 Rancho Road
Casper, WY 82601

RE: Comments on Draft Powder River Regional Coal Environmental Impact Statement.

Dear Mr. Wilkie:

The following are my comments on the draft EIS for coal leasing in the Powder River Region:

1. As a City, we favor the highest alternative level of additional leasing. The City of Gillette has undertaken a tremendous amount of risk to provide capital facilities for an anticipated population. A higher threshold will provide that population, and we can handle it, provided we can secure some additional things through the industrial siting process. We favor the highest level of coal leasing at this point in time, because we feel that future coal needs will cause a considerable escalation of coal leasing unless it's done at a higher level at the present time. We would rather accomodate the top level of leasing now than to be inundated at a later time. With the expenditures that we've already made and those that we can secure through processes already in place, we feel that we can adequately handle the growth and would encourage your endorsement of the 2.6 level.

2. It is apparent that the greatest socioeconomic impacts resulting from the proposed coal leasing under Alternatives 2, 3 and 4 in the Powder River Region of Wyoming would be in the Gillette area. Increased coal production under any of the alternatives, coupled with power plant and synfuels plant construction, will produce an increased demand for housing and services in the Gillette area. While Campbell County experiences a significant net fiscal surplus under either alternative, the City of Gillette must be primarily responsible for coping with the impacts associated with the increased employment and population.

Page 2
September 2, 1981

3. While the employment and population impacts associated with the increased coal production in Campbell County will strain the City's finances, it is not clear from the EIS how the deficit balances were arrived at for the City of Gillette. What kinds of assumptions were made to arrive at these deficits?

4. Projected 1980 populations in the EIS were based on the Bureau of Census 1980 ratio of community to county population. This 1980 ratio will change in the City's favor in the next few years, since the City plans to pursue a more lenient annexation policy. Thus, the projected populations for the City of Gillette, under each of the alternatives, should be revised upward.

5. In summary, it is essential that the City of Gillette be provided adequate mitigating measures, under any of the alternatives in the EIS, in order to cope with the projected employment and population impacts brought about by increased coal production in Campbell County. Without mitigation, the City will not be in a good position to cope with the socioeconomic impacts envisioned in the draft EIS.

We appreciate the opportunity to comment on the draft Powder River Regional Coal Environmental Impact Statement, and the City staff is prepared to work with the BLM team in order to incorporate their comments in the EIS.

Sincerely,

Michael B. Enzi

Michael B. Enzi
Mayor

MBE/js

7

August 24, 1981

Mr. Charles Wilkie
EIS Team Leader
Bureau of Land Management
951 Rancho Road
Casper, WY 82601

Re: Draft Powder River Regional Environmental Impact Statement

Dear Mr. Wilkie:

Please accept this letter as our written support for Alternative 3B as the preferred alternative of the Regional Coal Team.

As landowners in the area of the Kiotz Creek and Keeline tracts, we have followed the tract ranking and selection process since it began over a year ago. At each opportunity we have expressed our strong support for small business set aside for the area, and I know there are others who agree with us.

Recently it has been brought to our attention that some large oil companies have argued in favor of alternatives which would exclude the small business tracts favored by the Coal Team. We believe large oil company interests already control significant portions of the Powder River Basin and strongly believe that small business should have an opportunity to participate in coal development. In addition, big business interests are incompatible with our ranching and farming operations in that area. We have been dealing with small business interests which are interested in obtaining leases in our area and we believe our operations and theirs can coexist, while experience and history has proven that they cannot with large industry.

Therefore, as landowners whose lands will be directly affected by the tracts suggested by the Regional Coal Team, we strongly urge that at least to the extent that the Keeline tract is included in the preferred alternative as a small business set aside, the recommendations of the Regional Coal Team be accepted.

Yours very truly,

Gary W. Edwards
Frank A. Edwards

8

August 28, 1981

EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

Dear Sir:

The following are my comments upon the Draft Powder River Regional Coal Impact Statement:

In my opinion the DEIS inadequately concentrated on the significant issues and impacts related to rapid growth of the counties and towns. Your approach does not sharply define any option on any issue. "The issue of primary concern is the impact of coal mine development and population increases to communities" (statement from Summary). That text goes on to: "many other resource impacts are presented" and, about those "other" than that of the primary concern, "Many other resource impacts are presented, but in nearly every case, they are either insignificant or are mitigated by existing regulations." Mitigation of "population increases to communities" is not specified nor sharply defined nor are any mitigation measures adopted to offset this impact.

About Alternative 3, the preferred alternative, you state:"This alternative offers the most favorable ratio of coal produced to environmental impacts generated." As the DEIS text is developed, I see no logical background furthering the "most favorable ratio" discussion.

While Alternatives 2, 3, and 4 are described with coal tonnage, number of tracts, and number of surface acres disturbed, these factors are not described for Alternative 1 (no action) yet you offer the conclusion that the No Action Alternative "would have impacts considerable greater than any of the other alternatives in this EIS." The Summary does not prepare the reader for the conclusion because the general text does not prepare for the Summary.

The general conclusion that "all the alternatives, including the No-Action, would further commit the region to a single (emphasis added) economic base (coal)" is a conclusion without full vision.

Are all other economic bases trending to total disappearance?

Are you stating that the land use of reclaimed acres is (for no-use) never?

On page 7, you refer to oil, gas and power plants:

Are these within the economic base?

The sections of the Summary have general description, general conclusions and highlights. I suggest that there should be one on adopted Mitigation Measures. BLM/DOI Regional Coal Team endorsed an Impact Response Strategy in the June meeting at Casper. The Strategy provides for the implementation of mitigation measures by participation of the full range of federal, state and local governments; this follows NEPA. By not adopting mitigation measures, BLM/DOI, in my opinion, are defeating the purpose of EIS and the strength of NEPA. Mitigation measures can not be adopted from this DEIS because these measures are not set forth in this DEIS. Thus, the DEIS is inadequate.

The highlights section of the Summary would be useful as information if it was re-written to reflect the highlighted information by each alternative. Then, perhaps, your text could support the preferred alternative from the comparison. It should comply with CEQ regulations by providing emphasis which sharply defines the options and provides a clear basis for choice by the decision-maker and the public.

I am not going to take it on one by one but allow me to wonder what was intended by the vagueness of the text, for you have chosen to be vague rather than to "sharply define" these issues.

My perception that the text is vague is supported by a reading, for example, of the text for Geology and other minerals which states,

> "Coal, oil and gas, and uranium in economic quantities exist within the region. Coal production would not generally interfere with extraction of other energy minerals due to land-use planning constraints that minimize resource development conflicts."

or Cultural Resources:

> "Federal and state regulations protect these resources. Historic and architectural resources on private lands may not be protected unless steps are taken by local governments and private citizens."

or Soils, Vegetation, and Reclamation:

> "Soils in the area are often shallow, although slopes are generally gradual on a rolling type terrain. Reclamation success has shown to be good, although some areas could require more intensive and costly management."

I claim it is vague to report, as you do in Water Resources, that 312,000 acres of shallow local aquifers would be lost.

Is this acre-feet?

What use is made now?

How extensive is the use?

Is it all lost by a day-certain?

Who has the water rights now?

How is the water right preserved, by whom?

I claim it is vague to report no specific effect of Alternative 1, 2, 3 and 4 for the geology pieces; only the preferred Alternative in Water Resources; none of the Alternatives in Air Quality; none in Soils; none in Wildlife; none in Cultural Resources; only the preferred Alternatives in Land Use; Alternative 1 in Recreation; the preferred in Transportation; and none are referred to in Socialogy and Economics.

I could go back over these same pieces and support my perception of "vague" because you are not consistent in the specifics for region, area, Wyoming, Montana across each piece; in some pieces you use one description, climate, image, and in some pieces incompletely, certain areas of a state, then regionally.

Most of this is so vague that it misdirects the reader's attention, serves the reader badly and is inadequately specific. The Summary in its present form, does not enhance the DEIS. Rather it defeats the purpose of the process; that is, a clear basis for choice. Yours is a text which could have been composed without all the work you did.

Now there is a question on my mind and I may as well take this opportunity to ask it.

> How many dollars have been spent by OSI on this Powder River Basin process from the day you were directed to start through this DEIS?

The issues and areas of concern developed from the scoping process have me puzzled. I need clarification.

> This new scoping process - is it to elicit the issues and areas of public concern?
> Is it used to provide for emphasis and concentration, by BLM workers, upon what the public stated?
> Is it used to direct the BLM work to these concerns of the public?
> Is this why DEIS can be around 350 pages?

You state that the majority of concerns expressed through the scoping process focused on impacts to:

> water resources
> air quality
> socio-economics
> transportation

Some concern was expressed, you state, on reclamation and the increase in jobs.

As I had comprehended the new scoping process the answer to my questions immediately above should be "yes". Therefore every editing effort was made to comply with concerns of the public. You did this scoping in 1980, December. Tract ranking factors were considered by the BLM in early 1981 for ranking. These are not a reflection of the scoping process.

> Why aren't the tract ranking factors the same as the concerns "scoped"?

There are several details which are in error or are misleading at a minimum. For one, Table 1-3, Footnote: "Tracts selected for the 1982 lease sale" could be more accurate as "Tracts selected for further consideration for the 1982 coal lease target sale." Unless you mean it, for Alternative 4.

You have a "typo", page A1, Economics, Montana. "Table 3-6 should read "Table 3-7". All other composition seems flawless.

In Chapter 2, Alternative 1,

> Why do you allude to the DOE high production goal here?
>
> What production goal does Alternative 1 meet?
>
> Under Water Resources, it is misdirecting to change the units from acre-feet to acres (of aquifers).

You state : . . . 275,000 acres of aquifers would be removed by existing and projected mining operations."

> What acreage of that number is for existing operation?
>
> Why use "would be" for existing operations?
>
> Given EPA regulations, how can you state that sewage effluent will increase 0.61 percent in the Tongue and North Platte rivers by 1990?
>
> Whose effluent is this?
>
> Humans? Animals? Minerals?
>
> Why do you use year 1990 for coal production, and for sewage effluent, but year 1995 for air quality?
>
> How many tons of particulates by 1990?
>
> For some of these pieces of Alternative 1, you use "per year", why not for ground water and reclamation pieces?

This DEIS is for comparisons: hard to compare when the units used change from piece to piece.

The proposed T & Railroad would have an additional affect on train traffic on the BN lines leaving the region.

Alternative 1, No Action, is shown to affect Roosevelt and Powder River Counties.

> Is Sheridan unaffected under this Alternative 1?

Page 5

Under "No Action" please state which mine/mines create this level of impact, by year. Surely if you can calculate acre-feet of water per year, you can and should calculate community services and facilities per year as well as housing.

Under "No Action" do you still assess 40% of the socio-economic impacts to be in Powder River County?

At which alternative is the "40%" operative?

Under "No Action", you forecast the need for Rosebud County housing to number 1,813. You project Ashland population to BE0 in 1990. In 1981 Ashland has about 260 people.

What is the number of houses there in 1981?

Is it less than 50?

Upon what population increase do you base the need for 1,813 additional housing units under No Action?

If Ashland increases by 540 people, and even assuming there is one person per added house, where are the other 1,273 units (at one per D.U.) forecast to be needed?

An increase from 260 to 800 persons would exceed your 4% projected increase in municipal water use.

On Alternative 3:
The coal related employment in 3A for Montana is reported to reach about 6100 by 1990. In 3B it is 5520; the difference being that Ashland Cook Mountain Tract would be dropped. The difference in jobs is 800. In the earlier SSA's the employment number for Ashland-Coalwood was 365.

What is the difference in job numbers due to?

In 3C you add on Cook Mountain (with Coal Creek this is the same as Ashland Coalwood) and state the job number for Montana to be 5800; up 300 from 3B but not the same as 3A. Both 3A and 3C have equal tonnage. This set of numbers is very important. Ashland is projected to be 800 people by 1990. This 540 increase is 40% of the growth; 40% is projected for Powder River County. In 1981 others calculate the number of mining operations for the six major mines to be 1245 (see DEIS page 41).

What is the basis for the employment figures used here?
Since you stated that the development of coal will permit the region to a simple economic base (coal) how does this number of jobs, either years or the 1981 figure, compare with the number of Montanans in agriculture, government, and the other sectors?

How many new jobs are forecast in Montana sectors other than mining?

Page 4

For comparison, it is important to have baseline coal employment for Alternative 1.

Is it 1245?

It should be viewed as better information to the public and decision-makers if the text consistently refers to either the region or, preferably for clarity, to Montana and to Wyoming. For example, the number of wells destroyed, acres of shallow aquifers removed should be reported by county, if available. By state certainly. You do do this for Surface Water, for instance.

Alternative 3 analysis is based on 3C. This sub-alternative reports 5800 for the Montana coal related employment. It must be emphasized that the number of added jobs needs to be calculated; accurately.

If it is correct that the present number for Montana is approximately 1450, are there to be 1150 new jobs in the 3 new tracts (Cook Mountain, Coal Creek, Northwest Otter Creek)?

Under No Action, 1813 added housing units are projected for Rosebud County. Under 3C, 350 units are projected for Rosebud and 900 units for Powder River County. This seems to be 1250 units.

Can I assume this is for 1250 new places?

With 350 new dwellings in Rosebud, you calculate 1700 added people or 2.27 per dwelling.

Can you estimate the population increase in Powder River County and in Broadus?

This is important in order to review the piece on Community Services and Facilities.

If I can understand what you are willing, the additional housing requirements for 3-C are the same for Alternative 3. This is said for added population and for fiscal impacts. Since 3-C has a job number of 5800 and Alternative 3, 3-A a job number of 6100, this, for me, needs further clarification for my use as I compare Alternatives.

How does 3-A allow for free competition and choice among the tracts of Table 3-3?
Are you not required to "put up" 3 to 4 times the number of tracts required to meet DOE annual production to enhance free competition for the tracts?

For Alternative 4, as presented in earlier Site Specific Analysis (SSA) the 4 new coal tracts in Montana reported a peak work production force of 360-400 jobs per mine.

Clarify how your employment figure of 9100 was arrived at.
Given your stated requirement for additional dwellings of 2500, are there 2500 new Montana jobs or 4188 miners (or the existing 1450 or 7650 new jobs?

Page 7

Since you did not request the coal production employee number for Alternative 1, the report of employment numbers for the other Alternatives are not easy for me to accept. You should report that Broadus, under this Alternative, would anticipate 1850 added population by 1990 and Powder River County, 439 added persons.

Should your employment figures be reconsidered, it follows that other changes dependent on such numbers will be changed. See DEIS page 41.

Again, no mitigation measures for any impact of any alternative has been adopted.

Why not?

Community and social economic impacts are a major area and issue of concern.

In Table 3-13, Transportation, for average interruption etc. you use only 5 mph. However, in Table 3-4 you also report at 70 mph.

Can you reference Table 3-4?

In the Table 3-1, Sociology, the columns of numbers do not match numbers in descriptive text.

Which are correct?

How did you reach these numbers for services?

In Table 3-1, Economics, please give the source, revenue resources, the calculations; explain why Broadus population is excluded here.

For the purpose of my review, I'm going to assume the use of the Coulson model for the development of Table 3-1 was your perogative as Team Leader. I'm going to assume it is correct. Therefore, the negative balances as shown is recognition by the lead agency that an adverse fiscal impact will result from federal action.

Where are the adopted mitigation measures?

In Chapter 3, on page 34 your comment that Broadus water supply is adequate presently is inaccurate. This reflects the level of respect you have for local government cooperators. You can check the 1980 census to correct the comment, page 41, on the race which inhabits Ashland.

On page 41, coal employment for 1980 is reported to be 1245 in the region. This could be a useful number for you to use (my earlier comment).

The 1980 Census shows a "block" count for Ashland and shows the number of dwellings specifically in Ashland community. You do not need to use the enumeration district named "Ashland" for this Table 3-6.

Page 8

Table 3-3 has a title which should be revised. The display is not showing the existing economic environment.

On page 42, Noise, are you stating that Broadus is within the 55 dBA zone of railroad traffic?

If so, consider correction.

On page 42, Sociology, why is the potential for conflict specific between newcomers and Native Americans at Ashland?
Are you stating that only the Native Americans would feel their lifestyle and community as threatened by newcomers; or is it threatening to newcomers; or that theirs is an ideal as to one "threatened" while long-time residents (non-Indian?) may just "feel a loss"?
Are you implying that non-Indians will reside on the reservation?
What will be the effect upon the long-time residents and the Native Americans who enter the new work force, stating the work-load with newcomers?
Are they going to go to work "lost", "threatened" or "threatening"?
Are social adjustments in Montana less probable than those in Gillette which would "continue apace"?

The information on page 15, Sociology, for Powder River County under No Action is inconsistent with that on page 43, Economics, Powder River County, where in you state "No Action, county is static".

In this same piece, page 43, you state that increases in expected public expenditures during construction would outweigh any possible increases in revenues to the county. This is true for revenue but not for Coal Board impact funding.

On page 44, you state that Ashland has a 1980 population of 469. This is another error. The Miles City BLM District Office was told, was shown, prior to DEIS draft..

Referring to coal employment, numbers on page 41 for Big Horn and Rosebud counties is inconsistent with Table 4-10, page 77, baseline. Please explain how these figures are reflected in your coal production employment numbers used in 2-A, 2-B, 2-C, 3 and 4 for Powder River County and see also the SSA's on Ashland-Coalwood and Northwest Otter Creek, Southwest Otter Creek and Ashland Decker-Birney Tracts for estimated peak coal production employment numbers. From the scoping process, you know there is interest in new jobs and the beneficial aspects of mining more coal, by job descriptions and wage scale (page 8). For Montana, this DEIS addresses new jobs inaccurately; beneficial aspects of mining more coal are inadequately addressed. One benefit can be found in Table G-1, page G-7. There is a column headed "Gain to agricultural landowner" which can be compared with the column headed "Loss in Agricultural Sales". This particular Table presents figures which could be included in descriptive text under Economics for each Alternative, for each

State, County. By exercising your professional judgement for the choice to make the information tabular, again you deflect the purpose of the DEIS, in my opinion especially for Montana; specifically Powder River County and Ashland.

To summarize, this DEIS is used to deflect its purpose. This DEIS has error, misdirects reader, has uncompatable data format. This DEIS does not emphasize concentration on significant issues and impacts. This DEIS does not have an emphasis that sharply defines and provides a clear basis for choice by the decision-maker and the public. This DEIS is inadequate. This DEIS adopts no mitigation measures. The specifics are in the text above, with references.

Barbara Kennedy

Barbara Kennedy
516 Main
Miles City, Montana 59301

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September 1, 1981

Mr. Charles Wilkie
E.I.S. Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

RE: Powder River Draft
Environmental Impact Statement Coal

Dear Sir:

The purpose of this letter is to comment on the Powder River Draft Environmental Impact Statement Coal dated June 24, 1981. These comments have been prepared and are presented by the Cyprus Coal Company, a wholly-owned subsidiary of the Amoco Minerals Company. Further, we wish to have this information added to the appropriate section of the Environmental Impact Statement.

In August of 1979, a Federal Coal Exploration License was obtained for the Hanging Woman Creek Coal Field of the Decker-Birney Management Framework Plan area in Montana. Since that time, Cyprus has completed an intensive exploration program, developed a detailed geologic report, and formulated an in-depth initial Mine Plan. In addition to this overall effort, a transportation study was completed examining alternative market avenues and a negotiated Sage Grouse Mitigation Agreement concerning certain areas unacceptable for further consideration for leasing was signed with the Montana Department of Fish, Wildlife, and Parks.

Cyprus plans to continue on a judicious path aimed at developing the Federal Coal in the Hanging Woman Creek Coal Field.

Sincerely,

Ray C. Mateu

RGM:clr

Cyprus Coal Company
Subsidiary of Amoco Minerals Co
6300 SOUTH FIDDLERS STREET • SUITE 150
P.O. BOX 3299
ENGLEWOOD COLORADO 80155
(303) 740-5100

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516 Main
Miles City, Montana 59301
September 2, 1981

EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, Wyoming 87601

Dear Sir:

The Draft Powder River EIS is very inadequate as no reference is made to the operations workers. These are workers who will also impact the cities, towns, and counties.

How will they affect the human environment? and for 37 - 40 years?
How will they be affected by the human environment?
What is their life-style?
How will their life-style be affected?
By: Social organizations?
Religious groups?
Political groups?
School groups?
Private Clubs?

What factors determine their standards of living?
Wage scale?
Place of residence?
Job security?
Recreation opportunities?
Use of leisure time?
Education opportunities?

What is the baseline for social well being?
Per capita income
Median family income
Median school years completed
Total mortality
Mortality from suicides
Mortality from cirrhosis of the liver

What is the forecast of impact on the above by newcomers? Please compare.

-2-

What is the demography of operations workers?
How many married?
How many married with families?
How many married with families absent?
What are the ages of the children?
How many wives will seek employment?
How many are single?
What is the average age of those married?
What is the age of the singles?

Compare this with the baseline demography.

What will be the demands on the community?
For Housing?
1) single-family
2) multi-family
3) mobile homes
For water and sewer?
For utilities?
1) phones
2) propane
3) electricity
For police service?
For fire service?
For social workers?
For schools ?
For medical services?

With added demands for community services, who will comprise the secondary workers?
Ranchers?
Rancher's wives?
Operations workers families?
Wives?
Children?

Are there estimates forecast for commuting workers?

How are these impacts to be mitigated?

Where do you anticipate secondary impacts?

The text on regional economics is inadequate.
Compare the baseline and predicted levels for:
1. State public sector coal revenues and expenditures related to revenue distributions as per Statute, for example, severance taxes.

2. Per capita disposable income.

3. Degree of homogeneity

4. Degree of dependence of regional economy on the agriculture industry and the predicted coal industry.

5. Purchase of labor as a percent of the economy.

6. Agricultural employment and predicted coal industry employment.

7. Revenues from agricultural land should be compared with revenues from coal acreage since taxable valuations are of importance to regional economics.

8. Annual per capita revenues and expenditures of local and state governments in the region, adjusted for industrial wages.

9. Compare the distribution of federal mineral royalties by counties for the baseline and projected, by alternative.

In my opinion your DEIS has failed to provide data for comparison by ignoring the operations worker, his life style, standard of living and the effects of the revenues, by alternative. The DEIS does not tell the entire set of facts nor does the DEIS adopt mitigation measures. With this latter, the DEIS avoids responsibility of making a federal decision.

Sincerely

Margaret Ottey

Margaret Ottey
Assistant Planner

Richard W. Jones
808 N. 7th
Miles City, MT 59301

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EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, WY 82601

September 7, 1981

One of the chief concerns with resource development of the magnitude proposed in this DEIS is the impact on social well-being. There are at least two rapidly identifiable indicators of this unquantifiable value: income and employment. This DEIS does not adequately address either of these variables.

With respect to income, no measures of existing levels are presented, and no projections of changes to income are made. I have made some calculations, based on U.S. Department of Commerce/Bureau of Economic Analysis statistics, which indicate substantial effects from any of the Alternatives.

Labor and proprietor income, as used in these statistics, represents all income to persons, including wage and salary disbursements, other labor income, and the return to proprietors. This is the most aggregative measure appearing in the personal income and employment statistics series published by the BEA.

Labor and Proprietor Income, 1979

All Sectors	Total Income	Employment	Average Income/Employee
Big Horn County	$72,243,000	5681	$12,713
Rosebud County	51,176,000	4457	11,617
Powder River County	11,591,000	1318	8,795
Mining Sector			
Big Horn County	$30,602,000	925	$33,083
Rosebud County	12,927,000	393	32,893
Powder River County	3,503,000	99	35,363

Assuming these average figures hold through the development of Alternative 3, and based on the employment figures projected in Table 4-10 of this DEIS, the following increments to total labor and proprietor income would be expected in Big Horn and Powder River Counties (Rosebud County is not expected to receive any additional employment under Alternative 3):

Big Horn County	$3,663,600
Powder River County	23,444,820.

When analyzing impacts on income, one must consider the effects of significant population increases on local inflation. There will be substantial demand pressure on local markets, particularly housing. Land rents may rise faster than personal income, perhaps leading to a decrease in real per capita income. Using data from comparable regions which have already experienced rapid development, you should attempt to quantify this effect.

With respect to employment, the projections you offer in this DEIS are of little use, since there is no basis for comparison. Using the Montana Employment and Labor Force Monthly Report, February, 1981 (produced by the Montana Department of Labor and Industry, Research and Analysis Division, in cooperation with the U.S. Department of Labor, Employment and Training Administration), I have made some observations.

In 1979, Big Horn County had 5592 employed persons, out of a workforce of 5888 (unemployment rate = 5.0%). The unemployment rate in Big Horn has generally trended downward since 1972. In Powder River County, there were 1249 employed persons in 1979, out of a workforce of 1285 (unemployment rate = 2.8%). Powder River County unemployment has trended upward since 1978.

While these figures are interesting, they cannot be compared without some notion of workforce participation rates. For instance, do higher wages in one county induce more entrance into the labor pool, thereby increasing unemployment? Some

thorough analysis of the existing labor conditions in the affected areas is clearly in order. Further, population forecasts are difficult without consideration of existing conditions including excess workforce capacity and changing participation rates, and their effects on in-migration.

Table G-1 (page G-7) implicitly assumes a multiplier of 2.58 times loss in agricultural sales to achieve loss to gross regional product. What justification is offered for this assumption?

It is not my intent with these comments to answer all the questions that come to mind when reading this DEIS. I hope, rather, that by raising these issues, you will realize there is very little economic analysis contained in the document. Most of the assessments of economic impact deal with public sector enterprises (schools, town, and counties). The public sector economy accounts for a relatively small share of the regional economy. The private sector deserves considerably more attention.

Sincerely,

Richard W. Jones

HAMPSHIRE ENERGY
Suite 370
5990 South Syracuse
Englewood, Colorado 80111
(303) 773-6900

September 2, 1981

Mr. Charles Wilkie
Team Leader
Bureau of Land Management
951 Rancho Road
Casper, WY 82601

SUBJECT: Draft Powder River Regional Coal Environmental Impact Statement
Your Reference 1792-PP-EIS
HE-56

Dear Mr. Wilkie:

On behalf of Hampshire Energy, I am submitting these written comments on the Draft Powder River Regional Coal Environmental Impact Statement ("Draft EIS"). For the reasons outlined below, Hampshire Energy requests that the boundaries of Timber Creek Tract be modified slightly to delete 560 acres from the northern tip of the tract.

HAMPSHIRE'S PLANNED FACILITY

Hampshire Energy is a Wyoming partnership formed by The Northwestern Mutual Life Insurance Company, Kaneb Services, Inc., Koppers Company, Inc., Metropolitan Life Insurance Company, and the Standard Oil Company (Ohio). The enclosed brochure (Exhibit 1) explains this more fully. Hampshire proposes to build a plant facility to convert coal to gasoline at an estimated cost of $2 billion. The plant will produce 20,000 barrels per day of unleaded gasoline and other liquid fuels. It will contribute substantially to the economy of Gillette, Campbell County, and the surrounding areas of the Powder River Basin, adding to Wyoming's tax and industrial base and marking an important step in the national drive to develop practical alternative energy sources. The plant will employ up to 900 highly skilled permanent employees and will offer a ready local market for over 5 million tons of Powder River Basin coal annually. The favorable potential of the project has been realized by the Department of Energy, which awarded Hampshire a $4 million cost-sharing feasibility grant for project planning. On December 2, 1980, the Hampshire partnership applied for loan and price guarantees from the United States Synthetic Fuels Corporation, which is now reviewing the application.

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Mr. Charles Wilkie
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HAMPSHIRE ENERGY'S SITE

In choosing a site for the plant, Hampshire was careful to select a tract which was adjacent to a line of the Burlington Northern Railroad, in close proximity to coal sources, with reasonable topography, and close to a town which could provide a convenient administrative and commercial center for the project. In August 1980, Hampshire optioned a tract southeast of Gillette, Wyoming. The monitoring required for an air quality permit application for the selected site has been in process since October, 1980. The air quality data collected to date are not useful for any other site. An entire year's baseline data are required by the State of Wyoming. Hampshire has had consultants make site-specific ecological and archaeological studies together with socioeconomic studies which are tied to this site. Using these data, Hampshire has drafted its permit application which will be submitted to the Wyoming Industrial Siting Council in September, 1981. Controlled surface acreage includes Section 30, 31, and 32 and portions of Section 29 and 33 of T.49 N., R. 70 W. Overlays to page 5 of Exhibit 2 show the controlled acreage and the proposed plant site.

THE DRAFT EIS

The Draft EIS identifies a proposed course of action and four alternatives. One alternative is to take no action. As set fourth in Table 2-8 of the Draft EIS, the three proposed action alternatives all include leasing the Timber Creek Tract. The Timber Creek Tract Profile, previously released by the Bureau of Land Management, describes the tract in greater detail. As there described on page 7, the proposed tract includes parts of Sections 31 and 32 of T. 49 N., R. 70 W., 6th P.M. This part of the proposed Timber Creek tract, shown on an overlay to page 5 and 7 of Exhibit 2, underlies 560 acres of the Hampshire Energy Site.

HAMPSHIRE ENERGY'S GEOLOGY REPORT

Hampshire Energy has retained Arnex Corporation, independent consulting geologists from Denver, Colorado, who are familiar with the Powder River Basin. Using open file data from the USGS (see Open File Report 79-049) and drill-hole data available, Arnex has estimated that only 12.6 million tons of recoverable Wyodak I and W-1 (local) coal underlie the part of the Timber Creek tract in Sections 31 and 32. This represents less than 7% of the estimated tonnage of economically recoverable coal in the entire tract, and less than .0084% of the 1.5 billion tons which are targeted for lease.

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Mr. Charles Wilkie
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In fact, coal maps of the area show that the coal underlying the Timber Creek portions of Sections 31 and 32 is in a narrow nose projecting northward, with exposed oxidized outcrop on three sides.

THE PROPOSED SOLUTION

By now, the problem is clear: Hampshire is tied to a site because of air monitoring requirements, topographic constraints, proximity to the railroad and to Gillette, and because anywhere in the Powder River Basin it will face underlying coal of some sort if the other criteria are met. If Hampshire must move, it will be farther away from coal sources, greatly increasing the cost to the venture and weakening the project's economic feasibility.

Overwhelming considerations of policy argue for a compromise solution to this problem that would permit both coal mining in the balance of the Timber Creek Tract and further development of the Hampshire Energy project. Section 100(b)(2) of the Energy Security Act established national policies of "demonstrating at the earliest feasible time the practicality of commercial production of synthetic fuel from domestic resources" and "fostering greater energy security and reducing the Nation's economic vulnerability to disruptions in imported energy supplies . . . ." The Hampshire Energy project is one of the leading coal to gasoline projects in the country and by the beginning of 1986 can be producing unleaded gasoline from coal as a substitute for gasoline from imported oil.

Hampshire Energy has committed in excess of $20 million in development of the project of which approximately $6 million is site associated. The long air monitoring period required and the time involved in acquiring ecological and botanical baseline data for permit applications precludes the selection of a substitute site, when every month's delay could increase the cost of the project by an estimated $10 million.

Based upon the Timber Creek Tract Profile, the coal underlying the Hampshire site would be mined in only two years (Map 1.2-2). A reduction of 560 acres in the size of the Timber Creek Tract would allow development of the Hampshire Energy facility without impeding the mining of the coal in the balance of the tract. More importantly, and as confirmed by the independent consultant Arnex Corporation, the coal underlying the site is insignificant in comparison with the estimated recoverable reserves of 95 billion tons in the Powder River Basin, and even in comparison to the 1.4 to 2.5 billion tons of federal coal expected to be leased in the Powder River Basin in 1982.

BLM regulations prohibiting the leasing of certain federal lands for coal development make it clear that the needs of industry should be taken into

September 2, 1981
Mr. Charles Wilkie
Bureau of Land Management
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account in the tract selection process. The unsuitability criteria specified in 43 C.F.R. 3461.1(b) forbid the leasing of federally owned coal underlying surface land which has been leased for an industrial purpose. The regulation may be limited to federally owned surface leased for industrial development, but the policy it serves is the broader policy of deferring to industrial uses when selecting tracts of federal coal to be leased. It would be senseless and serve no sensible policy of resource development to protect the site of an industrial user who leased his site from the federal government, but subject the industrial user who secures fee ownership of the surface or leases it from a private owner to the constant danger that the mining of federal coal will destroy his industrial use.

The Hampshire Energy project would provide up to 3,500 construction jobs during the period 1982 - 1985, and up to 900 permanent jobs, and would provide a major long-term addition to the Campbell County tax base. Moreover, it would diversify the economy and skill base of the area by adding a high-technology facility to an economy now dominated by mining and ranching. Under the circumstances we believe that BLM to its long range outlook to the benefits accruing to the nation should not jeopardize a $2 billion synthetic fuels plant for the sake of producing a relatively small amount of federal coal. The Hampshire Energy Plant will consume annually 5 million tons of Powder River Basin Coal, insuring a long term stable market.

The reasonable solution to this problem is to remove from the proposed Timber Creek Tract the coal underlying the 560 acres of Hampshire Energy's plant site. This approach would accommodate two very important national objectives -- the development of alternative fuels to reduce our dependence on imported oil while continuing with the leasing of substantial amounts of federal coal.

Very truly yours,

HAMPSHIRE ENERGY

Mitchell F. Kenny

Mitchell F. Kenny
Chief Executive

MFK/cmb
cc: Project File (1.1.1.6)
Reading File

Texas Energy Services, Inc. **13**

Philip L. White
President

September 3, 1981

Mr. Chuck Wilkie
EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

RE: Comments on Draft Powder River Regional Coal Environmental Statement

Dear Mr. Wilkie:

Texas Energy Services, Inc. of Gillette, Wyoming welcomes the opportunity to submit comments on the draft Powder River Regional Impact Statement.

Since its creation in 1977, the Federal Coal Management Program has tended to be complex, with numerous distinct phases. The draft Environmental Impact Statement is attempting to assess impacts based upon the leasing and eventual mining of a number of selected leases.

The preferred alternative, endorsed with reservation by Assistant Secretary Garrey Carruthers, will likely result in few, if any, new mines. The majority of the tracts to be leased are either maintenance tracts or, because of their locations, likely to be attractive only as extensions of existing mines, and unlikely to attract more than one bidder. The preferred alternative, given its array of tracts, acts to restrict new entrants, whereas alternative 4 serves to foster competition in that it provides for one or two new lease tracts. Still, studies to date clearly show that assumptions relating to lead time, one on one leasing, and existing capacities will result in a shortfall in the early 1990's which could result in a crash leasing program.

Texas Energy Services believes, as does Secretary Carruthers, that the market should basically determine how much coal should be leased.

The comments filed in response to the draft are intended to be constructive. The decision makers in the program should review the preliminary lease target decision by Secretary Carruthers.

Based on conversations with city, county and state officials, Texas Energy believes that the position articulated in our comments is consistent with and promotes the best interests of Wyoming. Similarly, an expanded lease program would enhance the good neighbor policy outlined in Secretary Carruther's letter.

Respectfully yours,

Philip L. White
Vice President

PLW:sl

COMMENTS BY TEXAS ENERGY SERVICES, INC. TO DRAFT ENVIRONMENTAL IMPACT STATEMENT

On June 22, 1981, Garrey Carruthers, Assistant Secretary Land and Water made an interim decision which set the federal coal leasing target for the Powder River Region. (A copy of his decision is attached). Although the draft Environmental Impact Statement briefly discussed this decision, Texas Energy Services encourages further review of Secretary's Carruther's comments. We share many of his concerns and invite consideration of the following comments.

1. Competitiveness: The draft analysis defines "competitiveness" as maximization of royalty and bonus payments for the federal treasury and the states. This single dimension definition ignores the express intent of Congress contained in the Mineral Leasing Act of 1920 and the Federal Coal Leasing Amendments Act of 1976. Specifically, the DEIS approach discounts three essential aspects of competition:

   - The ability of the tract to be developed by more than one lessee.
   - The lack of competitive opportunities in the maintenance and preferred alternative tracts.

   - The fact that supply/demand is the real source of the competitive choice for utilities which translates into lower prices for consumers.

Secretary Carruthers apparently shares our concern about competition. In his decision document he has stated, "...Even though coal tracts are offered for lease, this does not insure that bids will be received. For one reason or another, there may be little competitive interest in the particular tracts." Texas Energy Services could not agree more. Since the inception of the Federal Coal Management Program, industry expressions of interest were relegated to a timetable behind land use planning. The Bureau of Land Management has mistakenly assumed that all delineated tracts are competitive, when in reality many are not.

In underscoring the latter concern, Secretary Carruther's has emphasized that, "...The Department of Energy, General Accounting Office, Department of Justice and Council on Wage and Price Stability have consistently recommended that the Department should lease amounts of coal well in excess of projected demand to maximize competition in the sale of coal and to meet unforeseen future market needs."

2. Lead Time: The following lead time assumption utilized in the DEIS appears substantially flawed:

"D. A three year period (1982-1985) for mine and reclamation plan development and approval would follow leasing. During this time further information on cultural resources would be collected, and a permit obtained for surface mining. Facilities construction would require two years (1986-1987); the resulting mine would be in full production by 1990." (DEIS p. 14)

Texas Energy Services has conducted an extensive analysis of coal mine development. It was determined that at a minimum the tracts require five years for engineering and environmental/permitting approvals. This is at least two more years than assumed by the draft. Furthermore, two years will be required for construction. This totals seven years from lease issuance. Given a 1982 lease sale, new leases will not be capable of commencing operations prior to 1989-1990.

Texas Energy also takes exception to the assumption that full production will occur within three years of initial production. For leases expected to produce 15 million tons per year at least five years are needed; for lease tracts producing 10 million tons per year at least four years are needed to full production. Texas Energy's analyses are supported by a DOI contracted study. (See "Impact of Government Regulations on Coal Mine Start-Up

and Production," Policy Planning and Evaluation Inc., May, 1981.)

Obviously, a shortfall or deficit will occur between 1990 to 1994, as the 1982 tracts will not produce at full capacity until 1994, not 1990. As a result, the 1982 sale should be based upon 1994 or 1995 requirements.

Secretary Carruthers apparently shares our concern that the 1990 based analysis is wanting. He has suggested that, "...The most likely scenario is to be based upon our estimates of probable production or demand for coal from the Powder River region in 1990 and 1995."

3. Shortfalls: The following "existing capacity" assumption, together with the assured tonnages included in Table 2-2, appear to be highly optimistic:

"3. Existing and proposed mines, and mines resulting from non-competitive leases and PRLA's would be in production by 1990." (DEIS p. 13)

Secretary Carruthers is critical of the BLM assumption regarding existing lease and PRLA production capacity. He has responded with, "...The regional target calculation appears to have been influenced by a general assumption that many of the existing leases and all of the preference

right lease applications within this region, will go into production. This assumption does not take into full account the many variables which determine whether production will actually occur." This unrealistic assumption was largely responsible for the Regional Coal Team decision to adopt a low-level leasing target.

Texas Energy Services has analyzed the PRLA's and existing leases for Wyoming. It is possible that pending PRLA's will result in zero production and existing leases will produce no more than 280 million tons. This would result in a shortfall of 70-80 million tons per year by 1990. This discrepancy alone would require an additional four, 15 million tons per year tracts, roughly equivalent to 1.5 billion tons of reserves. (See accompanying tables.)

Secretary Carruthers stresses the importance of the market place. On page 2 he has stated, "...I am personally committed to a market orientation, that is, letting the market basically determine how much coal should be leased. There is serious doubt in my mind that a level of 1.4-1.5 billion tons would be sufficient for the Powder River sale."

Texas Energy concurs with the Secretary. Numerous studies

reinforce this view. They include: GAO - "Shortfall in Leasing Coal from Federal Lands: What Effect on National Energy Goals," August, 1980; IFC Inc. "Analysis and Critique of the Department of Energy's August 7, 1980 Report, "October, 1980; DOE - "Coal Competition: Prospects for the 1980's," January, 1981.

4. Socio-Economic Impact: The DEIS's failure to adequately address which lease tracts will likely result in new mines together with when they will most probably gear up to full capacity, has resulted in both an overstatement and an understatement of probable socio-economic impacts. The statement has:

- Overstated anticipated regional environmental and socio-economic impacts as a consequence of over estimating production from existing leases, new leases, and PRLA's.
- Understated longer term impacts to the consumer, the industry, the region, and the Nation as a result of having failed to address the likelyhood of an ensuing supply shortage as a result of having offered to little coal for lease under the preferred alternative.

An independent appraisal of Wyoming tracts has determined that it is indeed plausible that the impact of the 2.6 billion ton alternative could be substantially less than the DEIS's projection for the preferred 1.5 billion ton alternative. The study concluded that the employment projections for alternative 4 were roughly one-third those forecast by the DEIS and that the total population impact in 1995 was virtually half that projected by the DEIS for 1990. In fact, the preferred alternative with its negligible growth potential could indeed prove to be injurious to the City of Gillette's best interests, in that the City has undertaken considerable obligations to accomodate growth which may not now be forthcoming.

The Secretary apparently shares our misgivings about the DEIS's impact projections and our concern that the preferred alternative may in fact be detrimental to the consumer and the Nation. Secretary Carruthers' concerns are outlined in his decision document in which he has stated that, "...The one to one relationship between DOE's production goals and Interior's leasing targets, and the assumption that every tract leased will be developed are probably incorrect. Such linkages tend to overstate impacts of leasing." Additionally he has stated that," ...Secretary Watt is committed to

a policy of making more of the Nation's energy resources available to the public for development, consistent with the letter and intent of existing environmental and other statutes. This policy is central to the objectives of stabilizing the price of energy paid by consumers and reducing our dependence on foreign energy sources." Texas Energy concurs and suggests that the final analysis fully address the Secretary's concerns.

5. Maintenance Tracts and New Competition: Analysis of the preferred alternative reveals that existing mines have benefitted significantly as a consequence of current lease tract configurations and as a result of a new category of leases referred to as production maintenance tracts. No less than six companies with existing mines have a distinct advantage for additional tonnage. It is highly unlikely that any serious competition will occur for their tracts. Nonetheless the tracts are considered "competitive" for bidding purposes under the RCT Analysis. It should be noted that production maintenance tracts are an administrative creation not authorized by statute or regulation.

We question the need for production maintenance tracts for existing mines that have a thirty year life and reserves in excess of 300 million tons.

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

JUN 22 1981

Memorandum

To: Director, Bureau of Land Management

From: Assistant Secretary - Land and Water Resources

Subject: Leasing Target for the Powder River Coal Production Region

The Secretary of the Interior has delegated to me his authority under 43 CFR 3420.1 to set Federal coal leasing targets. It is now necessary that the Department identify a leasing figure for use as the preferred leasing alternative in the environmental impact statement (EIS) on the Powder River region 1981 coal sale. My decision at this time is, therefore, an interim one in the process of determining how much coal will ultimately be offered for sale in the Powder River region.

The regional coal team (RCT) has recommended that the Department offer 1.4 - 1.5 billion tons of coal reserves in the proposed 1981 sale. From my discussions with the other Assistant Secretaries, it is evident that the national interest will best be served by a decision to offer a sufficient amount of Federal coal in the Powder River region to satisfy the demand for reserves in that region, while permitting the development of these reserves in line with the Department's coal regulations. Those regulations, of course, are designed to ensure development with appropriate environmental safeguards. The RCT's recommendation reflects its opinion as to the amount of Federal coal that should be leased to both satisfy the Department of Energy's (DOE's) projection of the coal market in this region and meet local concerns as to the level of development and its effects. The RCT recommendation may have minimized in its leasing target calculation several factors which indicate a need for a higher leasing level. The one-to-one relationship between DOE's production goals and Interior's leasing targets, and the assumption that every tract leased will be developed are probably incorrect. Both linkages tend to overstate impacts of leasing. Further, the regional target calculation appears to have been influenced by a general assumption that many of the existing leases and all the preference right lease applications within this region will go into production. This assumption does not take into full account the many variables which determine whether production will actually occur.

2.

Even though coal tracts are offered for lease, this does not ensure that bids will be received. For any reason or another there may be little competitive interest in particular tracts. The basic fact is that coal production tends to be market driven or demand oriented. It also can be expected that if industry has a selection of tracts available for production, the most economical coal will be mined first, other considerations being equal. In addition, the DOE, General Accounting Office, Department of Justice, and Council on Wage and Price Stability have consistently recommended that the Department should lease amounts of coal well in excess of projected demand to maximize competition in the sale of coal and to meet unforeseen future market needs.

After considering all of these factors, I am at this time accepting the RCT's recommendation as the preferred leasing alternative for the EIS. My decision is based on the fact that the RCT's recommendation reflects the principal assessment done to date on how to meet the demand for Powder River reserves. However, I wish to make it clear that I am personally committed to a market orientation, that is, letting the market basically determine how much coal should be leased. There is serious doubt, in my mind, that a level of 1.4 - 1.5 billion tons will be sufficient for the Powder River sale. The Department, of course, has the option of deciding to lease at a higher or lower level once all decision factors are before the Secretary, including the final regional EIS.

In light of these considerations, the Powder River EIS must give full attention to all of the available leasing alternatives, and the scenarios of coal production likely to result from each alternative. Two production scenarios should be evaluated for these alternatives ranging from the preferred alternative to the offering of 2.5 billion tons of coal. The most likely scenario is to be based on our estimates of probable production or demand for coal from the Powder River region in 1990 and 1995. This scenario will assume that end-use demand drives the quantity of coal that is actually produced. The second scenario is an assume that all Federal coal offered for sale in 1981 will be (a) sold to producers, and (b) brought into full production in the early 1990's.

This decision generally reflects my concern about the role which market forces play in determining the extent of Federal coal leasing. Secretary Watt is committed to a policy of making more of the Nation's energy resources available to the public for development, consistent with the letter and intent of existing environmental and other statutes. This policy is central to the objectives of stabilizing the price of energy paid by consumers and reducing our dependence on foreign energy sources. Also, I wish to stress that the role and involvement of the Governors, particularly through their participation on the RCT, is an issue of paramount importance to me. I fully intend, as we go forward with the Powder River effort, to maintain the Secretary's good neighbor policy and to enhance our working relationship with the Governors.

PROJECTED 1990 PRODUCTION FROM THE POWDER RIVER REGION, WYO./MONT.

WYOMING	PRO DEIS Estimate MM tpy	Revised Estimate MM tpy
Campbell County		
Existing Mines		
Belle Ayr	19.0	19.0
Black Thunder	20.0	20.0
Caballo	12.0	12.0
Clovis Point	4.0	4.0
Cordero	15.0	15.0
Eagle Butte	20.0	20.0
Ft. Union	1.2	1.2
Jacobs Ranch	14.0	14.0
Rawhide	24.0	24.0
Wyodak	5.0	5.0
Subtotal Existing Mines	134.2	134.2
Potential Mines		
Buckskin	1.5	1.5
Coal Creek	10.0	10.0
East Gillette	11.0	11.0
Pronghorn	5.0	NE 1/
Caballos Rojo	15.0	15.0
South Rawhide	7.0	NE
Wildcat Creek	10.0	NE
Rochelle	11.0	5.0
North Antelope	8.0	8.0
Dry Fork	8.0	8.0
Wymo Fuels	4.4	4.4
Subtotal Potential Mines	90.9	62.9
PRLA's and related	16.8	NE
Total Campbell County	241.9	197.1
Converse County		
Dave Johnson (existing)	3.2	3.2
Antelope/NERCO (proposed)	10.0	10.0
PRLA's and Related	14.8	NE
Total Converse County	28.0	13.2
Johnson-Sheridan Counties		
Big Horn (existing)	4.5	4.5
Black Mountain (potential)	.5	.5
Dutchman (proposed)	2.0	NE
Ash Creek/PSO (proposed)	.5	NE
PRLA's and Related	14.0	NE
Total Johnson-Sheridan Counties	21.5	5.0

1/ Pronghorn to be mined as part of Caballos Rojo project.

TOTAL WYOMING 1990 COAL PRODUCTION	291.4	215.3
MONTANA		
Big Horn County		
Existing Mines		
Decker	12.2	12.2
Spring Creek	7.0	7.0
Absaloka	10.0	10.0
Subtotal Existing Mines	29.2	29.2
Potential Mines		
CX-Kiewit	4.0	4.0
Crow-Young Creek	-	NE
Subtotal Potential Mines	4.0	4.0
Total Big Horn County	33.2	33.2
Rosebud County		
Colstrip (existing)	19.1	19.1
Big Sky (existing)	4.2	4.2
Montco (proposed)	9.0	9.0
Total Rosebud County	32.3	32.3
Powder River County		
Coal Creek (existing)	.03	.03
Total Powder River County	.03	.03
Cheyenne Reservation		
CX Ranch-Consol (proposed)	8.0	NE
Greenleaf-Miller (Peabody)	4.0	NE
Total Cheyenne Reservation	12.0	-
TOTAL MONTANA 1990 PRODUCTION	77.53	65.53
TOTAL POWDER RIVER 1990 PRODUCTION	368.83	280.83

LEGEND: "NE" = "Not Economic"

NOTE: A comprehensive and critical review of the PRLA's in Campbell and Converse Counties shows conclusively that the PRLA tonnage assumed in the DEIS is wholly unrealistic. Analysis of the resource, its mineability (including contiguous ownership), transportation and environmental factors suggests strongly that no significant production can be expected from the PRLA's by 1990, except as extensions of other operations.

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704 Oasis Drive
Billings, MT 59105
September 4, 1981

Mr. Charles Wilke
EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, WY 82601

Dear Mr. Wilke:

As a concerned citizen who has attended many of the EIS public hearings on the Draft Power River Regional Coal Environmental Impact Statement, I am disturbed by some of the statements which have been made regarding the amount of federal coal under lease and the necessity of leasing more federal coal. Some groups would have you believe that there is no need for additional leasing since much of the federal coal currently leased has not been mined. Of course, this ignores the real problems associated with economically mineable reserves transportation systems quality of the deposits leased, in short, all that which is necessary to make a project feasible.

Probably the most intriguing and amazing statements that I have heard is that "there is no need for additional leasing because the market is soft." Apparently, these groups and individuals feel that it is the United States Government's duty to keep the price of coal at a high level. Consider this analogy, in times of low beef prices perhaps the Bureau of Land Management should rescind grazing leases in order to raise prices. By restricting access to the market place you create upward pressure on prices.

I would like to suggest that the Bureau adopt a strategy which I know is politically questionable, but then good ideas often are. I suggest that the United States offer all federal coal for lease. Retain diligence requirements and apply any sort of environmental restraints and unsuitability criteria at the mine permit stage. Such an approach would insure that the most economically viable projects would be developed and that the United States would have an adequate supply of coal available to meet its needs. By retaining some sort of diligence requirements, speculation would be discouraged but serious attempts at putting together mineable properties would have free access to the market. I feel such a course of action is in the best interests of the nation.

Sincerely,

Kenneth L. Williams

KENNETH L. WILLIAMS

KLW:pc

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SOHIO ROYAL LAND COMPANY

September 3, 1981

Mr. Chuck Wilkie
EIS Project Leader
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Wilkie:

Re: Public Hearing for the Powder River Basin Coal Leasing EIS
Gillette, Wyoming on August 19, 1981

There is a possibility in my oral comments I transposed several numbers in expressing this Company's preference for the leasing alternative. Royal Land Company would like to see either Alternative 2 or 4 as the preferred alternative rather than that which was selected in the draft EIS. It was in my discussion of Royal's preferred alternatives that I may have transposed the numbers.

If possible, please correct the public statement and for the record.

Very truly yours,

ROYAL LAND COMPANY

Robert F. Matthias

Robert F. Matthias
Senior Geologist

RFM:jas

United States Department of the Interior **16**

BUREAU OF MINES
2401 E STREET, NW
WASHINGTON, D.C. 20240

September 3, 1981

Memorandum

To: EIS Team Leader, Bureau of Land Management, Casper District, Casper, Wyoming

From: Director, Division of Mineral Land Assessment

Subject: Powder River Regional Coal draft environmental statement (DEIS)

The DEIS is exceedingly brief and relies heavily on separate documents and data which are not included with the report. Procedures regarding the nationwide Federal coal program, including the sequence of environmental studies and processes, are addressed in the Federal Coal Management Program final environmental impact statement. More regional plan concerns are further detailed in the various Management Framework Plans, while site specific analyses of the selected tracts are given in individual tract profiles.

Most concerns about minerals--resolution of conflicts with non-coal mineral resources, additional and specific geological data, and the mining methods likely to be used on specific tracts of land--may be adequately considered and addressed in the referenced documents. Unfortunately, the DEIS fails to substantiate this fact. The statement could be improved by condensing pertinent minerals-related data from the referenced documents and include them as an appendix, or reference the parent mineral data in a more comprehensive manner.

Mineral resources other than coal that have been produced in the area covered by the DEIS include sand and gravel, stone (including pumice and limestone), silver and lead, and clays (including bentonite). It is suggested that, for each alternative, the DEIS include information on how mineral resource conflicts will be resolved or mitigated, and what land-use planning restraints will be used to minimize conflicts between coal and other minerals. Technological processes and mineral use priorities which could prevent loss or waste of resources present in the overburden should also be considered.

In addition, the statement should include more information on the location, thickness, depth of overburden, areal extent, and economic value of the coal in each tract. This information is necessary to assess the economic, environmental, and sociological impacts of coal development.

Thank you for the opportunity to review this document.

James Boone

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August 24, 1981

Mr. Charles Wilkie
EIS Team Leader
Bureau of Land Management
951 Rancho Road
Casper, WY 82601

Re: Draft Powder River Regional Environmental Impact Statement

Dear Mr. Wilkie:

Please accept this letter as our written support for Alternative 18 as the preferred alternative of the Regional Coal Team.

As landowners in the area of the Kintz Creek and Keeline tracts, we have followed the tract ranking and selection process since it began over a year ago. At each opportunity we have expressed our strong support for small business set aside for the area, and I know there are others who agree with us.

Recently it has been brought to our attention that some large oil companies have argued in favor of alternatives which would exclude the small business tracts favored by the Coal Team. We believe large oil company interests already control significant portions of the Powder River Basin and strongly believe that small business should have an opportunity to participate in coal development. In addition, big business interests are incompatible with our ranching and farming operations in that area. We have been dealing with small business interests which are interested in obtaining leases in our area and we believe our operations and theirs can co-exist, while experience and history has proven that they cannot with large industry.

Therefore, as landowners whose lands will be directly affected by the tracts suggested by the Regional Coal Team, we strongly urge that at least to the extent that the Keeline tract is included in the preferred alternative as a small business set aside, the recommendations of the Regional Coal Team be accepted.

Yours very truly,

Charles K. Mills
Mills Bros.
Larry C Mills
L. M. Mills

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WESTERN ENERGY COMPANY

GENERAL OFFICES: 101 EAST GRANITE, BUTTE, MONTANA 59701
(406) 723-3151

September 4, 1981

EIS Team Leader
BLM
Casper District Office
951 Rancho Road
Casper, WY 82601

RE: Comments on the Powder River Draft Environmental Impact Statement for Coal Leasing

Gentlemen:

The overall tone of the draft EIS is quite favorable to the leasing program, particularly the preferred alternative leasing target of 1½ billion tons. First, we would like to address some areas where the EIS contains obvious errors. On page 41, second paragraph under Community Services and Facilities, it mentions that there are parochial schools in Colstrip and Broadus and that Ashland does not have a high school. This is simply not the case. Ashland's high school is called the LaBre and there are no parochial schools in Colstrip or Broadus. Table A3 entitled National and State Ambient Air Quality Standards on page 83 of the appendix does not include the 1980 revisions to the Montana ambient air quality standards.

The air quality discussion under alternatives 2, 3 and 4, state that about 4,800 tons a year of particulate would be added to the Colstrip area. This is not the case. Air Quality Permit No. 1683 issued by the Department of Health and Environmental Sciences for the State of Montana indicates that no more than 4,583 tons of total suspended particulate will be emitted from the existing operations at the Rosebud Mine. Western Energy feels this figure is conservative and its own calculation show that the controlled emissions for particulate would be more in the neighborhood of 2,245 tons per year. In the preliminary determination for air quality permit for the Area C expansion to the Rosebud Mine, which has been assigned an Air Quality Permit No. 1570, controlled particulate level will be 838.96 tons per year. Using the more conservative estimates, the total for the Rosebud Mine at full production of over 19 million tons would only be 5,522 tons of TSP emitted per year. This figure is a worse case scenario, it does not represent the average. Therefore, the statement of 4,800 tons to be added by the tracts in Area D, Areas A & B and Area C is completely out of the question. There should be no significant increases in TSP levels when the Area D operation is brought into light since at that time Area B will no longer be operated.

Letter
September 4, 1981
Page 2

On page 35 under the discussion on air quality, the statement is made that Colstrip does not meet the national ambient air quality standards for particulate and has been designated a nonattainment area "which is not expected to improve in the near future." Under the terms of Air Quality Permit No. 1483, Western Energy Company has committed to a mine-wide dust management plan which has made a significant reduction in the amount of particulate emitted at the Rosebud Mine. Data from the first two quarterly reports required as a condition of this permit suggests that the air shed in the Colstrip area is improving. It is Western Energy's contention that the Colstrip area was improperly designated a nonattainment area and has petitioned the Air Quality Bureau for a redesignation.

The surface water sections in alternatives 2, 3 and 4 address a 4% increase in dissolved solids in Armells Creek. On page 53 this explanation is given as an increase in dissolved solids due to leaching of mine spoils, and that the 4% increase would occur near Forsyth. We feel that this figure is too high and is based on conjecture, not previous experience. Probably a better figure to use is 1%.

William F. Robinson/mm
William F. Robinson
Manager, Corporate
Development

27008/A

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OFFICE OF
County Commissioners
CAMPBELL COUNTY
Gillette, Wyoming 82716

September 9, 1981

Mr. Chuck Wilkie
EIS Team Leader
BUREAU OF LAND MANAGEMENT
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Wilkie:

The Campbell County Commissioners have reviewed the Draft Environmental Statement for the Powder River Region. In light of our review, we offer the following comments:

Campbell County prides itself on the efforts it has undertaken to cope with the social-economic problems that have been attendant with the development of coal in the area. The infrastructure of the County has now reached a point where it can accommodate reasonable growth without sacrificing quality of life. We encourage further growth of the coal industry provided that it is done in cooperation with industry and in compliance with the Wyoming Environmental Quality Act, the Wyoming Industrial Development Information and Siting Act, and our County and Municipal laws and ordinances.

In reviewing the four alternative courses of action described in the Draft EIS, we concur that the issue of primary concern is related to the impact of coal mine development and population increases on the affected communities. We have also reviewed Assistant Secretary Carruther's memorandum of June 22, 1981, and concur with his concern about the importance that the market forces play in determining what level of Federal coal should be leased. In our opinion, Alternative Four is the preferred alternative. By leasing the maximum level, steady growth will be maintained and the market will be stimulated to meet existing and future needs. It will eliminate many of the uncertainties involved with the other alternatives.

Mr. Chuck Wilkie Page -2- September 9, 1981

We respectfully request that our comments be considered in the preparation of the Final EIS and in Secretary Watt's final decision for coal leasing in the Powder River Coal Production Region.

Thank you for your time and consideration.

Sincerely,

CAMPBELL COUNTY BOARD OF COMMISSIONERS

Harry R. Underwood, Chairman

W. D. Flack, Member

Bob L. Farver, Member

/bsh

cc: The Honorable Ed Herschler,
Governor, State of Wyoming

The Honorable Mike Enzi,
Mayor, City of Gillette

Mr. William Flaherty,
Campbell County Engineer

THE STATE OF WYOMING

20

ED HERSCHLER
GOVERNOR

Game and Fish Department

CHEYENNE, WYOMING 82002

KARL M. THOMAS
DIRECTOR

September 9, 1981

RIS 142/L1, Draft RIS
for Powder River Coal
Campbell County, WY & MT.

Mr. Charles Wilkie, Team Leader
Bureau of Land Management
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Wilkie:

During our review of the Powder River Coal DEIS we found it difficult to determine the actual area covered by the document. A map of regional activity was included in the DEIS, but no DEIS boundaries were noted. Also, this map includes a lot of waters (Pathfinder, Alcova, Glendo, North Platte River, Bates Creek, Lake DeSmet, Keyhole, M. Fk., N. Fk., and S. Fk. Powder River and others) that were not mentioned in the DEIS.

Specific comments are as follows:

Page 2 - Soils, vegetation, reclamation - this section refers to Packer (1974) concerning the possibility of reclamation success. This is a relatively old reference. This would be more convincing if reference was made to a more recent publication or to ongoing studies.

The recreation section (Page 39) should point out that most outdoor recreation is limited by land access problems within the region, and that hunting, fishing, and camping increases will be felt on the edge of or outside the region. This section should also address the problem of meeting outdoor recreational demands caused by this coal leasing when fishing and camping are not now available in sufficient quantity in Campbell County, and when in the region some forms of hunting (elk, moose) are not available and others (deer, antelope, game birds) are restricted by private land ownership and trespass fees. The recreational impact of nearly 20,000 new people in Campbell County will be more significant than expressed in the DEIS.

Mr. Charles Wilkie
September 9, 1981
Page 2, BLM 143/81

Page 3 - Summary - mentions that funding for urban recreation facilities would be available, and that the quality of dispersed recreation would be diminished under Alternative 1. Funding to maintain basic facilities for camping and fishing would be appropriate. The statement that new federal leasing would not appreciably affect dispersed recreation is questionable (depending on the scope considered - national vs. local).

Page 5 Purpose and need for leasing - this section essentially says that leasing is being done to meet set production goals. With the private coal in the region, already-leased coal, and preference right lease applications, the need for new leasing does not seem justified.

Pages 18-19 Alternative , and mitigation should include mention of wildlife and recreation. Cumulative and off-site impacts were not mentioned.

Pages 23-24 - Table 2-1 displays cumulative environmental impacts; however, wildlife and fishing recreation were not displayed. Housing and population figures were provided. It should be assumed that these people will recreate at locations such as Keyhole Reservoir, Lake DeSmet and waters in the Bighorns.

Page 54 - Environmental Consequences, paragraph two, states that sewage effluent would increase and contamination would occur in the Tongue and North Platte Rivers. Then, based on low dissolved solids increases from the sewage, a determination of no significant impact to the aquatic biology is made. This method of analysis fails to recognize water quality problems from municipal sewage. A variety of state water quality standards apply to sewage effluent. Discussions of air quality relate to the Wyoming standards so it seems the same consideration should be given to water quality. Reliance on dissolved solids and percent depletions for water analyses, as was done throughout this DES, is not appropriate.

Pages 57-58 - Soils, Vegetation, Reclamation - revegetation may be a certainty in Campbell County, but reclamation to wildlife habitat is not.

Page 58 - Environmental Consequences - Wildlife - fails to mention fish.

Pages 58-59 - What is proposed to mitigate wildlife losses that are unavoidable?

Page 62 - Environmental Consequences - Recreation - says the greatest increases would be fishing in Montana and winter activities in Wyoming. Fishing in Wyoming was not mentioned. Demands on the nearest waters to the population centers affected can be expected to increase and should be addressed.

Mr. Charles Wilkie
September 9, 1981
Page 3, BLM 143/81

Page 71, Table 4-4 - shows wildlife habitat "disturbed". How much of this 33,080 acres will be reclaimed to wildlife habitat?

In summary, the DEIS needs to include clarification of the area covered and improved display of impacts to terrestrial wildlife, except for big game, raptors and endangered species. Fisheries, fishing recreation and water quality also need additional consideration.

Please contact us if we may be of further help on this project.

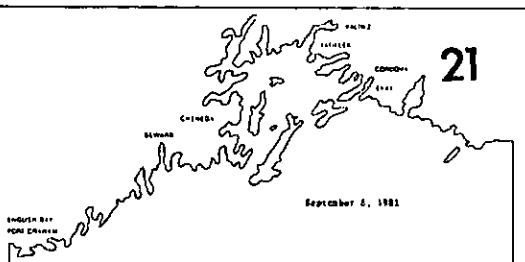
Sincerely,

H. Ronald Dexter

H. RONALD DEXTER,
ASSISTANT DIRECTOR, OPERATIONS
WYOMING GAME AND FISH DEPARTMENT

HRD:EBM:mlr

cc: State Planning Coordinator
cc: Game Division
cc: Fish Division



September 8, 1981

Mr. Maxwell T. Lieurance, State Director
Bureau of Land Management
P. O. Box 1828
Cheyenne, Wyoming 82001

Dear Mr. Lieurance:

We appreciate the opportunity to submit our comments on the Draft Powder River Regional Coal Environmental Impact Statement, as released by your office on June 24, 1981.

Under the terms of Section 1430 of the Alaska National Interest Lands Conservation Act, P. L. 96-487, a copy of which is attached, Chugach Natives, Inc., has identified two areas of federal lands within the Powder River Basin for possible conveyance. These areas are 7,020 acres of subsurface estate in the Spring Draw area of Campbell County, Wyoming, and 4,140 acres of subsurface estate in the Youngs Creek area of Sheridan County, Wyoming. Copies of the appropriate maps and legal descriptions are attached.

We note that your preferred alternative provides for the leasing of the Spring Draw tract by the BLM during 1982, and for it to be in full production by about 1990. Tables 1-1 and 1-4, on pages 9 and 11 respectively, estimate 387 million tons of coal reserves on some 4,093 acres of unconsolidated federal lands in the Spring Draw tract, for an estimated annual production of 14.3 million tons.

We believe that the Spring Draw tract offers excellent development opportunities to our corporation, as well as to Wyoming and the nation. Its transfer to our ownership would help satisfy our long-standing land claims dispute with the federal government, while allowing us to develop an area which would be developed under the federal government's ownership anyway. Its location ten miles north of Gillette provides easy access to

Chugach Natives, Inc.

901 West Northern Lights Blvd., Suite 301, Anchorage, Alaska 99503 Phone (907) 276-1900

Mr. Maxwell T. Lieurance
September 8, 1981
Page Two

long-haul rail transportation, if it is not burned locally for power generation. Moreover, the Tract Ranking in Table 1-1 on page 11 indicates that environmental and socio-economic impacts resulting from the development of the Spring Draw tract would not be severe.

In summary, we believe that the Spring Draw and Youngs Creek tracts in the Powder River Basin would be appropriate for conveyance to Chugach Natives, Inc., as part of the Chugach Region Study. We request that you provide for this possibility in your Final Environmental Impact Statement. Should you like any further information on the Chugach Region Study, I suggest that you contact Mr. Clay Beal, Moderator, Chugach National Forest, 2221 E. Northern Lights Blvd., Anchorage, Alaska, 99504.

Sincerely,

CHUGACH NATIVES, INC.

Carl A. Pedone Jr., Director
Lands and Natural Resources

cc: EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

NORTH ANTELOPE COAL COMPANY 22

CAMPUS GATEWAY, SUITE 800 1801 E EAST 40TH AVENUE
DENVER, COLORADO 80205
(303) 371-7900

September 10, 1981

Mr. Chuck Wilkie
EIS Project Leader
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

Re: Powder River Coal Draft EIS

Dear Mr. Wilkie:

I have reviewed the draft Powder River Regional Coal Environmental Impact Statement which was released on or about July 24, 1981. This comment will be limited to a single issue, to wit: the failure of the proposed EIS to consider or even mention the proposed North Antelope Mine which is to be constructed in the extreme southern portion of Campbell County. The only mention made of North Antelope appears on page 27 of the proposed EIS under Preference Right Lease Applications wherein a North Antelope (Peabody) PRLA incorrectly shows 1.6 million tons per year production in 1990 and 2.3 million tons by 1995. We believe that the EIS needs to be substantially amended to take into proper consideration the North Antelope Mine.

The public record will reflect that the North Antelope Mine is in the advanced stages of the permitting process. Furthermore, by Federal Register notice, dated July 27, 1981, the Office of Surface Mining Reclamation and Enforcement published a notice of Intent to Prepare an Environmental Impact Statement on the North Antelope Mine. Construction is expected to commence by mid-1982, assuming all remaining permits and approvals are timely obtained. Thereafter, initial production and coal removal is expected to commence by January 1, 1984.

North Antelope Coal Company is proposing to mine five million tons of coal per year for approximately 19 years. Extensive studies, design, and consultation with State and Federal officials were incorporated into a plan that complies with all applicable laws and

Mr. Chuck Wilkie
September 10, 1981
Page 2

regulations and addresses the environmental issues raised in baseline studies. Following is a brief summary of the issues raised in the baseline studies and the steps taken to address them.

General

North Antelope Coal Company is an unincorporated joint venture partnership created under the Wyoming Uniform Partnership Act between Powder River Coal Company, a wholly owned subsidiary of Peabody Holding Company, Inc., and Pan Eastern Coal Company, a wholly owned subsidiary of Panhandle Eastern Corporation. Peabody Coal Company, acting through its Rocky Mountain Division, has been designated as the Manager of North Antelope Coal Company.

The North Antelope reserves have been dedicated through a 1976 Coal Supply Agreement to Systems Fuels, Inc., the corporate entity charged with procuring fuel for the operating companies of Middle South Utilities, Inc., including Arkansas Power and Light Company, for use at AP&L's Independence Plant in Arkansas. Under the long-term Agreement, North Antelope is committed to provide five millions tons of coal per year to Systems Fuels, Inc.

Land Use

The North Antelope Mine area is currently used mainly as rangeland for grazing by sheep, cattle, and wildlife. Minor historic uses include oil and gas exploration and hunting.

History and Archaeology

Historical surveys for the project indicate uses of the North Antelope Mine area solely by ranchers and sheepherders. The only historical sites found were sheepherder camps.

According to studies conducted by the Office of the Wyoming State Archaeologist from 1970 to 1980, prehistoric (archaeological) finds included evidence of transient American Indian utilization of the North Antelope Mine area. Artifacts and evidence found include arrowheads, grinding stones, tipi "rings", and fire pits. In all, sixteen sites were found and recorded in the Permit Area in six years of field investigation. Of these, four will require additional investigation in order to determine their National Register Status. One site has been declared eligible for nomination to the National Historic Register and will require mitigation before clearance can be recommended. All other sites have been determined not to be eligible for nomination.

Mr. Chuck Wilkie
September 10, 1981
Page 3

In order further to define the cultural resources of the permit area and help the various agencies to execute their respective responsibilities under the provisions of historic preservation legislation., North Antelope Coal Company retained Western Cultural Resources Management, Inc. to perform another complete study of the North Antelope Mine area. The WCRM study, which was recently completed, included an analysis of the historical and paleontological features of the area as well as an archaeological study.

Climatology

The area has a semi-arid climate with an average annual rainfall of 10 to 13 inches, fairly constant westerly prevailing winds, and extreme temperature variations.

North Antelope Coal Company maintains and operates a meteorological station inside the permit area that measures wind speed, wind direction, temperature, and precipitation. Meteorological monitoring will continue throughout the life of the mine.

Air Quality Permits to Construct were issued to North Antelope Coal Company by the Air Quality Division of the Wyoming Department of Environmental Quality and Region VIII of the U.S. Environmental Protection Agency (EPA). The voluminous applications that contain the information upon which these permits were issued are on file with the U.S. Environmental Protection Agency, Region VIII in Denver, Colorado, and with the Air Quality Division, the Wyoming Department of Environmental Quality. As a condition of the Wyoming Air Quality Permit, the "North Antelope Coal Company 'will' establish an ambient particulate monitoring program for suspended particulates acceptable to the Division prior to the initiation of stripping operations".

Modifications to the mine plan , subsequent to the above permits, have resulted in a net decrease in projected emissions from the mine. An application for an air quality permit amendment has been submitted to Wyoming DEQ/Air Quality Division to reflect these changes.

Geology

The permit area is characterized by a few relief plateau cut by steep sided washes and gullies; flat top buttes, narrow and elongate divides and local escarpments are also present. The geology of the area is one of flat lying sedimentary formations consisting of alternating lenses of sandstone, siltstone, claystone, and coal. The coal seam (named

Mr. Chuck Wilkie
September 10, 1981
Page 4

here "Roland") is a consistent bed of subbituminous coal approximately 80 to 90 feet thick.

Overburden quality at the North Antelope Mine is generally characterized by high sodium adsorption ratios and electrical conductivities, with concentrations that are scattered and unpredictable.

Hydrology

The North Antelope Mine is located entirely within the Porcupine Creek Drainage Basin which is a tributary of Antelope Creek. Tributaries of Porcupine Creek which will be temporarily disrupted by the mining operation include Payne Draw, Knapp Draw, Cindy's Draw, and Rogers Draw. Information on the flow characteristics within these basins was obtained by crest stage gages, flumes, and theoretical predictions. In addition, surface water quality was sampled and analyzed in accordance with WDEQ/LQD guidelines.

Groundwater was also monitored intensely at the site. Over 100 wells were drilled and completed in overburden, alluvium, coal, or scoria. Monthly levels in each well and quarterly water quality samples at several wells were taken in order to obtain seasonal fluctuations. In addition, several pump tests were performed on each stratum which could be considered to be an aquifer. Finally, this information was gathered to draw basic conclusions about the hydrologic system.

In general, the surface and groundwater systems are closely related at the North Antelope Mine Site. Porcupine Creek in the northern part of the permit area, Payne Draw, Knapp Draw, Rogers Draw, and Cindy's Draw are all ephemeral in nature and convey water only in response to snowmelt or storm events. In contrast, as Porcupine Creek meanders south within the permit area toward the contact between the scoria and coal, it begins to receive discharge from the coal aquifer. At this point, the alluvial material becomes saturated and subirrigated vegetation becomes more prevalent along the creek.

Of the strata which will be disturbed by the mining operation, the coal and the alluvial material are of primary geohydrologic importance. The coal is highly fractured in the northern portion of the property and is considered to have a high water yielding capability. The saturated alluvial material also has a high water yielding capability and as

mentioned earlier, does subirrigate vegetation. The quality of water from each of these aquifers is considered to be somewhat poor and marginally useful.

Soils

The soils found in the North Antelope project area are typical of soils found in semi-arid regions of the Western United States. Most of the soils found in the project area contain at least some suitable topsoil material. However, many of the soils can supply only a limited amount of topsoil as they are shallow to bedrock, become saline with depth, have high SAR values in the substratum, and/or have high clay content. All of the suitable topsoil units contain greater than 20 inches of salvageable topsoil material.

The suggested salvageable depths of topsoil material presented in this application are based on laboratory data and field observation, and represent only good and fair sources of topsoil material. It is not suggested in the Mine Permit Application that any poor or unsuitable sources of topsoil be stripped and used during reclamation activities. No prime farmland soils exist in the permit area.

Vegetation

Vegetation communities in the permit area are consistent with the regional vegetation, dominated by a grama-needlegrass-wheatgrass grassland. Shrub and tree cover are sparse; greasewood shrubs are predominant on bottomland, and plains cottonwood are found in scattered groves along major drainages. The area is currently used for grazing by livestock, with a carrying capacity of 60.8 animal units per year on the permit area.

There are no protected vegetation species found on the permit area. Noxious weeds are scattered and not found in concentrations which would indicate potential problems (high selenium, etc.).

Wildlife

Wildlife habitats correspond to the vegetation types and include greasewood, upland grass, meadow (pasture), breaks, and scoria grasslands. Big game species recorded on or near the proposed mine site include pronghorn antelope, mule deer, and white-tail deer. Raptors including golden eagles, great-horned owls, red-tailed hawks, and other hawks nest primarily in cottonwoods along Porcupine and Antelope Creeks. Aquatic habitat in the vicinity of the mine is limited, with the major aquatic habitat being Porcupine Reservoir south of the permit area.

Protected species which occur, or potentially could occur, in the area include black-footed ferrets, bald eagles, golden eagles, peregrine falcons, and whooping cranes. Ferret searches of the prairie dog towns in and near the permit area revealed no indication of the presence of black-footed ferrets. Bald eagles migrate through the area and are known to winter roost on Antelope Creek approximately three miles southeast of the permit boundary, generally feeding on winter killed sheep and antelope. No peregrine falcons or whooping cranes were observed in the area of the proposed mine.

Golden eagles actively nest in and adjacent to the permit area. North Antelope Coal Company is actively participating in a regional golden eagle study being conducted by the U.S. Fish and Wildlife Service to determine population characteristics and develop methods to lessen the effects caused by mining on golden eagles.

Alluvial Valley Floors

Within the North Antelope Mine area to be disturbed by mining, there are 132 acres which have stream laid deposits. Of these, 20 acres are supporting subirrigated or naturally flood irrigated meadow vegetation. Artificial flood irrigation from Porcupine Creek is limited to 250 acres of hay meadow south of the permit area which will not be disrupted by mining.

All of the subirrigated or naturally flood irrigated lands within the area to be disturbed are unimproved rangeland; no soils on the permit area are classified as prime farmland soils, and the subirrigated or naturally flood irrigated meadow acreage is insignificant to the total ranch production.

Mine Plan

North Antelope Coal Company will use a dragline assisted by a shovel and trucks to remove overburden. The pit progression was designed to maintain the present drainage pattern for as long as possible, and when finally necessary to mine through the major drainages, the design is such that the drainage can be temporarily relocated in an area which was mined 10 to 17 years previously. This will allow ample time for the mined and backfilled area to settle and stabilize. Also, the coal haulage system was so designed that the channels to be used in the temporary relocation of the major drainages are used as haul roads, thus compacting the bottoms of the temporary channels.

Suitable overburden stockpiles and topsoil stockpiles are located on the mine spoil wherever possible, to keep the disturbed acreage to the absolute minimum.

Porcupine Creek will be diverted around the disturbed area. Sediment control ponds are placed downstream from all disturbed areas to control the sediment and flows. A separate waste water pond has been designed to contain all of the runoff from the facilities area, so that any runoff containing oils or other contaminants will be controlled by a separate pond.

There is some undesirable material in the overburden and it appears in lenses, is widely scattered and is not contiguous. These lenses are found mostly in the 20 feet of overburden immediately above the coal seam that will be handled by the dragline. All of the material over 20 feet of overburden will be removed by truck and shovel and will be placed on top of dragline spoil or stockpiled for use later as a cover for dragline spoil. This material (a minimum of 8 feet) will be suitable as a root medium and will be placed on the dragline spoil. All disturbed areas will be graded to the final proposed topography, covered with an average of 15 inches of topsoil, and then seeded to complete the reclamation program.

The mine surface facilities, rail loop, storage silos, shops, warehouse, office, and other necessary structures are planned to be constructed in the only area near the mining activities which has no coal beneath the surface. The facilities are located as near the outcrop as possible, thus keeping the total disturbed area to a minimum.

The railroad alignment was designed to keep the disturbed area to a minimum, stay as near the steep area as possible, thus disturbing the valley as little as possible, and yet staying off the recoverable coal found in the area. The design keeps the railroad off an irrigated hay field, as far from the Porcupine Reservoir as possible, and yet a safe distance from an eagle's nest found in the area, as coordinated with WDEQ/Land Quality Division, the U.S. Fish and Wildlife Service, and the Wyoming Game and Fish Department.

When mining is completed, the facilities will be dismantled, the area graded, topsoiled, and then seeded. The railroad will be taken up, the cuts and fills graded, topsoiled, and then seeded.

Reclamation Plan

The overall reclamation plan has been designed to restore the land to its premining potential for use by livestock and wildlife. Handling of overburden will occur so that replacement of these materials in the mined out areas will result in suitable material being located where groundwater could be affected and where it would be in conjunction with root zones. The combination of truck and shovel operations with a dragline will result in the capability to selectively handle materials and isolate either good or poor quality materials for precise placement in the backfill. When the nature and quality of overburden is borderline and where mixing of materials would solve any potential quality problems, the dragline is an excellent tool, as well as being an efficient materials mover.

Topsoils will be salvaged and stockpiled or hauled back directly to reclaimed areas. Total topsoil materials replaced will average approximately 15 inches over the entire mine site. The baseline studies defined the existing nature and extent of the soils resources. When topsoils are replaced on regraded spoil, they will be tested to insure that the nutrient levels are adequate to establish a self-sustaining vegetative cover.

Hydrologic restoration of the mine site begins with the replacement of alluvial materials in the restored stream channels. By reconstructing the selected channels with alluvium and adding a flood plain designed for a 100-year frequency flood, North Antelope Coal Company is increasing potentially flood irrigated land by 20 percent (from 50 to 60 acres).

The five (5) drainages in the mining area are: Payne Draw, Cindy's Draw, Knapp Draw, Rogers Draw, and Porcupine Creek. These drainages will be rebuilt in their original locations upon the completion of mining in their respective areas. Their final locations will be given ample time to settle and stabilize.

Great care has been taken to reclaim channels to an erosionally stable state. Channel cross sections have been designed to achieve low flood flow velocities by having a large width-to-depth ratio. The channel cross section will be vegetated to increase the roughness of the cross section and thereby increase its stability. Special erosion control measures, including riprap and channel compaction, will be used on critical areas. Finally, the final impoundment (as described below) will prevent accelerated erosion on Porcupine Creek upstream and attenuate flood peaks downstream, also adding in the stability of the reclaimed channel.

The projected postmining groundwater levels show water continuing, after mining, to discharge into the reclaimed Porcupine Creek valley. The overburden special handling capabilities of the combined truck-shovel and dragline operation assures that groundwater quality is protected from toxic forming substances in spoil and that the alluvial groundwater system will be reconstructed along the new Porcupine Creek drainageway. The proposed final impoundment is created by the mining operation. Therefore, it does not require construction of a dam. The pit will hold approximately 2,185 acre feet of water - 961 acre feet is surface storage above the groundwater table. Groundwater inflows will comprise less than 10% of the total inflow to the final impoundment. Over 90% of the lake inflow will be surface water. This will allow dilution which will ensure that the water in the impoundment will be suitable for irrigation.

The storage rights, as agreed to by the current water right holder, will be transferred from Porcupine Reservoir to the final impoundment lake. The existing Porcupine Reservoir has a current capacity of about 350 acre feet of storage due to silting over the last thirty years. The new lake will have 961 acre-feet of surface water storage for agricultural use, which will greatly enhance the life and extent of irrigable lands.

Creation of the final impoundment will have several other valuable environmental assets:

1. By leaving the final impoundment, approximately 6 million cubic yards of fill are saved, which will result in less surface disturbance and more topographic relief.

2. The surface within the high water mark will not be topsoiled, saving topsoil for use in other portions of the mine area.

3. The lake will act as a point of saturation for surrounding land which will replenish any loss of subirrigated land caused by active mining.

4. Wildlife benefits are enhanced considerably. The lake will restore surface water that is currently being lost at Porcupine Reservoir by siltation for shorebirds and waterfowl. The island in the new lake will provide habitat diversity for songbirds and waterfowl nesting. The analysis of water also indicates that a viable fishery could be developed. After testing for stability of water quality and quantity, North Antelope Coal Company will coordinate its efforts with the Wyoming Game and Fish Department in stocking the lake with fish.

There are no other permitted mines in the vicinity of North Antelope Mine. Nevertheless, North Antelope Coal Company recognizes and to the extent presently possible, has assessed the tentative plans for mines by Northern Energy Resources Company (NERCO) and Rochelle Coal Company in the immediate vicinity. Rochelle Coal Company is committed to estimating potential cumulative impacts between North Antelope Mine and Rochelle Mine. North Antelope Mine will coordinate efforts to define probable cumulative impacts with NERCO as data becomes available.

The revegetation plan has incorporated as many native plant materials as can be assured to be commercially available. Native plants which are available on an incidental basis are included to provide a maximum species diversity. The few introduced species included in the seed mix serve functions which cannot be performed by commercially available natives. For example, alfalfa is utilized as a nitrogen fixer to help maintain topsoil in stockpiles, and smooth brome is a cool season grass which supplies good early forage, and which is a good sod former to stabilize stream channels.

The shrub and tree plantings will be at an overall density of 300/acre, but grouping of shrub plantings into islands with a density of about 1500/acre will have the following attributes:

1. Establishment of shrubs can be more easily monitored and enhanced if a site specific shrub preparation is utilized. There can be less competition from perennial grasses.

2. The dense stands of shrubs will provide cover for small mammals and habitat diversity for songbirds.

3. The open lands between shrub groupings can be more easily managed for cattle and sheep grazing.

4. The shrub islands, once established, will become seed sources for additional shrub invasion.

5. The seed mixes will include some shrub seed, which will allow occasional shrub plants to establish in the grassland areas.

Tree plantings, primarily cottonwoods and willows, will be made to maximize the tree stratum for nesting raptors. Some trees will be transplanted using a tree spade. Others will be hand planted. In any case, maximum utilization of subirrigated areas will be made with trees planted along 1) the final lake, 2) reestablished stock ponds, and 3) the reestablished drainages.

Throughout the project, wildlife considerations were made in mining and reclamation design. Of critical concern is the high concentration of active eagle nests in the vicinity of the North Antelope Mine Site. After consultation, coordination, and field visits with Wyoming Game and Fish, U.S. Fish and Wildlife Service Research Branch, Wyoming Coal Coordinator, and Law Enforcement District, three major steps have been taken to lessen the potential effects of mining on these golden eagle nests:

1. The railspur near the nest in Section 21, T70W, T40N was moved as far away from the nest as possible without infringing on the active Porcupine Creek drainage.

2. Construction of the railspur in the vicinity of the nest will be scheduled to minimize disturbance during the nesting season.

3. North Antelope Coal Company was involved in initiating talks with USFWS and Wyoming Game and Fish in establishing a region-wide study of methods which could mitigate future impacts caused by mining on the golden eagle populations. North Antelope Coal Company is continuing to support this study (along with other companies) by providing access permission, study direction coordination, and funds.

The winter bald eagle roost located approximately three miles south and east of the North Antelope Mine will be monitored to determine any potential conflicts. Other

monitoring and mitigation programs devoted to wildlife include monitoring prairie dog towns in the mine vicinity for black-footed ferret signs, fencing during active mining in accordance with requests by USFWS, Wyoming Game and Fish and U.S. Forest Service to minimize disturbance to antelope migration, planting less palatable species along roads and railroads to minimize attraction of animals to high traffic areas, and establishment of rock piles on the final reclaimed surface to supply additional microhabitat diversity and additional raptor perching sites.

Construction

The construction of the North Antelope Coal Mine will include:

1. coal conveying and crushing facilities;

2. three 15,000 ton capacity coal storage silos;

3. load-out and weighing-sampling systems;

4. 5.3 mile rail spur and loop to connect to the Burlington Northern main line;

5. ancillary facilities including: administrative offices, a bathhouse, a truck repair shop, a maintenance shop, and an electrical shop. Other support facilities include an access road, a transmission line, sedimentation ponds, a fresh water reservoir, a wastewater treatment system, and a fuel storage area.

During the 39-year life of the project, an estimated 190 million tons of coal will be recovered from an approximate area of 3,700 acres. The annual coal production of 5 million tons will require approximately 90,000 gallons of diesel fuel, 6,000 gallons of gasoline, and 2 million kilowatt-hours of electric power per month. Potable and industrial water use is estimated at 200,000 gallons per day.

Site Location and Description

The proposed North Antelope Mine, an open-pit coal mine, is located in southern Campbell County, 68 road miles southeast of Gillette, 31 road miles southeast of Wright,

and 86 road miles northeast of Douglas. The active mine area, occupying 2,638 acres, will be located in Sections 4, 5, 8, 9, 16, and 17 of T48N, R70W.

The total permit area of 3,762 acres will have a life span of 44 years, from initial disturbance to final reclamation, though total productive life will be 35 years. If all permits are received in a timely manner, initial work on access roads will begin in mid-1982. Upon completion of mining, all facilities will be removed, and the site will be graded and revegetated.

Socioeconomic Impacts

The peak construction employment of 707 is anticipated to occur in 1983. The construction work force is expected to reside in Gillette, Wright, and Newcastle. The operating work force will begin with 56 employees in 1984, and will increase to a maximum of 165 by 1990. Due to low unemployment rates in the area of site influence, employment created by the project is expected to be filled by in-migrants to the area. Population effects associated with the North Antelope Mine will be minimal in Campbell County, Gillette, Weston County, and Newcastle.

Population increases attributable to the project are expected to intensify demands on certain capital facilities of Wright, Newcastle, and Weston County.

The construction of the North Antelope Mine is projected to create a demand for 220 dwelling units for direct and indirect employees in Campbell County, and approximately 50 dwelling units in the Newcastle area. Housing for the peak construction work force is proposed to be provided through the pre-leasing or guaranteeing of rent on 36 mobile home spaces, 10 apartments, and 91 recreational vehicle spaces in Wright.

The impact of the North Antelope Mine on the Newcastle area is not expected to be significant. However, this project is only one of five identified coal mines in the area expected to begin or expand production in the immediate future. According to population estimates compiled by the Newcastle City Engineer, these mines cumulatively are expected to bring 1,000 more residents to the Newcastle area by 1985. None of these mines are located in Weston County, so the area will not benefit from significant increases in assessed valuation. Increased sales and use tax receipts resulting from increases in Weston County personal income may help operating budgets, but Weston

County governments will not be in an appreciably better position to finance capital facility projects as a result of these Campbell County coal mines.

Committed Socioeconomic Mitigation Measures

1. North Antelope Coal Company has committed to a mass transit program which will be investigated and tested during the construction phase if feasible.

2. North Antelope has committed to an employee housing assistance program.

3. North Antelope has committed to widen and improve several miles of existing public county roads in Campbell County and to construct and upgrade private access roads into the mine site.

4. North Antelope has established payroll accounts and a general disbursement account during the pre-construction, construction, and operating phases in Gillette.

5. North Antelope has already provided Gillette with a $150,000 grant for design studies for a new sewage treatment facility.

6. North Antelope acquired an option to purchase approximately 154 acres in Gillette in the hopes of stimulating housing development through land ownership.

7. North Antelope will participate in the funding of a study in capital shortage problems facing Wyoming banking institutions.

8. North Antelope will pre-lease or cause to be built various mobil home spaces, apartments, and recreational vehicle pads in Gillette and Wright, Wyoming.

These and other commitments have been agreed to as a condition of granting a permit to North Antelope by the Wyoming Industrial Siting Council.

Status of Existing or Pending Permits

In addition to the air quality permits to construct described above under "Climatology", North Antelope Coal Company has also obtained a permit from the Wyoming Industrial Siting Council, pursuant to a hearing held in Gillette, Wyoming, on June 16, 1981, the record of which is referred to as Docket No. 81-1 before the Wyoming Industrial Siting Council and which is incorporated herein by reference. Furthermore, attached hereto and incorporated herein by reference is the document entitled "Staff Review of the Permit Application for North Antelope Coal Company to Construct the North Antelope Coal Mine, Campbell County, Wyoming, May, 1981, Docket No. WISA-81-1", which describes in considerable detail the facility, site location and description, site design and components, nature of operation, status of permits and approvals, area site influence in relation to other activities, alternatives, affected environment, climate and air quality, geology and soils, water quality and supply, land use, vegetation and wildlife, recreation and visual resources, cultural resources, social profile, current area economy, projected future economy (without NACC), area population, capital facilities, housing, transportation, educational facilities, government and public finance, environmental impacts of construction and operation, effects on air quality, effects on water resources, effects on land use, effects on vegetation and wildlife, effects on recreational and visual resources, effects on cultural resources, cumulative regional impacts, impact controls, mitigation measures and recommendations, socioeconomic impacts of construction and operation, construction schedule and estimated construction costs, economic effects of the project, population, capital facilities, housing, transportation, educational facilities, government and public finance, impact controls, mitigating measures, and recommendations, monitoring programs, monitoring of environmental effects, monitoring of socioeconomic conditions, and reporting schedules.

Reference is also made to the Mine Permit Application filed with the Wyoming Department of Environmental Quality, Land Quality Division, and the United States Office of Surface Mining Reclamation and Enforcement on May 3, 1981 for the proposed North Antelope Mine. Such Mine Permit Application is available for public inspection in the Wyoming Department of Environmental Quality, Land Quality Division, offices in Cheyenne, Wyoming, as well as the offices of the Office of Surface Mining, Region V in

Denver, Colorado. The contents of the Application and all related correspondence related thereto is incorporated herein by reference.

North Antelope Coal Company has also applied for and in most cases obtained a substantial number of lesser permits which are generally described in the above mentioned Mine Permit Application.

Conclusion

The North Antelope Mine has been designed to address and mitigate as many of the physical, environmental, biological, and socioeconomic impacts associated with the project as possible.

Because of its advanced stage of planning, we contend that the final draft Powder River Regional Coal Environmental Impact Statement should specifically recognize, describe, and identify the proposed North Antelope Mine.

Sincerely yours,

Terry O'Connor, Director
Legal and Governmental Affairs

TLO:sj
Att.

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THE CARTER MINING COMPANY
POST OFFICE BOX 2004 • GILLETTE, WYOMING 82716 • (307) 512-4001

[illegible]
PRESIDENT

September 16, 1981

Mr. Chuck Wilkie, EIS Team Leader
Casper District Office
Bureau of Land Management
951 Rancho Road
Casper, WY 82601

RE: Powder River Basin Coal Lease Sale Draft EIS

Dear Mr. Wilkie:

We appreciate this opportunity to comment on the captioned Draft EIS. Our comments are directed to the Spring Draw Tract and the Timber Creek Tracts.

SPRING DRAW TRACT

We have been working with the USGS and the District BLM office in Casper to process an I-90 Exchange for a portion of Federal Coal Lease No. W-5035. The attached draft schedule which was prepared by the District BLM office identifies the activities and timing required to complete the exchange by mid-1982. We entered into a cooperative drilling program with the USGS last June for reserve evaluation of the offered and selected lands. The drilling program and reserve evaluation will be completed and forwarded to the USGS by October 1st. The BLM is currently preparing an environmental assessment for the proposed exchange.

As you are aware, a portion of the selected acreage is in the Spring Draw Tract north of our Federal Coal Lease W-5036 (Carter Mining's Rawhide Mine). Exxon Coal is the owner of the surface lands over the selected coal reserve. Since work is proceeding rapidly to balance the amount of acreage and reserves needed for the exchange, we urge the Department of Interior to defer sale of the Spring Draw Tract until the I-90 Exchange has been consummated. Depending upon the final economic evaluation, there is a possibility that none of the Spring Draw Tract will be needed as a part of the final exchange; however, these lands not selected can be offered for sale at a later date.

As a further note regarding the DEIS, we wish to call your attention to Page 13 of the document, which references the Carter-Exxon proposed

A Division of EXXON Coal USA Inc

Mr. Chuck Wilkie 7 September 16, 1981

I-90 lease exchange. In the second paragraph, the Spring Draw acreage applicable to the exchange is shown as 560 acres and 41 million tons of recoverable coal. These numbers should be revised to reflect the current estimate of 494 acres and 82 million tons of coal as submitted in the South Rawhide Exchange Proposal.

TIMBER CREEK TRACT

With regard to the Timber Creek Tract we have attached two letters that reflect correspondence we have had with Mr. R. O. Buffington, Chairman of the Powder River Regional Coal Team, on the quality of coal underlying this tract. As discussed in our letter of April 16, 1981, to Mr. Buffington, there is a considerable disparity between the coal quality profile summary prepared by the BLM for this tract and Exxon Coal data based on four core holes offsetting the Timber Creek Tract. Comparison of these analyses indicates the designation of "high quality" for the Timber Creek coal in the DEIS is incorrect. Mr. Buffington advised in his letter of July 27, 1981 that the USGS is aware of the discrepancy in the coal quality data and may have the results of additional drilling on this tract at the next regional coal team meeting. In addition, Exxon Coal owns 1,700 acres of surface estate in the proposed Timber Creek Tract. This acreage may potentially be used in the development of adjacent reserves underlying Federal Lease W-3397. Mr. Buffington assured us that the coal quality discrepancy and our surface ownership in the Timber Creek Tract will be discussed at the next RCT meeting. We understand that the meeting has now been set for October 2, 1981, in Billings, Montana.

We urge your consideration of the aforementioned facts in drafting the final EIS.

Sincerely,

[signature]

JMH:cb

Mr. Chuck Wilkie 8 September 16, 1981

cc: Mr. Glen Dessinger
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JOHN D. WIENER
ATTORNEY AT LAW
PHONE 307-742-8417
[illegible]
LARAMIE, WYOMING 82070

September 15, 1981

EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, WY 82601

Dear Sir:

Enclosed are comments on the Powder River Draft Environmental Impact Statement on Coal Leasing, issued June 1981.

These comments are submitted on behalf of the Northern Great Plains Office of the Sierra Club, and on behalf of the undersigned as a private citizen.

These comments are extremely critical; on the whole, this statement is unacceptable, to say the least. It should be noted, however, that the large regional map is excellent, and for this we thank you. Also, the section entitled "Other Coal" is a step in the right direction. Aside from these shining deviations, the remainder of the statement is miserably poor, in terms of editorial quality (such as source specifications for data), scientific validity (such as use of incompetent and obsolete material -e.g. Packer), and as a hopelessly apathetic and deceptive treatment of the human suffering which will result from the proposed actions.

For Sierra Club, and
for myself,

[signature]

John D. Wiener

Wiener, -1-

WHY LEASE MORE COAL?

Friends of the Earth and the Sierra Club have already submitted very detailed analyses of this question. Unfortunately, the public was not allowed by the BLM to see this material, as it was considered somehow not relevant to coal leasing. That material was contained in comments on the Green River - Ham's Fork Regional Coal Leasing, which was the first round of leasing under the new program. It seems likely that BLM will not allow this material to be made available for free, but it is part of the official record, and can be seen or requested at the Craig District Office, P.O. Box 248, Craig, Colorado 81625 (455 Emerson Street), in care of Mr. Dan Martin.

In the hope that BLM will not prevent this information from being made public, let it be noted here briefly that two major considerations have apparently been ignored. First, at the rate of use of coal from federal leases, any new leasing is very hard to justify. As we have said so many times before, (see Friends of the Earth, Sierra Club, Natural Resources Defense Council, etc. in Federal Coal Management Program Final EIS), the numbers make leasing look very peculiar. The most recent report to Congress on the Federal Coal Management Program, for Fiscal Year 1980, (as required by law), reveals that in FY 1980

* 99 of 562 Federal leases produced coal; 463 did not.

* 17,261 BILLION TONS of RECOVERABLE RESERVES OF FEDERAL COAL WERE ALREADY UNDER LEASE as of September 30, 1980. As there were 71.9 million tons of federal coal produced in FY 1980, that is a 240 YEAR SUPPLY at 1980's rate. If the rate of use increases, the supply already

Wiener, -2-

under lease might not last the whole of the next two centuries. Perhaps it will only last half of that length of time. Still, there would be some time left in which to hold lease sales... (Pp.1, A-4, and A-7, op. cit. supra, FCMP FY 1980 Annual Report to Congress, by DOI.)

The second major consideration which has been apparently ignored by BLM and its figures-suppliers in the Department of Energy is that electricity demand is still tapering off, and not growing anywhere near as wildly as has been intimated. Persons seeking more information can find it in the materials already submitted by us, as mentioned above, but to put things in a nut-shell, consider the following:

Change from year-to-year	Electricity Growth Rate (sales)
1973-74	0.4 percent
1974-75	2.7
1975-76	6.3
1976-77	4.3
1977-78	3.9
1978-79	2.1
1979-80	1.1

This table is compiled from various sources which have been published by the Department of Energy (See Friends of the Earth comments on Green River - Ham's Fork, pp. 9-10A, and for 1979-1980, see pages 65-66 of the July 1981 issue of DOE's Monthly Energy Review), and is simplified somewhat by the omission of a great deal of qualification which results from need to use DOE raw data, as published, and the fact that DOE has consistently used different formats. The basic point is not at all affected by these qualifications. Doubting readers are most heartily encouraged to take pencil and calculator and attack the morass on their own; the Energy Information Administration of the DOE is very helpful. (202-252-5800).

Wiener, -3-

There are two interesting observations to be made about the table presented on page 2 above. First, after the shock of the 1973 oil embargoes, electricity demand started to swing back up, and then started to swing down very forcefully, and has continued a strong downward trend. The Harvard Business School's Energy Project, in the book Energy Future, explains this as simply the common-sense working of free enterprise: when the cost of something goes up, consumers will use that thing more efficiently. What we see is simply conservation - using less to do more. This is not going to be turned around by political appointees carrying out instructions to lease everything, regardless of demand. The second interesting observation is that the rate of growth in electricity demand before 1973 was basically 7 percent per year - which means doubling in a decade. That nightmare of ever greater mindless geometric growth has finally been laid to rest, despite vested interests in such cancerous waste of our finite resources.

Why then, shown the incredibly high disproportion of leased federal coal to federal coal which can be marketed, should more now be leased? The best motivation seems to lie with the would-be lessors. With the mines sitting idle now, or working at far less than capacity, and the demand for electricity being strongly slowed by rational economic behavior, no one would pay very much for another coal lease. And that is a reason to offer the leases now: they cannot be sold at a reasonable value, since demand is so slack. No one drowning will pay much for water. The Interior department's own figures show the oil companies drowning

Wiener, -4-

in federal coal. It stands to reason that amid the clamorous and propagandistic noises about "energy independence" - as if coal can replace very much oil which has not already been displaced - that there must be some motivation for the companies to make DOI offer this coal. The reason is speculation. In the late '60's and '70's, companies picked up federal coal dirt cheap. In fact, they paid far less than the value of the dirt as real estate for ranching. Why not do so now? The public seems to support this, to the extent that the public is informed at all enough to care. Why not stock up on the cheapest coal in the country, in case there turns out to be some use for it? Maybe the Synthetic Fuels Corporation will give some of the two or three billion dollars it has to you, to use that cheap coal, if you lobby hard enough and wave the flag all the way to the bank.

Incidentally, it is amusing to note that DOE has never given the public, in any coal related EIS in the West, any actual information about replacement of oil by coal. The potential is strikingly limited, as far as can be determined by this researcher. Insane figures which fail to separate peak load electricity demand from base load are simply evasive, because coal cannot be used for peak load without extensive transfer of the unused electricity to some other service area - it takes literally days to fire up a coal-fueled power plant.

What other than speculation can this coal be used for?

Wiener, -5-

THE ULTIMATE SOCIAL IMPACT MITIGATION - NONEXISTENCE

This EIS has accomplished something remarkable: a giant step backwards in dealing with social impacts. Numerous groups sent representatives to the regional coal team to tell BLM that they were worried (see, e.g., Casper Star-Tribune, May 30, 1980, p. B-1) - and its a shame that they used their meager resources to make the effort. In this statement, the problems of the aged and the rural population don't exist. Small businesses being displaced by chains don't exist. Elderly people unable to cope with terrible local inflation - "mineflation" - on top of national inflation don't exist. In fact, mineflation doesn't exist at all. Agricultural labor losses don't exist. NOWHERE IS THERE ADMITTED THAT INCREASED POPULATIONS BRING GREATER INCREASES than simply the additional proportion of people IN ALCOHOLISM, DRUG ABUSE, DIVORCE, JUVENILE DELINQUENCY, and on and on. See; for instance, Little, R.L., "Energy Boom Towns: Views from Within," in Native Americans and Energy Development Anthropology Resource Center, Cambridge Mass., 1978, Jorgensen et al., and see U.S. Civil Service Commission, "Energy Resource Development: Implications for Women and Minorities in the Intermountain West", and see any reference librarian at any university for a great deal more information than BLM is willing to give the public; also, the Old West Regional Commission of the Department of Commerce supplied a great deal of data, before being essentially laid to rest (Stapleton Building, Billings), and see Friends of the Earth in Final EIS, Federal Coal Management Program, and Final EIS, Coal Development in South-central Wyoming.

Wiener, -6-

and the above-mentioned suppressed comments on Green River - Ham's Fork.

RECLAMATION BY ORDERS OF THE GOVERNMENT - ALL IT TAKES IS ORDERS

Perhaps the most utterly fraudulent and insulting part of the statement is the ridiculous reliance on Paul Packer's 1974 pamphlet. AS A DIRECT QUESTION, HAS ANYONE CONNECTED WITH THE PREPARATION OF THIS EIS ACTUALLY READ ALL THE WAY THROUGH PACKER'S THIRTY-SIX PAGE PAMPHLET? HAVE YOU RUN ACROSS ANYTHING MORE RECENT? As we said in the FEIS on Federal Coal Management Program, (see p. K-111 et. seq.), Packer had a maximum of 7 growing seasons on lands which were being manipulated in ways that were not known to Packer, and on lands whose previous nature was never studied. The National Academy of Sciences study, severely attacked as being too easy-going in several areas, has never been admitted by BLM to have any significance - but it is just as old as Packer's 1974 pamphlet. Perhaps the Academy is ignored because it doesn't conclude that all strip-mined land can be restored within 15 years, but rather that it may take decades, or centuries in some cases. There are a vast number of scientific articles, books, treatises, manuals, and reports on the subject of reclamation which have come out since Packer's abused little paper. And the simple truth is that everyone who cares about these issues knows this. How stupid do you think we really are? Because ranchers are quiet, does that mean they're unable to see what is going on? You address a major field of research with one ridiculous little report that itself doesn't

Wiener, -7-

even make sense. This is just like saying that the whole controversy over whether radiation is safe was answered by a guest on a TV talk show in 1968, so you don't have to do any research now. All it takes to make money as a rancher is profits, right? That's the level and quality of explanatory value you have reached.

Readers who want to get some idea of what is going on can get help from any university library; especially useful is SEAMARKRT. That is a listing of current articles and publications on subjects relevant to surface mining; it has just come out with Issue Number 2 of Volume Five.

Meanwhile, does the BLM wish to claim that anyone, anywhere in the West, has gotten back his reclamation bond from a government agency, in recognition of "successful reclamation"?

INFORMATION FROM MARS? OR WHERE?

One of the most interesting items in the EIS is the level of claimed future production from the PRLAs (preference right lease applications). What provided many laughs for those who have investigated this subject is the grand future success that BLM seems to assume. Where did the information come from? As is the case throughout this poorly documented mish-mash of generalizations and oversights, BLM is credited. Who made this information up? All that can be said by this observer is that the Congressional Office of Technology Assessment has finally studied this matter in specific, and although the final report is still not published, BLM will be very pleased to have gotten this far before the facts catch up with the nonsense in this EIS.

Wiener, -8-

Through out the statement, tables are presented as rationale for statements with utterly inadequate description of the contents of the tables or the sources of information. For example, Table 2-1 fails to specify whether the PRLAs are actually included in the baseline figure, or some of the PRLAs as specified in Table 2-2, or some other possibility. Supposing that Table 2-2 specifies which PRLAs BLM expects to be in production by 1990, is there any source for that suspicion? It would be amusing to see the basis for that table, since the Office of Technology Assessment's expert panel (of which this writer was a member) found that less than half of BLM's projection was remotely possible for 1990. Sadly, BLM's wierd approach to PRLAs - undocumented, unattributed, and textually unspecified - is typical of this EIS.

One aspect of this sort of unspecified comparison, as a tactic for making things look better than they are, should be made plain to the public. This is the tactic which was used in the "programmatic" EIS, on adoption of the whole Federal Coal Management Program: to wit, use of reference areas so large that impacts dwindle into insignificance. Here, the best example might be the statement on page 20 that municipal water use would increase under the maximum leasing alternative by about 8 percent. That doesn't seem like very much, and it isn't - when you realize that the only place where "region" is really spelled out is the map at the back. The 8 percent increase is for the whole region, apparently - including Casper and Billings. Where the outflow of water from the region is specified, its only a tiny

little fraction of the drainage of the North Platte and Yellowstone rivers that will be affected. Isn't it a shame that any single little area may have to bear a somehow higher rate of change? Conversely, why not just note that this leasing, and all you poor members of the public, are probably not a very big deal in the whole of God's infinite universe, and thereby conclude that there is no need for any EIS at all?

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September 14, 1981

Bureau of Land Management
Att: Charles Hilkis
951 Rancho Road
Casper, Wyoming 82601

Dear Sir:

The following comments pertain to the Powder River Draft Environmental Impact Statement - Coal dated July 1981.

The general inadequacy of the statement is noted with numerous discrepancies throughout.

There is no justification of minimum sale of the sites contemplated in this EIS. No comment is made of the existing mines producing at half capacity, or existing over-capacity and past over leasing already going on.

SOCIAL IMPACTS

There seems to be a discrepancy in information regarding coal related employment and population. Assuming the 60% figure for Rosebud County and assuming an employee has a family of four as far as population is concerned, it would appear that the figure shown on page 68 of 1,900 increase for Ashland would be erroneous.

This report has completely overlooked the initial cost of building new schools, roads, sewer and water treatment plants, etc. The report is covering 1990 when everything is at an operating and maintenance level. School funding is not discussed and Federal 874 money will be out within three years - 1984. An example would be a father working on a federal lease with children in school in Ashland.

AIR QUALITY

It's also such sites has a one mile diameter plastic bubble covering it and the rest of the area will not be effected by particulate matter.

TRANSPORTATION

The preparer has completely ignored impacts of the proposed Tongue River Railroad. This is not an existing railroad and in fact is not a railroad

yet, nor is it assured of becoming one. It is noted throughout the report that this has been overlooked.

It is felt that some background should have been given regarding the feasability of this railroad and the fact that it cannot be operated without additional leasing. Impacts caused not only with train members and right of way but also in terms of agricultural economy that is destroyed or reduced with railroads bisecting farms and ranches should have been addressed in this report. Land productive projections have not been considered.

What transpires when Tongue River Railroad fails to get their permits?

No mention is made of the impact the land owners in the outer areas of the mines will be burdened with. The preparer must assume all landowners will receive royalties!

In every area there seems to be omissions or lack of perception to the total problem. In my opinion this EIS statement is unacceptable in its present form.

Sincerely,

Herb Mobley
Vice President
Tongue River Agricultural
Protection Association

NATIONAL WILDLIFE FEDERATION 26

ROBERT J. COLTON
COUNSEL

NATURAL RESOURCES CLINIC
FLEMING LAW BUILDING
BOULDER, COLORADO 80309
(303) 492-8157

16 September 1981

EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, WY 82601

Gentlepersons:

On behalf of the National Wildlife Federation, we are pleased to comment on the BLM's Draft Environmental Impact Statement (DEIS) on Powder River Coal Leasing. The National Wildlife Federation, America's largest private conservation organization, has, with its affiliates, over 4.5 million members and supporters. The Federation is devoted to the wise use, conservation, and protection of the nation's resources. We also submit these comments on behalf of the Wyoming Wildlife Federation, the largest conservation organization in the State of Wyoming, with over 1500 members dedicated to the proper management and conservation of the State's natural resources.

We have three sets of concerns about this DEIS: (1) the premises upon which it was built, (2) the failure to fully identify and discuss certain important and adverse impacts, and (3) the failure to fully describe other courses of action relating to both (a) alternative leasing methods, and (b) alternative ways, other than coal-burning, of meeting end-use energy needs.

1. Our first concern is that the DEIS is based upon highly questionable assumptions as to future market demand for coal. The DEIS need analysis rests on the premise that without new leasing the DOE high-production target goal cannot be met. There is no discussion of the econometric model or the data that the DOE used in arriving at this target goal. Instead, we are presented with an unexplained, and highly questionable, administrative edict which provides a basis--a shaky one, indeed--for all that follows.

The second major assumption, also dubious, is that all coal currently subject to Preference Right Lease Applications and existing leases will be fully developed. This ignores the fact

100% recycled paper

that many of the deposits may not be economically exploitable due to high transportation or extraction costs. A proper analysis would examine the actual likelihood of full development of existing leases and PRLAs, based on projected market prices for coal and site-specific costs of extraction and transportation. If full exploitation of existing leases and PRLA lands is assumed, the three new leasing alternatives appear relatively benign, in comparison to the high-production "no action" alternative (#1). Thus, in overestimating the impact of the "no action" alternative, the DEIS blurs the contrast between the impact of stable or moderate coal development and that of massive new coal development (e.g., 50 million tons per year increased production), and may mislead the public.

2. Our second area of concern is that the DEIS fails to address adequately certain significantly-adverse impacts. First, the study fails to discuss fully the direct effects of contaminated spoil water upon wildlife and the economic effect upon pump irrigators of declines in the water table. The secondary impacts of population influx are also glossed over. Increased land area will be occupied by new residents, and increased demand for recreation will result in more poaching and more pressure on diminishing wildlife habitat.

The poaching problem is briefly mentioned, but is avoided by blithely assuming full enforcement of applicable fish and game laws. The same assumption (i.e., full enforcement) is made regarding implementation of federal and state reclamation law. At this time of budget cutbacks and retrenchment--if not retreat--for example, at the federal Office of Surface Mining, it seems unlikely that there will be the staff necessary to enforce these laws.

In addition, and significantly, the DEIS fails to deal adequately with the considerable effects of the boom-town syndrome. The BLM proposes no solution (e.g., front-end financing by the coal companies) for local budget deficits besides state or federal subsidies. There is no mention of the effect of higher housing and living costs upon persons with fixed incomes. And what happens when the coal "boom" is over--the coal reserves are exhausted--and the "bust" comes along? What happens then to the quality of what used to be a range-and-rural environment but has been converted into a largely (and ephemerally) coal-dominated economy for some 20-30 years? The DEIS ignores that serious issue. The impact of population growth will also be felt through increased fencing of open range. [This new fencing can result in wide-spread starvation of antelope during migration.]

Finally, the study fails to treat the end-use impacts (e.g., air pollution) of burning the mined coal.

3. Our third area of concern with the DEIS is its failure to comply with section 102(2)(C) of the National Environmental Policy Act (NEPA), which mandates that the agency shall study, develop, and describe appropriate alternatives. The C.E.Q. regulations at 40 C.F.R. 1502.14 require that the agency "rigorously explore and evaluate all reasonable alternatives," and that it include appropriate mitigation measures in the proposed action. The DEIS does not mention alternative electric (e.g., renewable) power generation methods or energy conservation measures by power consumers, both of which would mitigate the supposed need for accelerated leasing; nor is there adequate discussion of alternative leasing approaches. For example, the study should explore the possibilities of maintenance leasing of existing tracts, augmented perhaps by break-through leasing (which offers a means of facilitating extraction where unleased federal coal stands in the path of efficient recovery). Land trading can also be used to mitigate mining impacts, by shifting extraction to less sensitive areas. Finally, a phased-in leasing schedule with periodic review of leases and needs offers time in which to make an informed decision. For one thing, the Department of the Interior is expected to rule on the status of PRLAs starting next year and continuing through 1984. DOI's PRLA review will provide more accurate information on which to base a need analysis.

In short, as written, the DEIS fails to discuss a wide variety of leasing options. Instead, it examines only three alternatives--all involving significant new leasing--and one "no action" alternative which assumes that, instead of new leasing, existing leases and PRLAs will be fully developed. A one-time, all-or-nothing disposition of new leases in 1982 is proposed.

It seems to us that an optimal approach, one certainly worth at least identifying and discussing, is a phased-in leasing schedule punctuated by periodic review, and which would accommodate next year's Interior Department evaluation of outstanding PRLA applications prior to further leasing.

In summary, it is our view that unwarranted assumptions in the DEIS, failure to fully disclose important environmental impacts, and disregard of not only plausible, but more sensible, leasing alternatives combine to compromise the integrity and usefulness of the EIS, and wrongly present to the public only the issue of how much--rather than if of when--new leasing should be allowed. It probably should be redrafted.

Very truly yours,

Richard Cauble
Legal Intern

dh

cc: Rod Doty, President, Wyoming Wildlife Federation
Ron Smith, Issues Chair, Wyoming Wildlife Federation
George Ramiasxi, Regional Executive, NWF

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WYOMING
EXECUTIVE DEPARTMENT
CHEYENNE

ED HERSCHLER
GOVERNOR

September 15, 1981

Mr. Charles Wilkie
Team Leader
Bureau of Land Management
951 Rancho Road
Casper, WY 82601

Dear Mr. Wilkie:

This office and several state agencies have reviewed the Draft Environmental Impact Statement for coal leasing in the Powder River Coal Basin, and comments are enclosed.

The DEIS appears to have covered most of the essential subject areas that would be impacted by federal coal leasing. However, several points need to be specifically addressed. They are:

1. The Regional Coal Team did not develop nor recommend a preferred leasing alternative as suggested on page 21;

2. It is extremely doubtful that coal production levels portrayed on Table 2-7 (pages 25-28) will be realized in the time frames indicated on the table; and

3. 1980 data should be used when possible, especially on Table 1-8 (page 49). This would present a much more accurate picture of the current situation.

The Department of the Interior has adopted an interim leasing target based on input from the Regional Coal Team. Some of the assumptions used by the Regional Coal Team have changed, specifically the possibility of a large synthetic fuels industry. Considering the Administration's proposed budget cuts, absence of a Synthetic Fuels Corporation Board, and the high (risk capital) requirements for a synthetic fuels project, it seems doubtful that some of the impacts originally envisioned will come to pass in the next decade.

If the Department opts for a higher leasing target, the target should be designed to encourage economic competition

Mr. Charles Wilkie
September 15, 1981
Page 2

and the timely development of resources. Additionally, current and future lease holders should not be allowed to secure or sit on federal leases for purely speculative purposes. Diligence requirements should be enforced. Second, the lease target should encourage and maintain a steady rate of economic development that will allow the communities and counties to adequately accomodate coal development while maintaining and protecting the socio-economic and environmental health of the area. Long term and stable employment opportunities should also be considered when selecting a lease target. When developing the final lease target, the Department should consider the desires of the cities, communities, counties, and other political subdivisions which will be most directly impacted by the leasing and development of coal in the Powder River Basin.

Regardless of which leasing level is adopted by the Department, the State of Wyoming intends to apply its environmental and public protection laws to all projects and proposals developed within our boundaries. The Department of the Interior must recognize the applicability of the Wyoming Industrial Development Information and Siting Act and the Wyoming Environmental Quality Act. Additionally, Prospective bidders on tracts having state coal should check with the Commissioner of Public Lands Office to determine the current status of the state section.

Comments from other agencies are enclosed for your information.

Yours, sincerely,

Ed Herschler

EH/wwt

Enclosures

28

AUG 17 1981

GARY B. GLASS
DIRECTOR AND
STATE GEOLOGIST

THE GEOLOGICAL SURVEY OF WYOMING
UNIVERSITY OF WYOMING
BOX 3008, UNIVERSITY STATION
LARAMIE, WYOMING 82071

Serving Wyoming Since 1933

August 14, 1981

Mr. Dick Hartman
State Planning Coordinator
Wyoming State Clearinghouse
2320 Capitol Avenue
Cheyenne, WY 82002

Dear Mr. Hartman:

Gary Glass, State Geologist, has reviewed the Powder River Regional Coal Draft Environmental Impact Statement (State I.D. No. 81-1271, and his comments are attached.

If your office or another state agency would like us to re-examine any part of this draft, please feel free to ask.

Sincerely,

James C. Case
Staff Environmental Geologist

JCC:sb

Geology - Interpreting the past to provide for the future

GARY B. GLASS
DIRECTOR AND
STATE GEOLOGIST

THE GEOLOGICAL SURVEY OF WYOMING
UNIVERSITY OF WYOMING
BOX 3008, UNIVERSITY STATION
LARAMIE, WYOMING 82071

Serving Wyoming Since 1933

MEMORANDUM

To: Dick Hartman, State Planning Coordinator
From: Gary B. Glass, State Geologist
Subject: Powder River Draft Environmental Impact Statement Coal
Date: August 6, 1981

Page 7, 2nd column, 4th paragraph from top

This discussion of the ETSI pipeline is inaccurate. In particular, it doesn't include all the mines supplying the pipeline, and one it lists (the Fort Union Mine) is not scheduled to participate at all.

There is also an indication that coal from new federal coal leasing will not be transported by the pipeline.

Pages 14, 15, 16, and 18 Alternatives

Maybe we are missing the point, but it appears that the preferred leasing goal is designed to assure that there is enough proposed mine capacity in the Powder River Basin to meet the DOE's high production goal for that area. If this is the case, why is the DES written to suggest that leasing is meant to prevent a production shortfall rather than a short/fall in a DOE-estimated demand that may or may not occur? A few wording changes in the DES would make this point clearer to a reader.

Also, there is no way that 360 million tons will be mined in this area by 1990. If it is of interest to the State, we could revise Table 2-7 to reflect our opinion of what really may be expected. Obviously, if less capacity is shown in that table, DOI will probably push for more extensive leasing than the BLM has already proposed. Because of this, we will not revise the table unless it is requested of us.

Final comment

The DES preparers should be complimented on their foldout Regional Activity map. It is a great improvement over older EIS's that didn't even include maps, let alone regional ones.

Geology - Interpreting the past to provide for the future

29

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Wyoming Recreation Commission

604 EAST 25TH STREET CHEYENNE, WYOMING 82002

JAN L. WILSON
Director
777-7686

August 6, 1981

Mr. Dick Hartman
State Planning Coordinator
2320 Capitol Avenue
Cheyenne, Wyoming 82002

Dear Sir:

Enclosed is a memorandum from our staff archeologist regarding the Powder River Coal DEIS. Thank you for giving us the opportunity to comment.

I agree with Mr. Bryant's comments, and encourage the BLM to make provision for "buried sites" when the Final EIS is written. If you have any questions regarding the proper procedures for such sites, please contact the appropriate member of our staff.

Sincerely,

Mark Junge, Chief
Resources Division and
Deputy SHPO

FOR:

Jan L. Wilson, Director and
State Historic Preservation Officer

MOJ:kim
Encls.

WYOMING RECREATION COMMISSION

STATE HISTORIC PRESERVATION OFFICE

REVIEW AND COMPLIANCE

Interdisciplinary Staff Comments

Archeology · History · Historical Architecture · Recreation Planning

TO: Mark Junge, Chief

FROM: Richard Bryant, Archeological Compliance Officer

DATE: July 14, 1981 (Districts 4, 6, 7)

RE: A95/881-27, Draft Environmental Impact Statement: Coal, Powder River

On page 59 and again on page 60, the DEIS states that "buried sites" (i.e. sites not identified during cultural resource surveys), would be irreversibly lost. Procedures for protection of resources discovered during construction are referenced in 36CFR800.5(a) and (b). Sites discovered during construction activities are protected under provisions of the Archeological and Historic Preservation Act 16 USC 469(a).

A discussion of these provisions should be included in the Final Environmental Impact Statement.

THE STATE OF WYOMING

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Wyoming State Highway Department

P. O. BOX 1708 CHEYENNE, WYOMING 82001

August 20, 1981

Draft EIS
BLM Powder River Regional
Coal Lease
State ID 81-127

Mr. Dick Hartman
State Planning Coordinator
Wyoming State Clearinghouse
2320 Capitol Avenue
Cheyenne, WY 82002

Dear Mr. Hartman:

We offer the following comments concerning the Draft Environmental Impact Statement for providing additional federal coal leases in the Powder River Basin:

1. The cumulative impact is well presented; however, the incremental impacts are difficult to determine, and in some instances can only be guessed at. For example, the current rail traffic is not given; nor are the projected rail traffic contributions of existing mines, mines that are not yet producing but are in some phase of development, and the 14 tracts under consideration. It appears, though, that the production of the 6 tracts in Wyoming will be equal to or exceed current production.

2. If the production goals are achieved within the time frame set forth, the impacts from rail traffic will be quite severe. Since this is indicated in the EIS, we are quite surprised that no mitigation measures are proposed. We suggest that the "at-grade" street and highway crossing problems be studied in depth and appropriate mitigation measures developed. This should also include means to finance the mitigation measures.

Very truly yours,

William P. King

William P. King, P. E.
Environmental Services Engineer

WPK/mg

THE STATE OF WYOMING

AUG 24 1981 31 ED HERSCHLER GOVERNOR

State Engineer's Office

BARRETT BUILDING CHEYENNE, WYOMING 82002

August 21, 1981

M E M O R A N D U M

TO: Dick Hartman, State Planning Coordinator

FROM: Louis E. Allen, Water Resources Engineer LEA

SUBJECT: State Identifier Number 81-127, Powder River Coal Draft EIS.

The subject DEIS was reviewed by Richard Stockdale, Ground Water Geologist, and myself. The following comments are composited from our notes.

The DEIS is too general on both surface water and ground water discussions. The regional impacts appear to be minimal, but local site impacts could be severe. There is inadequate site-specific information to evaluate the possibility of localized impacts.

There is no recognition of the Yellowstone River Compact and its restriction on diversions of water out of the Yellowstone River Basin. Neither is there mention of the Belle Fourche River Compact or of the North Platte River U.S. Supreme Court Decree and the resulting limitations on water availability. The DEIS seems to assume that both surface and ground water are available where and when it is needed.

The DEIS totally ignores the Wyoming water appropriation system, and the administration of ground water and surface water by the State of Wyoming. The assumption seems to be that the State Engineer will allow mining operations to affect vested water rights without regard to supply replacement or due compensation as required under Wyoming law.

The DEIS also seems to assume that all of the mining under consideration, plus others on non-federal lands, will occur at the same time. It seems that some of the activity could be staged, with new mines opening as other cease. Market demands may dictate otherwise, but present conditions indicate this would be possible. The concept does not seem to be even suggested in the DEIS.

Dick Hartman
August 21, 1981
Page two

Without specific proposals and site-specific information, specific comments are not possible.

Thank you for the opportunity to review this DEIS. The referral memorandum is being returned as requested.

LEA/ht

cc: George L. Christopulos
State Engineer

Richard C. Stockdale
Ground Water Geologist

THE STATE OF WYOMING

EXECUTIVE DEPARTMENT

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ED HERSCHLER
GOVERNOR

Office of Industrial Siting Administration

SUITE 400 ROYD BUILDING CHEYENNE, WYOMING 82002 TELEPHONE: 307-777-7388

August 26, 1981

Mr. Charles Wilkie
EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, WY 82601

RE: Powder River Draft Environmental Impact Statement Coal

Dear Mr. Wilkie:

The Industrial Siting Administration has reviewed the subject EIS. Our comments are as follows:

1) The map entitled "Regional Activity" does not include the proposed Hampshire Coal Liquefaction Plant which is planned for Campbell County. Is this an intentional omission or an oversight?

2) In the description of the affected environment, under the discussion of recreational resources, the statement is made that the present number of facilities in the Powder River Region is adequate to meet current use or demand. No study is referenced which supports this statement.

It has been the experience of this Office that outdoor recreational facilities are not adequate in the Gillette area. Keyhole State Park, the closest major recreational development to Gillette, is being seriously impacted by increased usage in combination with inadequate funds. State and federal recreational developments in Wyoming do not have mineral or severance tax earmarked to increase services in proportion with increased use and associated problems, but rather, must depend on general funding. As a result cumulative impacts from region-wide population increases have caused increased vandalism and higher costs in maintenance and repair. Consequently we question the broad statement that these facilities are adequate to meet current use or demand.

In addition under the discussion of environmental consequences it is stated that the short term effect would be increased use on a resource [recreational resource] that is in short supply. The long term effect would be a decrease in demand when the population levels off or decreases making recreational facilities supply adequate. We disagree.

If a resource is in short supply and nothing is done to increase this supply and population levels increase significantly and then stabilize there is no way that the recreational facility supply can be termed adequate. Therefore it appears that the EIS does not fully present the impact that will result on recreational resources. This inadequacy should be addressed in the Final Environmental Impact Statement.

3) On page 51 the EIS states that the proposed leasing would have little effect on the regional groundwater systems. Some study should be referenced to support this statement.

4) The EIS does not present an accurate picture of the housing situation in Gillette, Wyoming. On page 63 of the EIS it is stated that housing construction is expanding concurrently with the rapid growth rate that Gillette is experiencing. This is not entirely accurate; due to the high cost of dwelling units, high mortgage interest rates, and the lack of construction loans available from local sources, it is becoming increasingly difficult for the private housing sector to respond to the demand for housing units. Consequently it has and most likely will continue to be necessary for new industries such as coal mines to provide some type of housing mitigation program for their employees. The Final EIS should address the problems that are occurring in the housing area and discuss mitigating measures.

We appreciated the opportunity to review the EIS and hope that our comments will assist you in the preparation of the Final Environmental Impact Statement.

Sincerely,

Richard C. Moore

Richard C. Moore, P.E.
Director

RCM/sm

THE STATE OF WYOMING

33

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

AIR QUALITY DIVISION

EQUALITY STATE BANK BLDG
401 W 18TH STREET CHEYENNE, WYOMING 82002 TELEPHONE 777-7391

MEMORANDUM

TO: Robert E. Bundin, Director, Dept. of Environmental Quality

FROM: Randolph Wood, Administrator, Air Quality Division

SUBJECT: Draft Environmental Impact Statement - Powder River Coal

DATE: August 26, 1981

I have reviewed the Air Quality Section of the subject DEIS, and based upon our experience in issuing permits for coal mining, I offer the following comments:

(1) I believe it is inappropriate to use carbon monoxide and lead concentrations from Billings, Montana and Glenwood Springs, Colorado as background for Gillette, Wyoming.

(2) Absent the ability to spend large resources in reviewing the detailed analyses of air quality impact from the alternatives, I can only respond that in the final analysis, the issuance of permits for these facilities will be predicated upon a showing that the standards will be maintained. It would be nice to be able to reach such a conclusion at this time but I cannot lend assurance that such is the case.

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Consolidation Coal Company
Federal Coal Acquisition Group
17 Riverside Drive East Bldg 6
Englewood, CO 80112
(303) 770-1600

September 16, 1981

Bureau of Land Management - PAEC
Attention: Chuck Wilkie
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Wilkie:

Please accept this letter as Consolidation Coal Company's comment on the Powder River Draft Environmental Impact Statement for coal.

Although Consol has no problem with the alternative preferred by the Regional Coal Team, we do have a problem with the Northwest Otter Creek Tract within the preferred alternative. Certain areas within this tract, which Consol feels are mineable, have not been considered for leasing in the Draft EIS. These areas lie outside the "200' depth-to-coal line". However, they contain coal at a mining ratio of 5.0:1 or less.

With this in mind, Consol requests that the Northwest Otter Creek Tract description be amended to include the following areas for leasing:

T43-R45E

Section 8 - SW 1/4 SW 1/4
Section 10 - E 1/2
Section 20 - NW 1/4 NW 1/4

Sincerely,

Alan Falenski
F.C.A.G.

AF:kc

CC: R. Ford
K. Redding

NORTHERN PLAINS RESOURCE COUNCIL 35

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EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

September 14, 1981

To Whom It May Concern:

Enclosed please find the comments of the Northern Plains Resource Council on the Draft Powder River Regional Coal Environmental Impact Statement. Please consider these comments along with testimony at the hearings on the EIS.

Thank you for considering these comments. If you have any questions concerning the content of these comments, please do not hesitate to contact us.

Sincerely,

John D. Scillie
NPRC Staff

Comments of

the

NORTHERN PLAINS RESOURCE COUNCIL

ON

The POWDER RIVER DRAFT ENVIRONMENTAL IMPACT STATEMENT, COAL

U.S. Department of the Interior
Bureau of Land Management

September 14, 1981

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INTRODUCTION

The Northern Plains Resource Council (NPRC) appreciates this opportunity to comment on the Draft Powder River Regional EIS (EIS). NPRC is a private, non-profit organization of ranchers, farmers, and other citizens in Montana concerned about the effects of unwise and poorly planned energy development on the agricultural industry. NPRC members in Southeastern Montana have been monitoring and participating in BLM land use planning and coal management related activities for the past ten years.

NPRC has reviewed the draft EIS, and concluded that it is seriously flawed and totally inadequate for its intended purpose. It fails to conform to National Environmental Policy Act and Coal Management Program regulations. It fails to satisfactorily analyze issues raised by the public in the scoping process and in various planning efforts. It completely ignores the central question of whether there is a need for renewed leasing in the Powder River region. The EIS fails to analyze the impacts of leasing on agriculture. The analysis of environmental impacts is incomplete, filled with erroneous assumptions and data, and it contains numerous logical fallacies. The document is totally inadequate as a basis for decisionmaking, especially decisionmaking as important as that involved in the planned Powder River Coal Lease Sale. BLM should correct the deficiencies outlined here, and release a new draft for public comment in accordance with NEPA regulations (1502.9-a).

These comments are divided into general comments, comments on specific parts of (or gaps in) the EIS, and a short concluding section with recommendations.

GENERAL COMMENTS

I. The preparation and content of the EIS fail to conform to the spirit and the letter of National Environmental Policy Act regulations and Federal Coal Management Program regulations.

The first set of public hearings on the EIS was held illegally because notice for the meeting was inadequate. Many concerned citizens who have been involved in BLM land use planning for several years, and presumably should be on BLM mailing lists, never received a copy of the EIS.[1]

The EIS is supposed to be prepared on a proposed lease sale schedule and alternatives (see 43 CFR 3420.4-4(a) and 3420.4-5). The EIS does not analyze alternative lease sale schedules.

The EIS is supposed to consider the impact of leasing each specific tract as well as the intraregional cumulative impacts of leasing (3420.4-5a.1). The EIS fails to analyze impacts of tracts for comparative purpose or for any other purpose. Instead, specific tracts were analyzed only in "Tract Profiles" which did not accompany the EIS. This is insufficient to meet the requirements of 3420.4-5(a):

1. The clear language of 3420.4-5(a) states that impacts of leasing specific tracts are to be analyzed in the EIS.
2. The Tract Profiles are not, in any case, NEPA documents.
3. The profiles are not sufficient for the purposes of intertract comparison, although intertract comparison is the reason 3400 regulations require impacts of leasing specific tracts to be analyzed in an EIS.
4. The tract profiles were not generally available. No notice was published in the Federal Register or in local newspapapers announcing their availability or inviting public comment. No mention is made in the EIS or in notices inviting comment on the EIS to indicate that the tract profiles are to be considered as part of the EIS.
5. A letter from the Miles City District Manager to the NPRC office in Glendive dated January 23, 1981 referred to the profiles as "voluminous in-house documents not in a form for public distribution".
6. NPRC staff attempted to get one set of the tract profiles from the BLM office in Billings, just two days before the hearing in Broadus, Montana on the EIS. The NPRC staff was told that the documents were not available. The Miles City District Office also did not have extra copies for distribution.

For the above reasons, the profiles are not sufficient to allow comparison of the tracts by the public during the EIS process as required by 3420.4-4(e). NPRC reserves the right to participate under 3424-4(e) until such time as BLM publishes a draft EIS that is in compliance with group 3400 regulations, NEPA regulations, and contains analyses of the impacts on specific tracts. Until BLM complies with 3420.4-4(e), NPRC's position (in accordance with the express language of 3400 regulations) is that the Secretary of the Interior may not make any final decision on the adoption of a regional sale schedule including any of the selected tracts (3420.4-4(e)).

Ranking and selection of tracts and the preparation of a lease sale schedule are not supposed to begin until there is a final regional leasing target. The Powder River EIS is based on analysis of ranking and scheduling conducted before the Secretary had even chosen a preliminary target.

II. The EIS was prepared without due consideration of the issues raised by the public in the NEPA scoping process and previous planning efforts.

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The Eastern Montana Growth Task Force recommended several parameters for the analysis of social and fiscal impacts on local communities. Many of these impacts are not even mentioned in the EIS, let alone analyzed.[3]

The Coal Team was also informed about the concerns of local citizens in the region about the need for adequate community development lead times, and the effects of rapid growth on senior citizens and low-income persons. None of these issues is addressed in the EIS.[3]

Finally, Keith Bennett of BLM prepared a paper at the Coal Team's request, entitled "Regional Concerns in Coal Leasing". Of the unanaimous concerns of the regional public identified in that document, virtually none are analyzed in the EIS. His paper made a special point to emphasize the concern expressed about the impacts to agriculture, yet analysis of the impacts to agriculture (and of the specific sub-issues Bennett identified) is almost completely absent from the EIS.[4]

The EIS even fails to discuss the economic viability of opening new mines in a production region plagued with overcapacity; disruption of family farms and ranches; changes to agricultural productivity (as opposed to changes in gross agricultural production); or changes to rural quality of life--yet all of these are supposed to be tract ranking factors (Table 1-2). The EIS provides no useful information on these topics for tract ranking purposes.

In the introduction to the "Powder River Management Framework Plan Amendments" (Amendments; BLM, June, 1980), the BLM made the following commitment:

> ...serious issues remain unresolved regarding the specific impacts of mining on the area's agricultural land base and the region's quality of life...
>
> We totally agree that these impacts, as well as the overall regional perspective, must be assessed and the issues resolved before any decisions to mine coal are made...
>
> These issues are a matter of record, and the Bureau is committed to a reasoned, sound resolution of all remaining issues prior to any leasing decisions being recommended to the Secretary.

The EIS fails miserably as a fulfillment of that pledge.

In comment on the Amendments, Patty Kluver raised the issue of the degradation of groundwater quality and the effect of that degradation on wildlife and livestock. In response, BLM pledged to address this issue in the EIS. The EIS addressed the issue only in a cursory fashion (cf. specific comments below) and ignores the evidence mentioned in Mrs. Kluver's testimony.

In response to Jean Hough's testimony on the Amendments, BLM stated:

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> The numerous major potential impacts cited (i.e. mine-mouth utilization, reclamation, etc.) are impacts of mining and leasing...activity planning (including a regional environmental impact statement) will address those impacts...

The EIS, however, fails completely to address mine-mouth utilization or any other end-use impacts. Other "major potential impacts" such as reclamation are addressed inadequately or not at all in the EIS (cf. specific comments below).

In response to Mr. Weiner's comments, BLM said "...threshhold levels may be developed during coal resource activity planning based on public and state/local government comments." Yet BLM failed to solicit such comments or to consider the comment of Mr. Weiner, the comments of Ms. Hough and others made previously, or the provisions of the coal management program regarding the setting of threshhold levels. The EIS fails to discuss any threshhold levels, or whether or not threshhold levels might be appropriate.

Again in response to Mr. Weiner, BLM stated that "...the potential impacts on specific farms and ranches from leasing and mining coal will be considered in the regional (activity plan) EIS." The EIS fails to analyze even one farm or ranch and the effects leasing and mining might have on the profitability of its operation.

NPRC protested the adoption of the Amendments to the State BLM Director. The Director, Mr. Penfold, denied the protest in part on the following grounds:

> The tracts will then be analyzed, ranked, and discussed in the Powder River Regional Environmental Impact Statement. The impact statement will consider the impacts on each tract, should mining occur, as well as the cumulative impacts of leasing different arrays of tracts to meet the established regional production target. (Emphasis added).

The EIS fails to analyze the impacts on each tract as the Director pledged. Further, the EIS was prepared without an established regional production target.

III. The EIS totally fails to address the issue of coal demand and the need for renewed coal leasing in the region.

One of the most important issues raised by the public, industry representatives, Interior Department officials and other government agencies concerns the need for new leasing in the Powder River Basin. NPRC has commented extensively on the need for new leasing previously in activity planning. The EIS fails to provide any rationale for the proposed leasing target, to provide any reason for selecting that target rather than any other, or

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to analyze other possible targets. At a minimum, the EIS should include the following as alternatives, in addition to the four alternatives considered:

1. Leasing of maintenance tracts only.
2. Leasing to meet the originally established target of 776 million tons of federal coal.

The omission of any rationale for the size of the proposed lease sale is especially critical because there is no publically available document which explains or justifies the proposed 1.3 billion ton lease target. The Interior Department refuses to make the Powder River Lease Target Secretarial Issue Document available to the public. There is, therefore, no information available to the public from BLM to provide any basis for a recommendation on which alternative discussed in the EIS best responds to the nation's energy needs and coal management policy. Commentors have no basis for balancing environmental consequences of proposed actions against the need for the proposed actions, because no need for the proposed actions is anywhere identified.[5]

IV. The EIS was prepared under an accelerated schedule, which is partly responsible for the inadequacy of the document.

The schedule for preparation of the EIS as published in the Public Participation Plan and approved by the Regional Coal Team was accelerated without changing the Plan and without any action or discussion by the Regional Coal Team. While it is commendable than an EIS can be finished ahead of schedule, it is only commendable if the early completion date is not achaived at the expense of accuracy, sufficiently rigorous analysis, or compliance with applicable guidelines. The Powder River EIS was completed ahead of schedule at the expense of all three.

V. The assessment of impacts to agriculture, regionally and on a site-specific basis, is totally inadequate.

BLM is well aware of the history of NPRC's attempts to obtain adequate assessments of the impacts of leasing throughout the BLM planning process. Because of these efforts, BLM promised much analysis of impacts to agriculture in the activity planning process, and specifically in this EIS. The EIS, which is nearly devoid of any information on the impacts of leasing on agriculture, is therefore especially disappointing to NPRC.

The only discussion of the impacts to agricultural operations and economics is a reference to the two tables in Appendix C. These tables, in turn, consist of an almost useless compilation of impacts to on-site operators, the derivation of which is a complete mystery; and a table of statistics taken from a drought year in the region, which is apparently intended to show that stripmining even the whole of Powder River and Rosebud Counties would have only a negligible effect on national food production.

The EIS completely ignores the most important impacts to

-6-

agriculture, which are those that occur outside of the mining area (where landowners receive no compensation for damages). The discussion of issues vital to agricultural productivity--reclamation and groundwater--presents no new data or analysis, but rather consists of platitudes and generalizations and unfounded assumptions. The entire discussion of these important issues lacks any factual supporting evidence.

The impacts of associated facilities, such as new railroads, are completely ignored, although the preferred alternative would be associated with the permanent disruption of dozens of ranches on the Tongue River and elsewhere due to the construction of railroads. Many of these ranches would be rendered uneconomical as ranching units by the proposed action, yet the EIS fails to analyze this impact. The impacts of mine-mouth utilization, which are much more significant to agricultural productivity on a regional basis than even the impacts of mining, are not included in the EIS.

The EIS generally exhibits no understanding of the connection between disruption of part of a ranch and the profitability of the ranch as a unit. This problem causes the EIS to understate the only costs it did assess in regard to impacts of leasing on agriculture, the on-site impacts. The EIS fails to discuss the effect of marginal impacts (such as degraded, but not ruined, groundwater, the costs of well replacement, the effects of aquifer "reincation") on ranch economics. It is not enough to say that a shallow aquifer may be replaced by a deeper well, and to then assume that there is no impact on agriculture, as the EIS does repeatedly. The extra costs of drilling and operating that well must be identified.

SPECIFIC COMMENTS

SUMMARY

General Conclusions

The EIS states that "the No-Action alternative would have impacts considerably greater than any of the other alternatives in the EIS."

This statement is suspect on its face, palpably false upon examination, and is flatly contradicted by the data elsewhere in the EIS. For the most obvious example of data which contradicts the statement, see the summary table 2-1 on pp. 22-24. The statement is based on the faulty premise that it is permissable to compare the marginal impact of leasing tracts to the baseline impact of development that will occur with or without leasing. Of course, the proper comparison for the purpose of the summary is between the impacts of the baseline and the impacts of the baseline

together with the impacts of the tracts to be leased. To compare anything else is ludicrous, misleading, and invalid. The conclusion is also based in part on the statement that the impacts of leasing differ between alternatives by magnitude, rather than by type, and the magnitude of impacts is generally proportionate to the amount of coal produced.

This is an assumption which underlies the entire EIS analysis. It is not a conclusion. It is an invalid assumption, since the impacts of leasing will be entirely different--by type, not just by magnitude--from the impacts of the no-action alternative for the Otter Creek and Tongue River Valleys.

The EIS states that "All the alternatives, including the No-Action, would further commit the region to a single economic base (coal). This trend is well established in Wyoming but would create a shift in economic base in Montana where agriculture has accounted for a significant part of the economic base to date." (Emphasis added).

The statement is false. Agriculture is and will be the dominant economic force in southeastern Montana, even with the scale of development analyzed in the No-Action alternative. Agriculture is not, as stated, merely a "significant" part of the economic base in Montana; it provides the majority of the region's economic base, and it is the largest industry in the state.

Highlights

The section on water resources mentions shallow aquifers as the only area where problems would be created by leasing, and says that deeper water is needed for human consumption, anyway. This fails to note the impact of degraded water quality or increased pumping costs for deep wells on agricultural productivity.

The section on air quality mentions only "localized" impacts, and fails to note the impacts of end-use (on-site conversion). This is a major deficiency in the EIS.

The summary states that "reclamation success has shown to be good (sic) (Packer, 1974)." This conclusion is not warranted (cf. detailed discussion below).

Under "Land Use", the EIS states: "Land use patterns are expected to shift from agricultural toward mining and urbanization without new federal coal leasing and implementation of the preferred alternative would change this very little."

The EIS does not state which way this would change. The conclusion, in any case, contradicts the finding that 44 more ranches would be impacted under the preferred alternative. It also ignores all off-site impacts, including the impacts to ranches along Tongue River and Otter Creek which would result from the construction of the Tongue River Railroad, due to adoption of the preferred alternative. Further, it ignores

the fact that without Federal leasing, land use patterns would not shift to industrial uses in Southeastern Montana, since no new mines would open without federal leasing.

The EIS says, on page two, that "losses to the ranches that would be substantially affected would be offset by royalties or fees paid by the mines for the use of private land."

This is a gross misstatement and reflects a callous and short-sighted attitude about land use and impacts to agriculture. It completely ignores the national question of the availability of agricultural land, which would seem to be the central question regarding land use. Royalties to landowners do not bring more land into agricultural production.

The statement totally pleases the impacts to agricultural operators off-site. These landowners receive no royalties, although the impacts off-site (equifer disruption, ranches bisected for railroad rights of way, and so on) may dwarf the impacts on the minesites.

P. 3: The summary of transportation impacts does not include the cost of need improvements to highways near Ashland. It doesn't mention the Tongue River Railroad, which would have been appropriate at this point in the EIS. The statement says that the preferred alternative "equates" to 50 trains a day through Miles City, but it fails to note if this means 50 trains all together or 50 more than without leasing.

The EIS states: "Increases in population are expected with or without new federal coal leasing." This is not true for southeastern Montana, where the increase of population without leasing is expected to be slight and gradual. The EIS then claims that "most of the impacts (in Rosebud County) could be mitigated but only through strong community commitment and assistance from both federal and state governments." The EIS fails to note here (or elsewhere) how much money is available, what sources (specifically) it would come from, and so forth. The statement inexplicably clodes out the option of industry assistance in mitigating impacts.

CHAPTER 1: PURPOSE AND NEED

The section on required authorizations neglects NEPA.

At page 6, under the "Review of Program Implementation", NPRC is painted as a scapegoat for the withdrawl of the lands in the Powder River MFP Amendments from this coal lease sale. The EIS states that NPRC's Protest of those amendments was responsible for the withdrawl due to a delay caused by the Protest. NPRC is owed an apology and a retraction for this statement in the EIS.

The statement fails to note that the appeal of the denial of protest was never reviewed by the BLM Director, and that the merits of the protest remain undecided. The EIS states that delay caused by the protest is responsible for the removal of

lands from consideration. This is false.

BLM planning has been going on in the area since at least 1972 (cf. Amendments). Updating the land use plans began in 1979, and were underway at least 1½ years before the document was completed. In that time, BLM completed roughly 2½ of the application of the lands unsuitability criteria, so considerabin effort remained to enable the lands to be considered for leasing. Whether compared with 1½ years, 2½ years, or the 10 years that have elapsed since planning began in the area, the (at most) one month delay caused by the appeal of the protest pales into insignificance. It is plain that BLM's planning schedule allowed insufficient time for the application of the unsuitability criteria and the completion of other planning steps, and that BLM decided to drop the areas of presumably limited interest rather than delay the entire lease sale. Delays in completion of BLM responsibilities--not NPRC's protest--caused the areas to be withdrawn.

The opportunity to protest MFP amendment decisions was outlined in the public summary document on the Amendments. Presumably, BLM has the foresight to plan for a protest period when establishing the necessary lead times for planning purposes, and did so in this case. It is reprehensible for BLM to attempt to attribute a delay caused by its own planning deficiencies and judgemental mistakes to NPRC, which merely exercised its right to participate in BLM decisionmaking by calling attention to BLM's deficiencies. NPRC has been maligned as a result at several meetings of the Powder River Regional Coal Team, and again in the EIS.

In discussing the Tongue River Unsuitability Petition, the EIS incorrectly names three affiliates of NPRC. The correct names are the Tri-County Ranchers Association, the Rosebud Protective Association, and the Tongue River Agricultural Protective Association.

Page 7. The EIS states that "energy production within the region is at an all-time high and rapid growth is occurring... Feasibility studies for additional coal-fired power plants are being conducted by companies such as Tri-state Electric and Black Hills Power and Light..." The EIS goes on to mention synfuels projects such as WyCoal Gas.

The statement fails to mention that the feasibility studies have in many cases resulted in postponement of plans for power plants. The WyCoal Gas project has been dropped.

The statement is incredible in light of the tremendous coal glut in the region. It is hard to believe that the EIS could discuss energy production in the region (not to mention the need for new leasing) without any mention of the tremendous overcapacity in existing mines in the region. This is one of the most serious deficiencies in the EIS, because it is pointless to debate alternatives and varying levels of impacts unless the need for incurring those impacts exists.

The EIS not only fails to discuss any justification of the need for new leasing, but it also fails to note the existing situation of the coal market in the region. (For a brief discussion of some of the issues involved, see Attachment D).

CHAPTER 2: ALTERNATIVES INCLUDING THE PROPOSED ACTION

Introduction

The resource disciplines used in the EIS did not include any agricultural sciences, a deficiency with obvious results in the EIS.

Assumptions

The EIS assumes all relevant laws will be followed. Presumably, one of the main purposes of the EIS is to assess the practicability of compliance with those laws (i.e. reclamation, diligent development requirements, etc.).

Population impacts are assumed to be divided 50-45 between Rosebud and Powder River Counties. How can something as important to the assessment of leasing impacts by assumed? This throws the credibility of the entire social economic and fiscal analyses into doubt.

The EIS assumes that "post-mining land use will be the same as pre-mining land use, except for the lands used for housing or public facilities." This is an outrageous assumption. It is not supported by a single example in the Northern Great Plains where pre-mining land use has continued at comparable levels after mining. It ignores railroads and railroad rights of way and other associated impacts which permanently change land use. BLM has assumed away one of the most important questions which should have been addressed by analysis in the EIS.

Alternative 1

Groundwater: The EIS states that "wells usually can be replaced by tapping deeper aquifers or with wells in spoil aquifers." The statement ignores the increased pumping costs of deeper wells, and fails to demonstrate that spoil aquifer water quality will be equal to or better than premining water quality. The EIS states that "springs may eventually reappear, but would be in different locations." The statement should indicate the probability of this occurence, any changes in quality, and describe the frequency with which springs will be relocated to different pastures or onto new ranches; "eventually" should be defined. Examples of similar occurrences on actual minesites should be given.

The statement says that "impacts of coal mining on groundwater are restricted to an area within a few miles of the mine site." Again, examples where this has been true in the past, and studies or other supporting evidence, are needed.

The EIS states, "shale layers the may have caused springs and seeps would be destroyed; however, the increased infiltration may cause increased groundwater inflow to streams or the creation of new springs and seeps near the mine site." The EIS should state whether these changes would be beneficial or harmful; how these changes would occur, and in what areas under consideration for lease; the EIS should give examples, again, where similar occurrences of such restoration exist; and it should cite whatever studies underly this analysis.

Similar statements concerning groundwater and surface water are found throughout the EIS. No examples of the types of miraculous reconstruction of groundwater resources which the EIS describes are given. Instead, hypothetical scenarios are used to analyze impacts to groundwater. The impacts of changes that the EIS does predict (relocation, or degradation of groundwater) on economics of ranching units are not analyzed. No studies of groundwater problems--such as those conducted at Colstrip, Montana, for mine permitting purposes--are cited. For the purposes of keeping these comments brief, objections to all such statements are hereby incorporated.

Air Quality: This section should describe the impacts of mine-mouth utilization (power plants, synfuels plants, etc.) as well as the mines, on air quality. Under Alternative 2, the EIS states that "estimates of total suspended particulate (tsp), nitrogen dioxide, (NO_x), and sulfur dioxide (SO_2) emissions were calculated for mines, cities, major roadways, and major point sources." However, other than to cite 1995 regional particulate emission projections, none of this information--by tract, by region, or by source--is contained anywhere in the EIS.

Soils, Vegetation, and reclamation: The EIS states that "reclamation success has shown to be good (Packer, 1974) although some areas could require more intensive and costly management." The Packer study is controversial, and inapplicable in any case as proof of reclamation success. The study was written before the Federal strip-mine act--which contains the legal standard for judging reclamation success--was written. It is a study on reclamation potential, not reclamation success. The statement does not cite any source for the comment concerning more costly management in some areas; it certainly is not from Packer.

Transportation: The EIS incorrectly lists the Tongue River Railroad as an impact under the no-action alternative. Tongue River Railroad officials have informed the Powder River Regional Coal Team that production of 30 million tons per year in the area is necessary if the railroad is to be profitable. Production of this amount annually is dependent on new leasing (Alternatives 2, 3, or 4).

Sociology: The EIS does not mention any of the social problems attendant in boomtown growth, such as drug and alcohol abuse, spouse abuse, increased crime rates, etc.

Economics: The EIS discusses only 1990 budget levels. The years between 1985 and 1990--when impacts are at their peak, but income from the mines (still under construction) will be at a minimum--is much more critical in terms of local budgets than 1990.

The EIS assumes balanced budgets without new leasing, although the no-action alternative assumes increases in coal production of roughly 200% over current production. Obviously, some communities will be greatly impacted. This is also inconsistent with the conclusion that the no-action alternative has the greatest impact.

The greatest problem with the economic fiscal analysis is that the tables provided do not have the existing baseline and the Alternative 1 baseline together for comparison. This makes the comparison of leasing impacts misleading, and understates the overall impact of mining.

Soil quality: There is no site-specific discussion, or comparison between tracts, of soil quality in the EIS. This illustrates the critical importance of including site-specific information and analyses of tracts in the EIS document. The information would be particularly appropriate here. For example, the tracts considered near Ashland have extremely high percentages of soil that is poor and even totally unsuited to reconstruction and revegetation. These tracts may have serious reclamation problems, according to the data in the tract profiles.

The tract profiles, however, were not generally available, and the EIS contains none of this information. The bland assumptions made in the EIS concerning the ease of reclamation are contradicted by the data in the tract profiles. Had the information been included here in the EIS, some of the more outlandish predictions of reclamation success might have been tempered by the authors.

Sociology: Table 4-8 appears to contain inaccurate extrapolations from the Powder River Comprehensive Plan. The actual figures for needed services should be higher.

Alternative 4

The EIS says "...it should be noted that possible production under this alternative (467 million tons per year) exceeds DOE's high production goal (412 million tons per year). Production approximating DOE's high goal would result in impacts similar in type and severity to those described under alternatives 2 and 3."

It is clear from this statement that production at the level discussed in alternative 4 is highly unlikely. This is even more true when it is considered that virtually no one thinks DOE's high goal resembles anything approaching reality. (Cf. attachment 3. This reinforces the need for discussion of the coal market in the "Purpose and Need" section of the EIS: BLM isn't sure whether or not the level of impacts discussed will be reached or not.

On page 21 is found the only reference in the EIS to the impacts of leasing on Agricultural economics. "Impacts to agricultural economics are considered insignificant" under Alternatives 2, 3, and 4, according to the EIS; the EIS then cites Appendix G, and refers to the tract profiles for the methodology used. This information (methodology) should be in the EIS itself, at least in an Appendix. MPRC has been unable to get a single answer as to how the figures in Appendix G were arrived at. It is clear that different methodologies were used, and possibly different data, between the calculations in the Tract Profiles and those in Table G.

The discussion is misleading in any case, since the analysis only considers impacts to agriculture on the minesites. Furthermore, the EIS elsewhere states that the preferred alternative will remove 291,500 acres from production and cause a total change in the economic base of the region from agriculture to coal. How BLM can nonetheless conclude that "impacts to agricultural economics are considered insignificant," is past understanding.

The analysis of fiscal impacts in Table 2-3 leaves out impacts to Ashland because it is an unincorporated community without formal budget". It would seem logical to project expenses and revenue on a per capita basis, as was done with the incorporated communities. This would at least provide some analysis of likely fiscal impacts to Ashland, which could experience the greatest impact of any locality under the preferred alternative. to ignore these impacts, as the EIS does, because of the inconvenience involved in measurement is inadequate and inaccurate.

CHAPTER THREE: DESCRIPTION OF THE AFFECTED ENVIRONMENT

Introduction

The EIS leaves out many portions of the existing environment--including flood plains--because they "would not be affected regionally". However, since the EIS is supposed to include site-specific analysis as well as regional analysis, these features of the existing environment should be described in this chapter. This would seem particularly important for such areas as the Tongue/Otter Creek area, where mines and a major railroad are proposed for construction in and near flood plains.

Soils, Vegetation, and Reclamation

On page 36, the EIS states "Most soils in the region have a fairly good reclamation potential based on reclamation success at other mines in the region." This statement needs correction for several reasons. The logic is faulty, but opp

in a way opposite from the reasoning on reclamation in the rest of the EIS. Where previously the EIS cites studies on reclamation potential in an attempt to prove the existence of reclamation success, the EIS now moves from site-specific reclamation success backwards to prove the existence of good reclamation potential.

Unfortunately, the only proof cited in the EIS for reclamation success at existing mines is the aforementioned study on reclamation potential, which leaves the EIS with fairly classic circular logic--and no evidence--on the subject of reclamation.

The "success" at existing mines is certainly not a given. Studies of actual mines--such as Reclaiming the West--have shown reclamation success to be an open question, not proven. Using the legal test of reclamation under the strip-mine Act, the question is still open--no reclamation bonds have yet been released in the State of Montana. BLM's assumption, then, that reclamation is a success is both unfounded and wrong.

In any case, the success of reclamation at existing mines --if true--would still not show that most soils in the region have a good reclamation potential. The statement is contradicted flatly by the data cited earlier from the tract profiles (see, for example, the Northwest Otter Creek Tract Profile). This is, to repeat, another case where the need for tract by tract analysis is obvious. Site-specific variations in reclamation potential of soils are important to decisionmaking--reclamation potential is, after all, a tract ranking factor--and should be discussed in the EIS.

Land Use

The EIS states "productivity on these lands can only be estimated because of fluctuations caused by climate, markets, and operational decisions." This kind of pointless and vague information was anticipated by MPRC, and is precisely the reason that MPRC has been pressing BLM to do agricultural inventory in the land use planning process for several years. It is noteworthy, also, that after limiting measurement of agricultural productivity to estimates because of the variables inherent in inventory totals, the EIS then neglects to make the estimates. Fluctuations in agricultural markets, it might be pointed out, appear to be no larger than fluctuations in the region's coal market.

Transportation

The EIS incorrectly includes the Tongue River Railroad in the description of the existing environment. The railroad exists only on paper. It does not belong in the description of the existing environment.

Sociology

Community Services and Facilities

The EIS states that Ashland does not have a high school, and that students attend "private and parochial schools in Colstrip and Broadus." There is a parochial high school in Ashland; Ashland doesn't have a public high school.

This does, however, raise the question of how the costs of educating the increased high school age population in Ashland that would result from the preferred alternative are included in county budgets--are they included in the Rosebud County budget, or the Powder River County budget?

Attitudes

The EIS states that "overall, people who were interviewed within the region favored coal development. A few respondents stated they would be in favor only if it was certain the coal was needed to help meet the nation's energy requirements."

This is an inaccurate and extremely misleading summary of the survey results as reported in the Tract Profiles. The Northwest Otter Creek Tract summary reported, for example, that "this favorability is not unconditioned; if it is felt that the nation does not need the coal to ease the national energy programs or that reclamation is not possible or not planned, favorability towards coal development would be greatly reduced."

Emphasis has been supplied. Clearly, more than "a few" respondents conditioned their favorability; they conditioned it on more than whether or not the coal was needed; and some respondents were unconditionally opposed. This type of distortion of sociological survey data has no place in the EIS.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Introduction

The EIS states that the information in the chapter on the affected environment was used to assess the impact of No-Action "which was, in turn, used as the new baseline to assess alternatives 2, 3, and 4." This is not acceptable EIS methodology. Impacts of various alternatives on a single baseline must be compared to each other in a proper analysis. It is not valid to use one of the alternatives as a baseline.

At page 53, the EIS states "...a significant reduction in DS concentrations can be expected with increasing distance from the mined area as a result of the selective retention of ions on particle surfaces (Riffenburg, 1925; Gayyun and Kesper, 19621. Thus degradation of water quality in areas adjacent to reclaimed spoil is expected to be a slow process, and it would be centuries, if ever, before deleterious effects become significant more than a few hundred feet from reclaim

areas." There are several points that need to be made about this analysis.
1) Dissolved Solids are not the only parameter of water quality contamination due to stripmining, and indeed are not the most important pollutants to consider.
2) This is another example of the EIS extrapolating from hypothetical situations to measure impact. The practice is particularly suspect in this case, because the studies cited predate the stripmine act and present mining technology; their its applicability to the activities of 80 cubic yard draglines and their effect on Western aquifers is questionable.
3) It would be helpful if the authors of the EIS had provided a comparison here (or anywhere else in the EIS) of the hypothetical extrapolations and data from the real world. For example, all kinds of water quality degradation problems are showing up, off site and some distance from the mines, at Colstrip. A draft DSL EIS and Western Energy's application for extension of a mining permit in Area E predicts similar problems. When the hypotheses are not supported by evidence--and, in fact, are contradicted by available evidence--one begins to doubt the validity of the hypothesis.

On page 58 of the EIS, the authors state: "The success of reclamation and revegetation would depend on the nature of the mine site" and on the reclamation plan."
This statement recognizes several things that are not discussed anywhere else in the EIS.
1. Reclamation is dependent on several site specific factors, and is not a given.
2. Success will vary from place to place.
3. "Revegetation" and "Reclamation" are not identical terms.
However, the statement does not indicate recognition of another important point: that is, that reclaimed land (if reclamation is successful) will require more intensive management than unmined land, which makes the economic viability of returning it to its premining land use at least questionable.

There are several references to reclamation and reclamation success in the EIS; like the discussions on groundwater, they are largely hypothetical and NPRC's criticism of them can be incorporated here in the interests of brevity.

On page 60, in discussing impacts to visual resources, the EIS says that "mines located in these areas could also provide a resource for interpretive and educational programs." What programs? The statement apparently implies that mines are to be treated as a visual resource: NPRC is not aware of any mandate that BLM manage stripmines as a visual resource, or that stripmines are considered a visual resource for planning purposes. This statement certainly has no bearing on the discussion of the environmental impact of stripmining on the

visual resources of the region.
The EIS states further that no irreversible or irretrievabl commitments of visual resources were identified. The attention of the BLM is directed to Appalachia, to the old North-South railroad bed (which is still marring visual resources of the region 80 years after construction was abandoned) and to the power plants at Colstrip.

On page 60, concerning land use, the EIS states that "underground utilities, pipelines, and overhead power lines would modify agricultural land use but would not remove acres from production." This is not accurate. Rights of way for buried utilities can remove acreage from production. Overhead power lines certainly remove acreage from production. Railroad rights of way, and roads, remove not only the acreage right of way from production, but may also reduce or negatively effect production outside of the right of way by dividing ranching units or making divided fields unprofitable to develop or irrigate.

On page 61, concerning transportation, the fiscal impacts of necessary road improvements are not quantified. These costs should be included in projections of county budget expenditures and state expenditures.

The costs of noise pollution (reduced weight gain in cattle, etc.) are not but should be included in the EIS.

On page 62, under Sociology, the discussion of the impacts on housing should include discussion of the effect on housing costs and quality of housing, not just quantity.

Tables

The figures in tables 4-1A and 4-1B appear to be annual production from Federal state and private coal, and annual production from Federal coal only, respectively. However, the figures for existing mine production are identical in each table. This is impossible, since existing production includes production of federal and state coal at many mines (eg. Colstrip.)

The figures in table 4-3, total acres disturbed, do not add up from the categories listed to the total. Note 'c' indicates that "data breakdown of total acreage is not available". The breakdown comes out to less than 25% of the total. What is the remaining 75%? Should all totals be multiplied by 4 to get approximations for each category, is the 75% not included likely to be broken down differently? The table gives no indication of whether the regional percentages of land type are well approximated by the table.

Table 4-11, p. 78, projects no increase in population for Forsyth under any of the alternatives--yeat the EIS has

previously stated that some services (for example hospitals) would be met by facilities in Forsyth and Miles City. How can the use of facilities in Forsyth increase, without and increase in the population there?
Note 'a' says that projections of community populations are based on 1980 ratios of community to county populations. Yet it is obvious that Forsyth's population projection increase 10% is not based on a proportional increase from Rosebud County's population increase.

Table 4-18 (pp. 79-80) should include budget projections for the years 1985 through 1995, at least, and not just for 1990. A budget projection for just one year is not a good indicator of short and long-term impacts to the local communities, and could be very misleading. It is not a good use of the Coal Town model.
The data in the table are obviously anomolous. Budget surpluses are projected for Powder River schools and Broadus, figures that do not correspond to any real-world situation in booming areas. This data should have indicated to the authors that there were serious problems in the assumptions used in the model, unless an example of the type of budget surpluses projected here can be found to indicate that such surpluses are likely.

APPENDICES

The information in most of the appendices is of questionable use in analyzing environmental impacts. Appendices should be included describing the methodology used to calculate agricultural impacts, changes in water quality and quantity, changes in air quality, and socioeconomic and fiscal impacts. Inclusion of such information is clearly appropriate under NEPA regulations.

CONCLUSION AND RECOMMENDATIONS.

The EIS is clearly inadequate as written. BLM should reissue the EIS in accordance with the NEPA regulations cited in the introduction. The reissued EIS must include, at a minimum:

1) A thorough discussion of the need for the proposed action, including a discussion of the market for the region's coal and existing mine capacity, undeveloped federal leases, etc.

2) Important viewpoints on controversial questions such as the feasibility of reclamation, effects of mining on aquifers, and so on (this is in accordance with NEPA regulations.)

3) Notations in the EIS where data is lacking or inconclusive (this is also in accordance with NEPA regulations).

4) A thorough discussion of the impact of leasing on agriculture, including the effect on agricultural productivity (not just gross production), off-site impacts, the effects of railroad rights of way (not just in terms of right-of-way acreage), costs of replacement of shallow aquifers with deeper wells, aquifer "reinjection", etc.

5) A more detailed discussion of the impact of leasing on communities, including all of the parameters discussed by the Eastern Montana Growth Task Force. The analysis can not simply make the assumption that per capita expenditures in the budgets will be the same (in a community that must double its physical plant)in a boom period as presently, when most facilities are paid for and community expenditures are largely for maintenance.

6) The EIS must include analysis of the impacts of leasing each tract, as discussed above.

7) The EIS must include references to current, available literature on reclamation and the impacts of leasing on groundwater, much of which differs from the conclusions and assumptions of the draft as written.

8) The EIS must use a proper comparison of alternatives, as discussed above; the no-action alternative "baseline" cannot be compared to additional production due to leasing only.

9) A retraction of the false characterization of responsibility for removal of the lands in the Powder River Resource Area Management Framework Plan Amendments from the activity planning process.

10)Appendices describing the methodologies used, as discussed above.

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ROYAL LAND COMPANY

[illegible] WEST WASHINGTON STREET CHICAGO, ILLINOIS [illegible]
(312) 332 [illegible]

September 15, 1981

Mr. Chuck Wilkie
E.I.S. Project Leader
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

RE: Draft E.I.S., Eastern Powder River Basin Coal Leasing

Dear Mr. Wilkie:

Sohio makes the following observations concerning the Draft Environmental Impact Statement for the leasing of federal coal in the Eastern Powder River Basin:

1. Maximum amounts of federal coal should be proposed for leasing to allow competitive development of the best reserves available and to provide maximum economic return to the federal government. Sohio does not believe that the preferred alternative in the D.E.I.S. makes enough federal coal available.

2. Logical mining units, in which significant competitive interest has been shown, should be proposed for leasing. Sohio is the licensed operator, together with eight (8) other participants, in three federal coal exploration licenses covering the Spring Draw, Hay Creek and Calf Creek tracts; each of which is a logical mining unit. This is the greatest degree of participation in any federal coal exploration license program to date in the Powder River Basin. The large number of participants indicates the high level of industry interest in these logical mining units. Leasing of these desirable tracts provides: 1) higher bonus consideration to the federal government than would result from the leasing of smaller tracts having ownership or geologic constraints such as thin seams or high stripping ratios; and 2) greater regional competition. Sohio does not believe that the preferred alternative in the D.E.I.S. makes enough high-interest logical mining units available for sale.

3. Sohio is opposed to lease exchanges which are not based upon equal economic values or which are not in the best public interest. Holders of federal coal leases in these instances should be compensated for coal made unavailable to them by governmental action. The preferred compensation in these cases should be an award of bidding credits applicable in competitive lease sales rather than approving an inequitable exchange with widely disputed values or which would break apart a logical mining unit as has been proposed for the Spring Draw tract.

Mr. Chuck Wilkie
E.I.S. Project Leader

September 15, 1981
Page 2

3. (Continued)

Sohio believes it to be in the best public and competitive interest for the Regional Coal Team to make more viable logical mining units like Spring Draw, available for competitive bidding.

4. Relating specifically to the environmental impacts predicted in the D.E.I.S., the expected impacts associated with Alternatives 2, 3, and 4 in our view, do not clearly demonstrate the relative desirability of the preferred Alternative 3. In fact, it appears that less coal would be leased and more impacts occur with Alternative 3 than with Alternative 2. Moreover, the environmental impacts associated with Alternative 2 or 4 do not seem significantly greater than with 3, and Alternatives 2 and 4 would seem result in the leasing of more coal and more logical mining units than the preferred alternative.

Sohio recommends that the Regional Coal Team change its preferred alternative to one which: 1) results in more coal and more logical mining units being scheduled for competitive bidding; and, 2) preserves the configurations of high-interest logical mining units.

Sincerely,

ROYAL LAND COMPANY

R. E. Calkosky
Vice President, Exploration

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WYOMING CHAPTER
SIERRA CLUB
BOX 376, KAYCEE, WYO.
82639-0376

September 16, 1981

Mr. Charles Wilkie
Team Leader
U.S. Department of the Interior
Bureau of Land Management
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Wilkie,

Enclosed please find the comments of the Wyoming Chapter of the Sierra Club on the draft Powder River Regional Coal Environmental Impact Statement. We have reviewed the document and have presented our views on the accompanying pages.

I am sorry to say that we were disappointed with the document because there doesn't appear to be any need for it. Overproduction of coal has resulted in a reduced need to lease for coal. Therefore, we recommend that the Bureau of Land Management make use of the time it has to redo the dEIS and release it at such time as further leasing seems necessary.

Thank you ofr the opportunity to comment on this Environmental Impact Statement. Please send us any more information you have on it, as well as the final Environmental Impact Statement if you plan one.

Sincerely yours,

Mark Gordon
Chairman

enclosure

"Not blind opposition to progress, but opposition to blind progress."

WYOMING CHAPTER
SIERRA CLUB

COMMENTS ON THE DRAFT
POWDER RIVER REGIONAL COAL
ENVIRONMENTAL IMPACT STATEMENT

Recent developments in the national energy picture have reduced the need for additional leasing of coal tracts. Therefore, the Wyoming Chapter of the Sierra Club suggests that the Bureau of Land Management redo its Environmental Impact Statement on federal leasing in the Powder River Basin. On the whole, the draft *Powder River Regional Coal Environmental Impact Statement* suffers from incomplete -- or inadequate -- information, faulty or archaic assumptions, and careless consideration of important potential impacts to the people in northeastern Wyoming. The document would be vastly improved if these errors were corrected. As it stands, the EIS is nothing more than an outline of what a proper EIS should be. We hope these comments will assist the Bureau of Land Management in the revisions they should make to the text before it can be accepted as a valid decision maker's tool.

Demand for electricity has decreased over the past few years because the price per unit of electricity has risen so rapidly during that period of time. Consumers have started to conserve more than was expected by many utilities. In the period from 1973 to 1978 77% of our incremental energy supply came directly from conservation and efficiency improvements. From '79-'80 the United States did even more to conserve: about 91% of our economic growth came from conservation.[1] Last year that figure approached 113%; in other words, our efforts to conserve energy actually effected a reduction in the amount of power generated by utilities.[2]

Our ability to conserve major amounts of electricity has caught some utilities by surprise; many who did not accept this fact currently suffer severe economic hardship.[3] In fact, the fiscal condition of many utilities has prompted Congressional review of the problem.[4] Most utility analysts will admit that the problem lies in massive overcapacity; utilities are not able to sell a portion of their electricity because there is no demand for the power. Since many utilities have an impressive reserve capacity currently, demand for the fuels to produce electricity has fallen off.

1. Amory and Hunter Sheldon Lovins, "Good News About Energy," *New Age* (October 1980): 11,12.
2. Personal conversation with Amory Lovins.
3. Basil L. Copeland, Jr., Walter W. Nixon, III, and Scott C. Trotter, "A Corporate Maze that Spells Trouble for Arkansas," *The Arkansas Gazette*, (August 31, 1980)
4. *ESC Weekly Bulletin*, (February 16, 1981): C3-C6; *Ibid.*, (March 30, 1981): C5; *Ibid.*, (April 6, 1981): C8-C9

"Not blind opposition to progress, but opposition to blind progress."

Powder River Regional Coal EIS comments

Demand for coal has fallen off. A new draft report from the Congressional Office of Technology Assessment concludes that 200 million more tons of coal are being produced than can be currently used. The report also states that production from existing mines will increase over the next several years in response to demand.[5] Consequently, since the market for coal is dependent on the market and not on Department of Energy estimates, some description of the market place, and its potential trends would be in order for this EIS. Single-minded adherence to the DOE projects results in overleasing, overproduction, and unnecessary hassle for coal companies who have to respect "diligent development" requirements.

Another factor which should be considered in the EIS discussion of the market is the recent cancellation of provisions in the *Fuel Use Act of 1978* which required utilities to convert to coal or uranium by 1990. Since these requirements have been dropped many plants which might have converted to coal are not going to -- that means there will be even less demand for Wyoming coal.

As for the rest of the document, clarification is needed. Figure 2-1 is about entirely unexplained: Are the PRLA's included in the baseline figure? The assumption that the No Action alternative will result in greater impacts to the community is unsupported in the EIS. The impacts cited in the statement should be both generic (i.e., regional) and sight-specific. More mention should be made of the attendant problems of coal mining growth: divorce, child abuse, alcoholism, crime, etc.. Generally the document should be beefed up with more studies, more thought, and more accurate assumptions before it can be accepted as a good Environmental Impact Statement; for example, why is the reclamation of strip-mined lands assumed to be an successful? Granted there have been some notable successes in this field, but they are by no means universal. There are certain problems with reclamation in the Powder River Basin, and they should be covered in the EIS.

The Wyoming Chapter of the Sierra Club believes that the timing of this draft Environmental Impact Statement is inappropriate; an EIS on leasing in the Powder River Basin should be done when there is a demonstrable demand for the coal mined from these tracts.

5. Sierra Club, *National News Report*, (August 31, 1981): 3

2

Shell Oil Company

Jack L. McKelley
Vice President Mining

September 14, 1981

CERTIFIED

Mr. Charles Wilkie
EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Wilkie:

Shell Oil Company appreciates the opportunity to comment on the Draft Powder River Regional Coal Environmental Impact Statement. The following comments enlarge in detail the statement (attached) delivered by our attorney, William C. Lowrey, to the hearing panel in Gillette, Wyoming on August 19, 1981.

We are concerned with the designation of Alternative 3 as the preferred alternative. We are, in fact, unable to find in the minutes of the Regional Coal Team meetings any action by the Team with respect to adopting your recommendation of a preferred alternative. Assistant Secretary Carruthers' decision of June 22, 1981, to set a regional coal leasing target of 1.4 to 1.5 billion tons can be equally satisfied by Alternatives 2 or 3 with their several variations. Thus, we believe the statements on pages 1 and 18 referring to the selection of Alternative 3B as the preferred alternative are not accurate. Further, we can find no basis for the summary statement on page 1 that "This Alternative offers the most favorable ratio of coal produced to environmental impacts generated and is the preferred alternative". Alternative 2 appears clearly superior in that regard.

The tracts contained in Alternatives 2 and 3 are similar except Alternative 3 removes the Spring Draw Tract and substitutes for it the Kinta Creek and Kemlins Tracts; therefore, many of the impacts are identical. However, of those that differ, most seem to show the development of Spring Draw to have the far lesser impact. The following citations from the DEIS favor Spring Draw:

Table 2-1 (pages 22-24):

1. Eleven fewer wells would be destroyed; two fewer wells would be impacted.

Mr. Charles Wilkie 2

2. 2,000 fewer acres of aquifers would be removed.
3. Two fewer springs would be destroyed.
4. Total suspended particulates would be 1,400 tons per year less.
5. 6,800 fewer acres would have to be reclaimed. (See Table 4-3, page 70 also).
6. Eight fewer unit trains per day would be required to move the coal.
7. Average grade crossing interruptions would be 55 minutes per day (at five miles per hour) less.

Page 56:

"Spring Draw would increase TSP concentrations 1 ug/m^3 within one to two miles of the mine." "Kinta Creek and Kemlins are predicted to add less than 5 ug/m^3 of TSP in their vicinity in 1990 and 1995."

Page 65:

Alternative 2: "10) Loss of 1,200 acres for conversion of existing rural land uses to mine-related and urban uses." Alternative 3: "10) Loss of 12,200 acres for conversion of existing rural land uses to mine-related and urban uses."

Table 4-4 (Page 71)

Cumulative acres of wildlife habitat disturbed by 1990 according to hunt areas are 114 less for Alternative 2.

Table 4-6 (Page 73)

Average daily grade crossing interruptions at Torrington, Wyoming, would be one hour, 36 minutes less (at five m.p.h.) under Alternative 2 and car/train accidents per 100 years one less. Data for Miles City, Gillette, and Newcastle are the same for both alternatives.

There are a few factors cited in the DEIS favoring Alternative 3. These are:

Table 2-1 (Pages 22-24):

1. Alternative 3 would require 45 acre-feet less water for coal mining in 1990.

Mr. Charles Wilkie 3

2. The energy produced/energy consumed ratio is 1.25 percent better for Alternative 3. This is based on an assumed heating value of 7800 BTU/pound for the Spring Draw coal. However, this difference would be nearly eliminated if the 8,183 BTU/lb coal value, from the adjoining Buckskin Mine, were applied (Eastern Powder River Coal DEIS, page BU-10).

Pages 58, 59:

Impacts on wildlife appear somewhat greater at Spring Draw. However, the Tract Profiles suggest this may be a function of better documentation at Spring Draw as a result of data provided in the Permit Application from the adjoining Buckskin Mine.

Page 65:

Twenty-seven fewer cultural sites would be disturbed under Alternative 3.

In addition to data presented in this DEIS, the TRACT PROFILES also indicate Spring Draw (Alternative 2) to be less sensitive than Kintz Creek/Keeline (Alternative 3). These last two tracts exactly equal the delineated Two Top Tract; hence, the Two Top Tract Profile was used in the following comparison.

Page 21:

"Shallow groundwater exists and subirrigation appears to be occurring locally in the bottom of Kintz Creek and Black Thunder valleys. Groundwater is extremely poor quality." (See also page 42).

No comparable section is in the Spring Draw Tract Profile.

Page 22:

"The Kintz cemetery is located on Section 20, T.45N., R.79W. The cemetery and a 100-foot buffer zone would not be disturbed."

No comparable mine design problem is to be found at Spring Draw.

Page 43:

"The two producing oil and gas wells would be capped below the depth of the coal. Production lost by this action would be 67 barrels of oil per day and 127 million cubic feet of gas per day."

Mr. Charles Wilkie 4

There are no producing wells on the Spring Draw Tract.

Page 44:

"The Swainson's hawk nest would be destroyed by mining. The loss of this pair of hawks would represent 20 percent of the county population (79 percent probability)".

"Disturbance to the golden eagle nest during the breeding season (Feb. 15 - July 15) would cause nest abandonment."

No comparable problems are to be found on the Spring Draw tract.

Adverse impacts to wildlife through the life of the mine not identified in the Two Top Profile, but covered in the Spring Draw Profile (page 42) include mule deer ("losses not likely to exceed 75 animals"), sage grouse ("losses would be minimal"), short-eared owls ("would not be critical") and a prairie dog town ("with no sign of black-footed ferrets").

We feel all the foregoing well demonstrates Shell's strong belief that mining in the Kintz Creek and Keeline areas will have a much more severe impact on the environment than at Spring Draw.

We also believe the selection of Alternative 3 is not responsive to the demonstrated high level of industry interest at Spring Draw. This has been most recently shown by the participation of nine companies in a Federal Coal Exploration License drilling program on this and adjacent tracts. No such program has been conducted at Kintz Creek/Keeline. It is our feeling that this is a clear indication of industry's judgment regarding the relative economic merits of these tracts. We maintain that leasing of Spring Draw would result in more competition and a greater monetary return to the Federal government for coal leased than would result from leasing at Kintz Creek/Keeline. This would clearly be in the public interest. Another curious feature of Alternative 3B is, that of the six non-maintenance tracts included, three or 50% are Small Business set-asides and one of the three non-Small Business tracts, Duck Nest Creek, is essentially a maintenance tract (Duck Nest Creek Tract Profile, page 3). We doubt that such a tract composition in this first, long-awaited Powder River Basin lease sale is within the spirit and intent of the Federal Coal Leasing Program or in the national interest.

Mr. Charles Wilkie 5

We respectfully request that the preferred alternative under the DEIS be reevaluated in light of the concerns we have expressed. We believe that the preferred alternative should be modified to allow the leasing of the Spring Draw Tract.

Yours truly,

Jack L. Mahaffey

RCD:CKT:CC

Attachment

39

Interstate Commerce Commission
Washington, D.C. 20423

OFFICE OF POLICY AND ANALYSIS

September 15, 1981

Mr. Charles Wilkie
EIS Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, WY 82601

Dear Mr. Wilkie:

I am writing to forward comments of the Interstate Commerce Commission's Energy and Environment Branch (EEB) on the BLM Draft Environmental Impact Statement on the Powder River Coal Leasing Program.

Comment #1: Based on the information in Tables 1-1, 2-2, and 2-8, Alternative 3 would have 103 million tons (MT) of coal produced in Montana in 1995. Of that amount, 51 percent would be produced by existing mines. Of the remaining 50.4 MT, 12 percent would come from the Peabody noncompetitive lease in Rosebud County, 24 percent from the CX Ranch in Bighorn County, and 65 percent (32.8 MT) from the Tongue River (TR) Railroad area, which includes the proposed Montco mine, the NW Otter Creek tract, and the Ashland Coalwood tract.

I believe that the preferred alternative overstates the amount of coal which would come out of the TR Railroad area by 1995. This is due to the following: (1) the figure of 103 MT of coal produced in Montana in 1995 is very probably an overstatement.[1] A demand analysis prepared in conjunction with the preparation of the ICC's TR Railroad EIS indicates that demand for Montana coal will be 90 MT in 1995; (2) a comparison of the quality of the coal resource in the TR Railroad area with that of the coal resource in the Decker and Colstrip-Sarpy Creek areas indicates that it is very unlikely that coal from the TR area would capture 65 percent of new coal sales in Montana; and (3) even if it were assumed that TR area coal could capture 65 percent of new Montana sales, it is very doubtful whether mines

[1]/Page 13 of the DEIS acknowledges that, even though the DEIS assumes that all tracts offered under an alternative would be leased and mined within the time frame covered in the DEIS, "it is recognized that in reality coal production will be governed by market demand."

which might open in the TR area could achieve a production level of 32.8 MT in 1995, given the potential for delay which exists at the various stages of mine development.[2]

Comment #2: Overstatement of 1995 annual coal production in the Tongue River area and understatement of 1995 production in the Decker and Colstrip-Sarpy Creek areas would result in overstatement of environmental impacts for the TR Area and an understatement of impacts in the Decker and Colstrip-Sarpy Creek areas. One example of such overstatement in the TR area can be seen on page F-4, Figure F-3. This figure shows that, under the preferred alternative, there would be 17 train movements per day (TPD) on the proposed TR Railroad in 1995. The EER expects 1995 demand for TR Area coal to generate only 8 or 9 TPD on the TR line.

Comment #3: For the tracts being considered for leasing in Montana and which BLM expects to accommodate new mines, the assumption is made that 40 percent of the related socio-economic impacts will occur in Powder River County and 60 percent in Rosebud County. Nowhere in the applicable tract profiles or in the DRIS itself is there any explanation of what this assumption is based on. Preliminary work on the ICC Tongue River EIS indicates that Custer County would also incur a fairly sizeable portion of such impacts. The distribution assumption made by BLM would thus overstate socio-economic impacts on Rosebud and Powder River Counties and understate impacts on Custer County. Furthermore, BLM makes the assumption that all of the increased population in Rosebud County related to the new mines would reside in Ashland. The EER feels that the Colstrip area will receive a certain amount of population increase as a result of mining development in the Tongue River Valley. The reason for this is that within two years, the construction of Colstrip Units 3 and 4 will be complete and there will be surplus housing available in the town. Failure to take this into consideration results in overstatement of socio-economic impacts on Ashland.

Comment #4: The BLM DRIS does not account for trade patterns which result in induced employment in places such as Forsyth and Miles City, nor is it sensitive to location of indirect employment.

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[2] Since assessment of Alternative 3 in the DRIS was based on Subalternative 3C, the numbers quoted above also are based on Subalternative 3C. However, the same comment would apply to the preferred Subalternative, which is 3B. Under this subalternative, Montana would produce 96.5 MT in 1995, 58.5 percent of which would come from existing mines. Of the remainder, 60 percent would come from the TR Railroad area (Montco mine, and the Coal Creek and BN Otter Creek tracts).

Comment #5: From examination of Figure F-3, it appears that the number of trains on each segment of the BN line through Miles City was derived by assuming that all of the traffic flowing into the line moves to or from the east. For example, the 13 TPD (Alternative 3) on the segment between Sarpy Jct and Nichols appears to be the sum of the 8 TPD on the segment to the west of that line and the 5 TPD generated by the Sarpy Creek spur line. If an east-west split had been assumed for the traffic flowing into the BN line, TPD on the various segments could vary substantially from that shown in Figure F-3, as would environmental impacts associated with those TPD levels.

In addition, Figure F-3 shows that TPD on the Nichols spur will be 10 TPD in 1995 under Alternative 1 and 19 TPD in 1995 under the other Alternatives. However, as I understand it, the tracts in the Nichols spur area which would be leased under Alternatives 2, 3, and 4 are expected by BLM to be maintenance tracts, which would not increase production over baseline 1995 levels. If this understanding is correct, I fail to see why TPD on the Nichols spur is different under Alternative 1 than it is under Alternatives 2, 3, or 4.

Comment #6: Generally speaking, the document is difficult to interpret for two reasons. First, the organization of tables and narrative is confusing. One has to shift back and forth between sections and chapters in order to assess the validity of numbers and to correlate figures to the narrative. As an example, the figures on coal production under the various alternatives are not readily apparent in the DRIS. Rather, they were derived using Tables 1-1, 2-2, and 2-4. A second problem with the document is that the methods employed in developing the impact analysis for various resources is not apparent. Most of this information was supposedly prepared and summarized in individual tract profiles. It would be helpful to have at least a summary of these tract profiles available as an appendix to this report.

Comment #7: Table 2-2 erroneously lists the Peter Kiewit CK Ranch as being in Rosebud County. It is in Big Horn County.

Comment #8: The amount of uncommitted federal coal reserves shown for the maintenance tracts in Tables 2-4 are not consistent in all cases with the numbers in Table 1-1 in the Federal uncommitted reserves column.

Comment #9: The DRIS assesses soil, vegetation and wildlife impacts on the assumption that all of the land within a given tract will be disturbed. As between 20 and 25 percent of a logical mining unit may not be disturbed by mining, the EER feels a more realistic approach to the assessment of land disturbance impacts would be to calculate, based on a typical mine development, the total number of acres disturbed per million tons of coal mined, calculating also the number of acres to be used for mine facilities.

In addition, the DRIS should be modified to include information on differences in soil conditions and particular reclamation potential by area as well as the types of vegetation ranked in significance of vegetation lost.

Comment #10: The DRIS should contain a more thorough discussion of mitigating measures for terrestrial wildlife impacts, as well as of the potential impact of the expected increase in human population on wildlife. Both topics are treated rather superficially in the DRIS. Table 3-1 (p. 42) shows large amounts of wildlife habitat in acres, with no breakdown into major habitat types or a detailed discussion of the importance of these habitats. Furthermore, there is no explanation of how these large acreages were computed. On pages 58 and 59, there is a discussion of the loss of antelope and grouse, but again, there seems to be no discussion of how these losses were calculated. These figures appear to be worst-case speculations based on the assumption that local populations are at carrying capacity, losses will be total, and that all information concerning wildlife in the area is known.

Comment #11: Cultural Resources:

There are a number of problems with analysis of the cultural resource as presented in the BLM document. The principal problem again concerns the method in which land disturbance was calculated. It would assume that there was total disturbance of all tracts, as opposed to actually looking at the mineable area of a tract with a typical mine plan. Furthermore, the BLM developed a density ratio for sites in the region based on the number of surveys that had been conducted in the area. Many of these surveys were conducted at different levels of intensity, and there was no attempt to adjust for this distinction.

Furthermore, in Table R-6 (p. 72), which lists the number of sites to be impacted under each alternative, it is clear that while many sites could be potentially impacted by mine activity, federal and state statutes and regulations require only National Register eligible sites be considered in impact analyses and mitigation. There is no attempt to determine the total number of significant sites that would be disturbed and that could be considered a resource loss. While Appendix B, Table C-1 suggests the number of National Register eligible sites for some of the areas that have been surveyed, it is clear that the determination of eligibility has not been made for most sites that have been located in previous surveys.

It also should be noted that there are some corrections necessary to the BLM's cultural resource sections. On page 59, the BLM states that:

> The State Historic Preservation Officers (SHPO) in Montana and Wyoming, and the advisory council will determine significance. Any site identified as

> potentially eligible for listing on the National Register would be protected [National Historic Preservation Act, Section 6].

The Advisory Council on Historic Preservation does not determine eligibility for the National Register of Historic Places. The Keeper of the Register makes that determination. Moreover, by the BLM's own assessment, not all sites would be protected. Clearly, data retrieval of information from sites is the common mitigation practice and would be the suggested action on most sites in this area. The BLM indicates at the bottom of page 59 that "Buried sites would be lost." Obviously, this would not be the case should data retrieval be successfully conducted on eligible cultural resources. Finally, the appropriate section of the National Historic Preservation Act is Section 106.

Thank you for the opportunity to comment.

Sincerely,

Carole Dawkins

Carole Dawkins
Community Planner
Energy and Environment Branch

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII
1860 LINCOLN STREET
DENVER, COLORADO 80295

SEP 17 1981

Ref: 8W-EE

Mr. Charles Wilkie
Team Leader
Bureau of Land Management
951 Rancho Road
Casper, Wyoming 82601

Dear Mr. Wilkie:

The Region VIII office of the Environmental Protection Agency has completed its review of the Powder River Coal draft environmental impact statement (DEIS) and offers the following comments for your consideration.

The DEIS is generally well-written, organized and to the point. It appropriately spends its time discussing only the significant environmental impacts in any detail. As the DEIS correctly points out, all alternatives will deteriorate the air and water resources on a localized basis to varying degrees depending on the level of additional coal development.

The DEIS points out there are 87 preference right lease applications (PRLA's), various lease exchanges and lease proposals pending in the Powder River Basin in addition to the new tracts proposed for leasing which will be used to meet production goals. Because of the apparent "softening" of electrical demand, stemming from its higher price and the slowing of our economic growth, past energy demand projections and forecasts done by utilities have been lowered in recent years to reflect these trends. This trend seemed to be in evidence in the scoping meeting held on this project. Various industry, governmental and environmental representatives pointed out that many of the existing mines in the Powder River were having difficulties in establishing sufficient markets to sell their coal to capacity. A recent State of Wyoming report forecasts that in 1990, demand for Wyoming coal will be 175.5 million tons compared to known mine production capacity of 276.4 million tons (Wyoming Coal Production Survey, Wyoming Geological Survey, August 1981). Given these trends, we question the need for additional leasing at this time other than production maintenance leases at existing mines.

The fourteen tracts proposed for leasing were selected on the basis of a land use planning process which applied environmental and other criteria to determine their suitability. We agree with your proposal to use eight of these tracts to extend the life of existing mining operations. You should

-2-

consider using the other six tracts as exchange leases for existing preference right leases or other leases that may not be as suitable. This approach would provide a contribution toward our nation's real coal production needs, while insuring that coal development takes place on the tracts which are most suitable in terms of environmental and other criteria.

According to the system that EPA uses to rate draft EIS's, the Powder River Coal DEIS will be listed in the Federal Register as EU-1. This means that we have some environmental reservations relative to the project's impact on both air and water resources. If you have any questions regarding our comments, please contact Dennis Schecki of my staff at FTS 327-4831.

Sincerely yours,

Steven D. Durnes
Regional Administrator

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BURLINGTON NORTHERN

ENERGY AND MINERALS DEPARTMENT
COAL AND MINERALS DIVISION

600 First Northwestern Bank Center
175 North 27th Street
Billings, Montana 59101
Telephone (406) 657-8400

Mr. Charles Wilkie, Team Leader
Bureau of Land Management
Casper District Office
951 Rancho Road
Casper, Wyoming 82601

September 16, 1981

Dear Mr. Wilkie:

Burlington Northern Coal and Minerals Subsidiary would like to submit these comments as an addition to those presented at the public hearing in Billings on July 30, 1981. Again, we would like to reiterate that overall, we feel that the Draft Powder River Coal EIS is commendable and is an accurate basis for comment. We feel that the length of the document is a vast improvement over many past EIS's and is therefore less verbose and easier to follow.

We have one general comment to make on the tone of the EIS. We feel that the EIS gives the impression that larger degrees and amounts of mining associated impacts will result from federal leasing than we expect would occur from many of the given alternatives.

The fourth paragraph on page 31, Chapter 2, does not adequately explain the relationship between federal leasing levels and corresponding levels of production expected from market demand. The worst-case analysis is repeatedly described for each of the EIS alternatives. Nowhere does the EIS clearly describe what the most likely level of development would be if the market were allowed to function. Once this market clearing level has been identified, it should be stated that alternative levels of coal leasing over and above that necessary to clear the market would be unlikely to generate impact levels any greater than those associated with this market clearing level. After all, only that coal demanded in the marketplace will be produced regardless of how much "excess" federal coal is leased.

In addition to failing to establish the most likely level of production and corresponding impacts, the EIS continually refers to impacts associated with the various levels of production as expected levels of impacts. For example, under alternative four, if in fact this is truly a worst-case analysis, the tone should be clear as to imply that the impacts could be as high as or would be no more than presented under this alternative. All worst-case analysis levels over and above the most likely level of production should clearly state that they are worst-case projections and not actually expected.

Mr. Charles Wilkie
September 16, 1981
Page 2

We have a more specific comment regarding the social economic materials in Ashland which we believe are unnecessarily inaccurate. If several new mines are constructed in the northern Powder River Basin near Ashland, it does not automatically follow that the employees from those mines would live in Ashland. It is possible that arrangements could be made to provide rail or mine company bus service from Miles City to the Ashland area for mine employees, therefore shifting population growth to a larger town. Also, the EIS in several places points out probable local government deficits which would result from large scale developments. Although these deficits may be accurate projections, there is a substantial severance tax percentage for Montana coal which in part is intended to provide impact assistance for local communities. One would not get the impression from reading the EIS that monies from existing severance tax revenues are available for this purpose.

We would again like to thank the Regional Coal Team for allowing us the opportunity to comment on this document.

Sincerely,

M. P. Holmes
Project Coordinator

MPH/sd

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Fors th, Montana
Sept. 12, 1981

The Powder River Regional Coal Team
U. S. Dept. of Interior
Bureau of Land Management
2515 Warren Avenue
Cheyenne, Wyoming 82001
Gentlemen:

Thank you for sending me a copy of the Draft EIS regarding the prospects for leasing of coal in the Powder River region.

Due to the pressure of personal matters, I missed the reading of the deadline for questions which may be presented to you on October 2nd, in Billings. For this reason, I am asking your extension of that courtesy.

The map in the back of the EIS Draft volume clearly includes sections of privately owned land, property owned by our family corporation, underlain in part by Federally owned coal. This land is in 2N, 42E, adjoining Western Energy Company's Area D, at Colstrip.

Our family has sent word via letter, and by the form sent out by the Miles City B.L.M. that there is no Surface Owner Consent to mine the coal under those sections.

Why were they included in the map area of selected coal tracts?

The vagaries of the Groundwater section are certainly understandable. There has been no IN DEPTH study made of the adversities resulting from the mining of the shallow coal aquifer, either to the lower groundwater flows, or to the surface water. Nor has a factual and understanding study been made of the adverse impacts of the shallow coal aquifers to Agriculture.

In fact, the volume has been compiled with the major theme being LEASE THE COAL AT ALL COSTS, to the Agriculture of the area; to the unsuspecting public who really own the coal. Neither will ever find compensation for the loss they will have suffered at the hands of the opportunists within our State and Federal appointive offices.

It is my fervent hope the Powder River Regional Coal Team is not made up of people of such character.

Sincerely,

Patty Kluver

Patty Kluver

Will see you Feb 2nd.

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Testimony of Reed Zars, on the Powder River Draft EIS, Wednesday, July 29, 1981 - Casper, Wyoming.

REED ZARS: My name is Reed Zars. I am with the Powder River Basin Resource Council, and in the brief time that we have had this impact statement, around five days, I have at least been able to make a preliminary review of its sufficiency and would like to comment on that at least briefly.

First of all, the Resource Council, as many of you may know, is an agricultural group that has many members in Wyoming, many that live in the area that is to be leased or is proposed to be leased for additional coal, and I think we have a very specific interest in what happens today and what happens throughout this process.

First, I would like to reiterate our problems with the schedule. We just received this impact statement last week and would very much like to have more time to review the document. I understand there might be some additional hearings, and we would certainly support these. I think the turnout today is even indicative of the little time that the public has had to review this one.

Okay. Briefly, I would honestly say that this is the worst impact statement I have read. That's just pretty basic. I think it's clear that the impact statement began with the political objective--that is to lease more coal and only used the technical data to support a predestined conclusion. I think that's very sad, but there is no justification for additional coal leasing in the basin, and I think BLM, especially with the shift in administrations, is even harder pressed or harder put to find reasons to support additional leasing.

The only way, if you will look at this impact statement, is if you choose the high scenario for DOE's target and figure some 40,000,000 tons per year shortfall in 1990, but that high scenario is unrealistic, unimaginable, I would say, for the Powder River Basin.

On specifics, it certainly falls far short of analyzing any sort of demand for this coal. It picks up the DOE numbers, the 400,000,000 tons or whatever, and uses them as gospel when there is no backing support for why did they pick those numbers, especially in light of what's happening with electric growth rates today and industry statements themselves. I have chosen a couple out of the Casper Star Tribune out of the last month with Carter Mining saying we are not getting new business we had hoped for. There is a certain insecurity about the utilities, meaning utilities, because of the weak state of the economy which in turn means less electric power consumption, and statements by AMAX saying we are in a situation in which the industry is setting still because there are no markets. The goose is definitely not forever golden. Some of those eggs

could turn to lead, and we have production capacity in place for the most part. The problem is who is going to consume it. These are recent statements by the industry themselves, and if the industry can't even support to themselves publicly at least a need for coal leasing, what are we doing here today talking about more coal leasing? Well, as I said before, there is quite a bit more symbolism than anything else in the production targets.

There was no mention that I could find of any effect on the Clean Air Act and the bills that are now in Congress which might restrict the act's effectiveness, modified, but, in other words, the Clean Air Act is back in Washington now up for review. It may be scaled down. That is certainly going to affect all western coal markets. If sulfur dioxide standards are modified, diminished, so that they open up eastern coal markets, you can be sure that that's going to affect the western coals. No mention whatsoever that I could find.

Also, and I believe in direct violation of the regulations pertaining to this impact statement specifically, there were no site specific analyses of the tracts there were chosen, and I could read that portion out of the regulations talking about this environmental impact statement. The statement shall consider both the site specific potential environmental impact of each tract being considered for lease sale and the inter-regional cumulative environmental impacts. Nothing in here talks about the impacts of the tracts themselves in any specific line. I think that's a significant problem with the impact statement.

The regulations also ask BLM to consider schedule alternatives, different schedules that you could lease on. Again, and I would submit for political reasons, there is only one schedule considered, and that's 1982, and it's either no leasing in 1982 or three scenarios for leasing in 1982. There is no alternative chosen for just maintenance leasing which our organization feels might be the most reasonable. That is to say leasing for operations that are in existence now, but not leasing for new mines, not opening up new areas when we already have a tremendous over-capacity in the Powder River Basin today, and all estimates are for that to continue into the future, but there is no alternative that I can pick and say, well, the Powder River Basin Resource Council will support this alternative, because it's not in there, but that should be considered, so the only other option I am given in this statement is to consider the no action which is a real gen because it says that all of the PRLA's are going to be mined instead, and I would like if any industry person is here, for them to comment on that as to whether all of the PRLA's are going to be mined whether that would represent in any way some sort of reasonable alternative.

HEARING OFFICER BESSINGER: Excuse me. Eight minutes is up.

MR. SAXS: Okay. The PRLA argument stands with the other alternatives. Maybe the panel can correct me, but as I read the alternatives the PRLA's aren't considered in two, three, and four. They are just considered to the no action, and I can't understand why that's done.

Okay. Finally, I was on the OTA, Office of Technology Assessment, Task Force last year with many other people from Wyoming including the industry representatives and the state geologists, and so forth. We looked at all of the undeveloped leases that are in the basin now. Okay. There are about 2.9 billion tons of undeveloped leases that we gave favorable development potential status to. Okay? That's just about double the amount that BLM wants to lease right now that we have setting in place that's not even being developed. Okay. By 1991 in a task force we figured that in the Powder River Basin there is 350,000,000 tons of capacity that would be available, and that was to meet the ICF demand which was an industry-sponsored demand study for 226,000,000 by 1990 at Cary Glass from the GS kers in Wyoming with his 175,000,000 tons per year for 1990. Clearly we have the capacity. I would urge BLM and Secretary Watt and whoever else is in charge to consider these comments very carefully and that, in any event, a revised draft is needed for this impact statement beyond a shadow of a doubt because it falls far short of its requirements in law and its obligations to the public.

Thank you. Sorry, Glenn.

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COMMENTS TO THE POWDER RIVER COAL TEAM
ON THE POWDER RIVER REGIONAL COAL DRAFT EIS

DATE: July 30, 1981

LOCATION: Billings, Montana

SUBMITTED BY: Martin P. Holmes, Burlington Northern Coal and Minerals Subsidiary

Good afternoon. My name is Martin Holmes from the Burlington Northern Coal and Minerals Subsidiary. I would like to thank the panel for giving us the opportunity to offer our comments on the Draft Powder River Regional Coal EIS. The comments offered here today will be general in nature. We will submit more detailed written comments later during the comment period.

As you may know, Burlington Northern has just undergone a major reorganization. Our coal property management and development activities are now centered in a separate operating subsidiary based in Billings, Montana. As a result of this reorganization, we expect to take a more active role in the management of our coal resources. To do so, we know it is imperative for us to establish a closer working relationship with the Federal and State officers involved in coal management.

We have followed the efforts of the Powder River Regional Coal Team throughout this coal activity planning effort. The Regional Coal Team has made a commendable effort to reconcile the

divergent views of the many parties having an interest in renewed Federal coal leasing in the Powder River Basin. We feel the Federal and State employees who are responsible for preparing the Draft EIS and all of the many associated documents to date are to be applauded for their efforts. The length and format of the Draft EIS is a substantial improvement over its unwieldly predecessors, and it is adequate as a basis for comment.

My comments today will center around two issues--one dealing with the structure of the Draft EIS and the other with the proposed action itself.

The structural issue involves the treatment in the Draft EIS of the relationship between leasing levels and expected production levels and their resulting environmental impacts. The setting of the leasing target has apparently dictated the approach taken in developing estimated impact levels. In setting proper leasing targets, enough unobligated coal reserves must be made available to allow the marketplace to function properly to supply new demands by the least expensive reserves. To ensure this, the Regional Coal Team focused on the high DOE demand level for 1990. This is a reasonable starting point for the lease target setting process. However, we would argue that to allow the market to function properly, Federal leasing levels

should be set even higher than those needed to meet the DOE high estimate. The economic impacts of underleasing could be substantial. The impacts of overleasing are not as clearly discernible and are more easily mitigated.

Regardless of what leasing levels are included for study in the Draft EIS, we must not lose track of the fact that only that coal demanded by the marketplace will be produced. Increasing leasing targets to promote least cost production will not necessarily result in higher levels of production and increased environmental impacts.

The Draft EIS addresses this problem only in passing at the beginning of Chapter 2. Having pointed out the business reality, the Draft EIS then goes on to paint a picture of even larger impacts associated with increasing levels of leasing. It loses track of actual demand expectations. Figure 2-1 indicates that the DOE medium demand estimate is in fact lower than any of the leasing alternatives presented in the Draft EIS including the no-action alternative. We feel it is imperative that an effort be made to determine the impacts associated with the most likely level of development, i.e., the DOE medium, and that this impact level be the standard of comparison for the EIS. The other impact level estimates would then be put in a

better perspective as worst case levels only, and clearly not as the levels expected to result from the proposed actions.

We also wish to comment on the small business set aside tract that we understand is contained within alternative 3B, the perferred alternative. We support the concept of identifying limited numbers of tracts uniquely suited as set asides for development by small businesses. We feel that when the Regional Coal Team identifies potential mining units consisting totally of Federal coal, which it feels are suited for small business development, a set aside is appropriate. We do, however, question the advisability of setting aside Federal coal which can be best and possibly only mined in conjunction with substantial amounts of private coal not obligated to the set aside effort. In the case of the proposed Coal Creek, Montana tract, the potential mining unit involves significant reserves of Burlington Northern coal. This Burlington Northern coal is already under lease to another party who could not qualify as a small business. Therefore, we strongly suggest that the Regional Coal Team look to another area where it has an all Federal mining unit to offer for its small business set aside. In the future, Burlington Northern would welcome the opportunity to discuss with the Regional Coal Team potential sites for small

business set asides that require Burlington Northern coal to form Logical Mining Units. We would hope to identify for you either unleased Burlington Northern coal which could be offered under some form of cooperative leasing or Burlington Northern coal which has already been leased to a small business lessee.

Again, I would like to thank the Regional Coal Team for allowing us the opportunity to comment. We deeply appreciate the work that has been done to date on the Powder River Regional Coal EIS, and we look forward to submitting more detailed written comments before the close of the comment period.

Thank you.

NORTHERN PLAINS RESOURCE COUNCIL 45

TESTIMONY OF BILL HACKAY, JR.

for the

NORTHERN PLAINS RESOURCE COUNCIL

Powder River Region Draft Environmental Impact Statement:

Coal

July 30, 1981

Billings, Montana

NORTHERN PLAINS RESOURCE COUNCIL

TESTIMONY OF BILL HACKAY, JR. ON THE POWDER RIVER DRAFT EIS
July 30, 1981, Billings, Montana

My name is Bill Hackay, Jr. I am from Roscoe, Montana, and I am a member of the Northern Plains Resource Council.

I am here representing NPRC members in Powder River and Rosebud Counties who could not make it today because of the ridiculously short, and illegal, notice provided for this hearing. That notice, unfortunately, makes this hearing on the Powder River Draft EIS a pointless waste of the taxpayers's money.

This hearing is unnecessary. The coal lease sale which this EIS is supposed to evaluate is unnecessary. There simply isn't any demand for the coal BLM proposes to lease, and there won't be any demand for twenty years or more. A coal lease sale now would be an unproductive giveaway, an invitation to energy companies to speculate with public coal at the expense of the taxpayer. It will not advance our country's goal of reaching energy self-sufficiency.

The existing mines in the region are producing barely half of the coal they are capable of producing. In Montana, we have had miners laid off at Decker, at Colstrip, and at Westmoreland's Absaloka mine. And now we face the possibility of a slowdown at the Spring Creek mine, which just opened.

Even the Department of the Interior has admitted that this huge overcapacity may exist into the 1990's, even if no

new mines are opened. In the West alone, well over 100 million tons of overcapacity exists. There are also about 8 billion tons of federal coal--enough to last the entire country for almost 10 years--in Powder River Basin leases already handed to the coal companies. Most of these leases don't even have mining plans, because there is no market for the coal.

We were amazed last year when, despite all of this, BLM proposed to lease 776 million tons more. That would be a ridiculous and irresponsible handout to the coal companies.

The massive, uncontrolled leasing of federal coal during the 1960's was the major reason that the Department of Interior had to stop leasing coal in 1971, and design a new leasing program to prevent rampant speculation by private companies with the public's coal. But instead of correcting past abuses, the Department of Interior now seems to be intent on covering them up. In fact, Secretary Watt wants to add to past mismanagement.

Not content to handout just 776 million tons of unneeded federal coal to the very same companies who are already leading speculators in public coal--companies like Consol, Shell, and Pacific Power and Light--Mr. Watt has doubled the giveaway, to one and a half billion tons of coal. In other words, on top of billions of tons in existing, non-producing leases, and in the face of a huge overcapacity in existing mines, Watt proposes to lease enough coal to open six major new mines and expand production at several more existing mines. One and a half billion tons is far more than needed to meet the Department of Energy's

highest projection of demand--a projection which is widely regarded as greatly inflated.

The abuse may not end there. Mr. Watt has strongly hinted that he is going to double the 1982 giveaway again. Even a billion and a half tons won't be enough in handouts.

This EIS doesn't even try to demonstrate the need for this lease sale. That is the most serious deficiency in the EIS, but it is certainly not the only one.

This EIS is inadequate for two basic reasons, and a host of specific reasons. First, it does not include an analysis of the impacts of leasing specific tracts of coal, as it is supposed to do. Second, it does not have a realistic analysis of the impacts of not leasing coal, which is also a requirement.

The EIS, incredibly, claims that not leasing will have a greater impact than leasing. I don't know what the reasoning behind that claim is supposed to be, because the figures in the EIS itself flatly contradict such a conclusion. *

The absurdity of that statement is obvious. But the same twisted logic is found over and over in this EIS. For example, the EIS claims that aquifers ripped up by draglines will, miraculously, reappear stronger than before. Instead of destroying springs, as strip mining has done up to now, BLM says that strip mining may cause creation of new springs.

The EIS also manages to completely ignore the impact of a hundred miles of railroad running through the middle of

nearly every ranch on the lower half of the TongueRiver. The railroad would not be built unless the lease sale is held as proposed in this EIS, but the EIS doesn't discuss it.

And the EIS claims that reclamation in the Northern Great Plains has been proven successful--but it uses as proof studies that were done on reclamation potential, not on actual reclamation. The EIS blithely ignores studies conducted on actual reclamation efforts around the West that contradict its assumptions. Although not a single acre of land has yet been reclaimed to the standards set for release of reclamation bonds under Montana State law, BLM assumes that reclamation is an established success story.

There is not time today, or perhaps this year, to list all of the erroneous assumptions, mistakes, and gaps in this EIS. One more statement though, stands out. The EIS says, and I quote, "Energy production within the region is at an all time high and rapid growth is occurring." It is absolutely incredible that BLM can make this statement in the face of the huge slump facing the coal industry in this region. There isn't a single mention in the entire EIS of the current coal glut, the 50% overcapacity in area mines, the unemployment of area miners due to overleasing and overcapacity, or the billions of tons of federal coal already under lease. There is no mention of the unproductive, speculative profits that have been and still are being made at the taxpayers' expense with public coal.

This EIS is wholly inadequate, but that in itself is not surprising. What is surprising is that BLM would make such a

transparent attempt to whitewash Mr. Watt's 1.5 billion ton giveaway.

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STATEMENT OF WESCO RESOURCES, INC.

My name is Steve Elliot, Vice President of Wesco Resources, Inc., a Billings based natural resource development firm. In reviewing the Powder River Draft EIS, I notice a discrepancy that I feel needs the attention of the BLM. In the minutes of the May 21, 1981 Regional Coal Team meeting in Casper, I notice that the RCT was considering three alternatives to the Ashland (Coalwood) tract.(see page 1 attached hereto) Among other things, the tract was to be divided because it had a coulee dividing the two tracts into Coal Creek and Cook Mountain. This was done to satisfy the Coal Creek Mining Co.'s request for a small business sale. Further, no additional environmental work was necessary because it did not enlarge the area.

Then on page 5 and 6 of the same minutes Tim Gallagher of the State of Montana moved that the Ashland tract be divided into two tracts. This passed. He further moved that the Coal Creek tract be set aside as a small business tract. Referring to page 3 again, Tim Gallagher recommends that the tract be set aside as a small business tract and a large business tract.

On page 18 of the draft EIS, the preferred alternative is 3B which eliminates the Cook Mountain tract. No reason is given as to why this is the preferred alternative. In the summary, alternative 3 is the preferred alternative because it has the most favorable ratio of coal produced to the environmental impacts. I submit that this is an error for the following reasons:

1. The impact of mining in the Ashland area is basically

the same if mining begins on the Coal Creek tract as if it took place on the entire tract.

2. Montana did not recommend that the Cook Mountain tract be eliminated.
3. As I stated in Casper, the Ashland (Coalwood) area is not a good place for a small business set aside tract because the area is a checkerboard (railroad-federal) coal ownership area. Other existing business investments have already been taken by other companies in the area. For instance, BN has already leased their coal to another major coal company. I still believe that the mining of isolated sections is uneconomic. The tract selected for small business will be isolated unless the coal and surface interests can be consolidated. There is no guarantee that this will happen.
4. Finally, not as a matter of sour grapes,but the EIS team should be aware of the recent article showing the sale of the Coal Creek Mining Co. to interests that own the Chicago White Sox. This suggests to me that a true small business arrangement as contemplated by the regulations does not exist. (see attachment)

As I stated in Casper as did others, I think the tract should be put up for competitive leasing. In the alternative, I feel that the Cook Mountain tract should not be eliminated from this sale. If it is leased, the likelihood of Coal Creek surviving as a small

business tract and meeting the due diligence requirements is enhanced. This will happen because the large business interests in the area including Peabody, Burlington Northern, Cities Service and Consolidation Coal will have a significant impact on the timely development of coal in the Ashland area. Without their development, the economics won't exist for Coal Creek to mine 5 million tons a year.

Thank you for the opportunity to appear.

July 30, 1981

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COMMENTS BY SHELL OIL COMPANY - MINING DEPARTMENT
ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT
PREPARED FOR THE POWDER RIVER BASIN

I am William C. Lowrey, attorney for Shell Oil Company, Mining Department, headquartered in Houston, Texas. Shell appreciates the considerable efforts that have been exerted by the BLM in preparation of this DRAFT Environmental Impact Statement for the Powder River Basin, and we welcome the opportunity to comment on the document while it is in this preliminary stage. Our comments will focus on the selection of the preferred Alternative. We are concerned that we are unable to verify that the RCT made any public decision selecting Alternative 3, or, in particular, Sub-alternative 3B as the preferred alternative. We are also concerned that the selection, however accomplished, is not supported by the information available to the Team. Data from the DEIS and tract profiles indicate that Alternative 2 is more environmentally acceptable than Alternative 3. Furthermore, current industry interest strongly suggests that competition would be more intense in an Alternative 2 sale.

The Powder River DEIS, on page 1, states:

> "The alternative selected by the Regional Coal Team (RCT) as the preferred alternative would offer for lease in mid-1982 14 tracts which would result in an average annual production of about 50 million tons."

Additionally, a statement appears on page 10 of the DEIS that "Sub-alternative 3B has been selected as the RCT's preferred alternative."

DEIS

A reading of the minutes of recent RCT meetings shows that the Team made no public decision whatever with respect to a preferred alternative. Both Alternatives 2 and 3, with all their variations would closely fit the recommended coal leasing target of 1.4 to 1.5 billion tons adopted by the Assistant Secretary on June 22. It follows that the statements previously cited appear to be inaccurate. Furthermore, in our opinion such a selection is not supported by the data presented in the DEIS and the tract profiles.

We do not believe that Sub-alternative 3B is the most environmentally acceptable alternative to reach the leasing target. The tracts contained in Alternatives 2 and 3 are identical except Alternative 3 removes the Spring Draw tract and substitutes for it the Kintz Creek and Keeline tracts, therefore it is not surprising that in some respects there are no significant differences in the socio-economic or environmental consequences of the two alternatives. Nevertheless, data in the DEIS indicate that the selection of Alternative 2 with the inclusion of the Spring Draw tract would result in a number of significantly reduced environmental impacts related to hydrology, air quality, disruption and reclamation of land, volume of rail traffic, loss of rural land use, and disturbance of wildlife habitat.

In contrast, the counterbalancing environmental factors favoring Alternative 3, those factors that must have been relied upon by BLM in selecting the preferred alternative, appear relatively minor and may be based in large part upon variations in the amount and quality of data utilized in the analysis.

DEIS

The Tract Profiles for Spring Draw and Two Top (Kintz Creek/Keeline) contain additional environmental considerations covered only lightly or not at all in the DEIS. Significant differences in environmental impacts favoring selection of Spring Draw are related to mining of alluvial valleys, cultural disruption, disturbance of critical wildlife habitat, and interruption of existing oil and gas production.

We recognize certain of these factors have more weight than others. Nevertheless, any summation of the impacts would seem to favor the selection of Spring Draw over Kintz Creek and Keeline and we are at a loss to understand the summary statement that Alternative 3 "offers the most favorable ratio of coal produced to environmental impacts generated."

There are other factors that should be considered in selecting a preferred alternative. Industry has consistently expressed an interest in the Spring Draw Tract. A recently completed Federal Coal Exploration License drilling program on the Spring Draw Tract involved participation by nine companies. No such program has been conducted at Kintz Creek/Keeline. It is our feeling that this is a clear indication of industry's judgment regarding the relative economic merits of these tracts. We maintain that leasing of Spring Draw would result in more competition and a greater monetary return to the Federal government for coal leased than would result from leasing at Kintz Creek/Keeline. This would clearly be in the public interest. Another curious feature of Alternative 3B is, that of the six non-maintenance tracts included, three or 50% are Small Business set-asides. We doubt if that percentage in this first, important Powder River Basin lease sale is within the spirit and intent of the Federal Coal Leasing Program.

DEIS

We respectfully request that the preferred alternative under the DEIS be reevaluated in light of the concerns we have expressed. We believe that the preferred alternative should be modified to allow the leasing of the Spring Draw Tract.

Shall appreciates the opportunity to present our comments on the DEIS to this panel. We also plan to submit a more complete written comment which will reference the details on which our statements this evening have been based.

Thank you.

Testimony of Dr. Watt, on the Powder River Draft EIS, Wednesday, August 19, 1981 - Gillette, Wyoming.

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DR. WATT: I am John Watt, Arvada, Wyoming, retired college professor and presently a rancher doing research on cattle hybridization.

I was hoping there would be many speakers to cover most of the topics so that I could simply add comments, wishing to speak as little as possible. However, there are two or three things that concern me especially. Recently, at the Bank of Commerce in Sheridan I noticed an article in the Casper paper saying that at Kemmerer, Wyoming, they were planning to extend a--well, I mean coal mine, strip mine, to 1,000 feet depth and leave the hole open for water storage.

The last time Dr.--I mean Senator Hansen spoke in Sheridan just before his retiring he stated that mining, strip mining, in Germany was to a depth of 1,200 feet. At that meeting I asked him if he knew anything about any leaving of the coal holes open for storage and suggested that that was something he had to look into. A depth of that kind would certainly be a means of restoring water to aquifers which might have been disturbed. I, therefore, very highly recommend that we give consideration to that and doubt--and I have unfortunately not seen a copy, but doubt that this is here.

Governor Hathaway proposed while he was governor that they build a dam two and a half miles above Clear Creek on Clear Creek to store water, 135 feet of water, to be sold to Gillette and to coal companies looking especially towards getting a gasification plant in this area. Thus, if you have any significant coal under the water the depth might compensate for the height of the dam.

Now, we might apply also to Moorhead. We have a well about a quarter of a mile south of the south footing of this Hathaway Clear Creek dam site. The well is 500 feet deep. We have the logs from 300 down to 500. In that 100 feet there are two seams of coal, each of which are 39 feet thick and some others thinner.

A local map man--was employed by some eastern money to put together a lot of coal in this country. He studied many of the wells in the area as recorded in Cheyenne. He found that there were characteristically, over the entire area from Kendrick Siding on Clear Creek and Arvada on the Powder River down to the Montana line, consistently 100 feet of coal above or below the 200-foot level and above the 200-foot level there were irregularly local additional seams, thus corresponding to the log of our well.

In addition to that we have a well about 200 feet deep about a mile north and in that one we have 40 feet of coal which would come in that surface variable area. Thus, it appears likely that there would be from a hundred to 140 feet of coal submerged by the Hathaway dam and reservoir site.

Now, if we took that hundred--140 feet of coal out of there we would probably have more storage because the--the water plus depth would be 135 feet at the dam, but that would taper off to zero at the upper end leaving an average of somewhere around 60 feet. Thus, a hundred feet of coal taken out would provide more water storage and an a permanent sort of basin.

There was an earlier plan for a railroad from the Kendrick Siding which was the point in which the study was made down Powder River on the east side to a point about three miles above the Hathaway dam site. There it crossed the river and went on down to a point about a mile below the dam site. At that point it turned up Cabin Creek, crossed the divide into the--to the north slope and down Otter Creek to Ashland, Montana, thus traversing an 80-mile strip of coal all the way from the juncture to the completion of that line.

Now, if that--if they had a hole there instead of a dam, reservoir, that railroad line could still be built and be an immediate shipping point for all that coal, simply by making a fill as they remove the line, the railroad line, over to the fill which would carry it. If this now were extended, there is one proposed also from Miles City to Ashland. If both of these were constructed, Gillette then would have a coal shipping railroad to Chicago which would be at least 100 miles shorter.

Now, concerning the mineability of Powder River coal, this part where I was hoping that somebody else might comment particularly, but being unsold I guess I will have to initiate it much as I would hate to. Concerning the mineability of Powder River coal, it is very important that we understand how washouts heal themselves, a term which I doubt any of you have ever heard.

After seventy years observing the environment and many years of that as a post-graduate person with a Ph.D minor in plant ecology and broad studies in the field of biology, the term 'fragile alluvial valleys' just has never sounded right to me. I have been very badly disturbed by it.

About four or five years ago a young fellow from one of the Colorado universities stopped by the ranch looking for information he could use in a master's thesis on the topic of self-healing of washouts and streams. That gave me a word to think. In other words, we usually think in terms of words, and it immediately cleared that feeling of unrest in my mind about the unsatisfactory nature of that term.

Now, the nearest thing I know to a fragile alluvial valley is Powder River along, possibly, with Platte.

HEARING OFFICER CURRIER: Excuse me . Doctor, could you summarize the rest of it, please?

DR. WATT: Yes. I have about four more, five more, lines.

This would be the nearest thing. About 1901 Frank Kelsey, who later moved down into Montana senator and the one who proposed the Hoorhead Dam at a meeting of our local neighbors said, "After all, Powder River is a pretty good old stream. It's true that it takes land away on one side, but it gives it right back to you on the other." He did not say, but could have and should have that it gives it back at a lower and more useful layer which I submit to you is an example of one of the numerous ways in which rivers self-heal themselves.

Testimony of Ed Svarte, on the Powder River Draft EIS, Wednesday, August 19, 1981 - Gillette, Wyoming. **49**

MR. SVARTE: My name is Ed Svarte. I am a rancher north of Gillette, Wyoming, and I have been asked to say a few words tonight on behalf of the Powder River Basin Resource Council of which I used to be on the board of directors. I have not been for several years. They asked me to say that they remain opposed as they did before to additional coal leasing when there is such a tremendous quantity of coal already under lease, and one of the main points that they wanted me to make is that, according to the Wyoming Geological Survey done by Gary Glass in 1980, that nine years from now in 1990 the state total demand for coal will be one hundred seventy-five and a half million tons and the probable 1990 mine capacity, same year, will be 278.4 million tons, which would show that existing mines would only be operating at 63 percent of capacity.

I think you probably heard and seen these figures before and yet the BLM seems determined, and Department of the Interior, to go ahead with coal leasing regardless of what the demand will be.

Basically, those are my comments for the Powder River Basin Resource Council. I have additional comments I would like to make on behalf of myself as a rancher in the area where some preference right lease applications will be issued to a company very soon.

Because of my former activities with the Powder River Basin Resource Council, I got a copy of this Draft Environmental Impact Statement on coal which I probably wouldn't have obtained otherwise. While gleaning through it on Page 27, I happened to see that--Page 27, that on my ranch--parts of my ranch by 1990 they are estimating a mining of four and a half million tons of coal, by 1995 14,000,000 tons of coal. I

have not given my permission to anybody to do this. There has been nobody talked to me about coal since 1972. The company that will get these preference right lease applications, which they intend to mine from the looks of this Draft Statement, when they were last on my ranch drilled several exploration holes, one of which was very close to my house. Shortly thereafter, I lost my good house water.

Thinking my well had caved in, I drilled a new water well and completely cemented the old one shut. That didn't help the water supply. It would make you sick to drink it and you couldn't wash a load of clothes because of the rust.

After checking I found out that this company had not separated any of the water sands with a plug and consequently I felt that after spending over $10,000 out of my own pocket trying to get the water back I felt that it was their obligation to prove to me that they had plugged the holes which they said they didn't plug the holes, and they said they would be glad to pay me for my damages if I could prove it in court.

This is a company that you guys are going to grant a lease to, that they don't have to bid on competitively, and that they don't have to pay very much money for, and I think there should be some way to issue these preference right lease applications to companys that are going to be good citizens.

This same company in the late Sixties and early seventies, as I understand it, was working in the Bull Mountains of Montana. At that time they were running over ranchers, abusing them, leaving gates open,

actually threatening them with physical damage for trying to keep them off of their own ranch lands, and I think if you will check, I don't know the exact date because I do not have the article, but it was the source of an article in the National Geographic magazine. If you have ever been associated with them, they don't print anything that is not true. This particular company was certainly abusive to ranchers in the community in the Bull Mountains area of Montana.

I think, like I said before, it behooves you to find what kind of corporate citizens you are issuing these basically free leases to before you just turn them loose.

As I said before under the other comments that--that the mining capacity is going to far exceed the demand. About every article you read shows that.

Heared the bull out of me in the Casper paper Sunday. Study says Wyoming faces big bust by 2010. They are going to lose their market for coal according to one study which apparently is done by reputable people. People are going to go to alternative energy sources as much as possible. The fossil fuel market is going to be down. I might not be here in 2010, but I don't want my children stuck paying taxes for a bunch of things that we are building now and over-building like schools and hospitals, public facilities in Gillette and Campbell County, Wyoming, that the landowner, the rancher, who is trying to make a living is going to be stuck paying off further down the line.

Don't over-lease. Don't over-build the coal mines. I think you are very close to getting on the verge of that. There are quite a lot of existing coal mines in Campbell County right now. They are probably coming quite close to reaching or will come close in the next years to reaching the carrying capacity of the railroads. They are going to have to build more railroads. I don't think we need to build more mines. I think, if anything, any more leases are issued or anything is done it should be in the area of keeping existing mines operating, keeping them with a good supply of coal. Don't operate the mines at 60 percent. Operate the mines at 80, 85 percent if you can possibly get there. Don't build more new mines that are going to be operating at fifty percent where they are all going to go broke. It's a tremendous investment for these companies to build a mine, and I think with the actions that you are coming close to taking in issuing so many more new leases you are very apt to help this want that we are being faced with, according to this study.

I have on my ranch probably one of the finest deer herds in the entire area if not in the state and maybe in the world as far as quantity goes. Wildlife is treasured over me highly that I can't believe it, and I don't want you to take my word for this. I wish you would talk to the local Game and Fish Biologists, wardens. My ranch has probably been repopulating the entire northern part of Campbell County after the, quote, death losses that occurred in '78, '79 or whatever the actual years were listed in the report under wildlife.

There is another little item I would like to bring up at this time. I am not sure if it was under your authority or under somebody else's, but about two weeks ago starting at about 6:30 in the morning until about 10:30 there was an airplane flew low and slow and circled my ranch and several neighbors' ranches, just kept flying low and slow, nobody around. None of my neighbors knew what was going on. None of them knew who it was, why they were doing this. It turns out that it was a survey being done of eagles' nests.

About two days later a guy walks into my house and says, "Oh, we have been surveying your ranch for eagles' nests. Do you know you have two?" I said, "No, I have three." I said, "Why didn't you come and talk to me before you wasted taxpayers' dollars and upset everybody in the country out there?" There was one of my neighbors actually ready to shoot him down, had his rifle out. He was so tired of that airplane circling. He didn't know whether he was poaching, if he was coyote hunting, what he was doing, but he was hired by, I believe, the U.S. Fish and Wildlife Service.

Like I said , I don't know if it has anything to do with this statement, but if it does, it behooves you people for whatever reason this survey was being taken to notify the ranchers, because we still feel that we have a right to control what goes on over our place, and if four hours an airplane circled, it would make you very nervous if you owned a ranch, I am sure, but to me they wasted their money. They spent four hours circling the country finding two eagles' nests and I have three. We said, "The people up around Recluse," but nobody--we aren't around Recluse, and none of my adjoining neighbors who I phoned knew anything about it.

I would like to talk on a lot more, but I would like to close with the statement that I reiterated two or three times. Please don't over-lease the coal. Don't get so many mines working that none of them can operate efficiently. If the bust comes, don't--don't have facilities built so much on the tax rolls and under bond issues that the people who are planning on staying here cannot make a living.

I appreciate the time that you gave me this evening to make these comments and thank you very much.

MR. SWARTZ: Okay. Ed Swartz again. I noticed one thing on that map that was issued that the Gas Draw Oil Field, part of which is on my ranch, was not listed on this, and about 1977, 1978, or '79, I don't know exactly when, that was the ninth largest oil field in the State of Wyoming in terms of oil produced, and those figures I got in the Casper Star Tribune annual energy issue, and I think the map maker really slipped there when he doesn't even realize there is an oil field in the middle of a possible lease tract of coal.

That's basically the only thing I forgot. Thank you.

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Testimony of Mr. Matthias, on the Powder River Draft EIS, Wednesday, August 19, 1981 - Gillette, Wyoming.

MR. MATTHIAS: My name is Robert Matthias. I am with the Royal Land Company in Denver, Colorado. Royal is a subsidiary of the Standard Oil Company of Ohio popularly known as Sohio.

I appreciate the opportunity to be here tonight and to make comments regarding the Draft Environmental Impact Statement on the Powder River coal leasing.

Further clarification of the Royal Land Company--Royal, as the gentleman from Shell mentioned, is the lead company in the exploration program which was recently concluded on the Spring Draw, Camp Creek, and Hay Creek tracts north of Gillette.

While I am here this evening I would like to make four main points. The first is that Royal feels that the more federal coal that is leased, the better. The Regional Coal Team will not cause coal to be mined. The marketplace will. Coal will not be mined and sold that the marketplace will not accept. The Regional Coal Team can only have negative impacts or impede the market mechanism by not leasing enough coal or by leasing uneconomic coal leaving unleased coal which is more competitive.

Royal does not believe that the alternative recommended in the DEIS makes enough coal available for sale.

The second point I would like to make is that Royal feels that the more logical mining units or LMU's that are available for lease, the better. As I mentioned earlier, we are conducting the exploration program on the Spring Draw, Hay Creek, and Camp Creek tracts which have a total of nine major companies as participants. I believe that shows the high level of industry interests in logical mining units.

The leasing of logical mining units leads to higher prices for federal coal than does smaller tracts having adjacent ownership problems or other physical constraints such as poor quality, thin seams, or generally high stripping ratios which prevent that tract or any given tract from being a viable economic entity or logical mining unit. Royal does not believe that the recommended alternative in the DEIS makes enough LMU's available for sale.

The third point I would like to make is that Royal Land Company is opposed to lease exchanges. Federal coal lease owners should be compensated for coal made unavailable due to government action such as the construction of Interstate 90. Compensation, however, should be in terms of bidding credits to be used in competitive bidding rather than as a wholesale exchange for LMU's such as was proposed earlier in Utah or by covering up what would otherwise be an LMU as has been proposed in the Powder River Basin such as the Spring Draw Tract. Although compensation for I-90 coal has been required by Congress, Royal believes it is the Regional Coal Team's responsibility to ensure the competition for tracts is fostered by minimizing as many tracts as possible as LMU's and by ensuring that as many LMU's as possible are put up for sale. If these or if any proposed lease exchanges have played any role in the tract ranking, the tract selection, or evaluation of the alternatives considered in this DEIS, this is unfortunate.

Royal would like to see more coal and more LMU's leased than proposed under the recommended alternative.

The fourth and last point that I would like to make relates specifically to the environmental impacts predicted in the DEIS. The expected impacts associated with Alternatives 2, 3, and 4, and the various sub-alternatives do not in Royal's opinion clearly show the relative desirability of the recommended alternative. In fact, it appears that less coal will be leased and the impacts will be greater with the recommended alternative than with Alternative 3B. The environmental impacts associated with Alternative 4 do not seem significantly greater than with 3B, but would result in the leasing of more coal and more LMU's than the recommended alternative.

Royal Land Company respectfully recommends that the Regional Coal Team change its preferred alternative to one which results in more coal and more LMU's being leased and that, henceforth, the economics of coal production be given much more consideration than in the past.

Again, I thank you for the opportunity to make comments on the Draft Environmental Impact Statement.

My notes are not in the form that you would find usable and I will follow this up with a detailed written letter to you in the next few days.

Testimony of Mr. Symonds, on the Powder River Draft EIS, Wednesday, August 19, 1981 - Gillette, Wyoming. **51**

MR. SYMONDS: My name's H. G. Symonds, and I am affiliated with the Powder River Basin Resource Council, and is it okay for me to proceed?

It seems we already have quite a bit of access in the past to the Powder River Basin now and leasing at this time when there is a low coal market would seem to give the government a problem of low rate of return and allow a small group of companies to acquire leases quite cheaply and, thus, lease up a large amount of property and may hamper the development of the coal, so locking up the coal, and so on, I don't think would do anything to benefit the economy of the local area or the country--would end up in disruption of the local agriculture, socio-economics.

I am finished.

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August 20, 1981

COMMENTS TO THE POWDER RIVER COAL TEAM ON THE POWDER RIVER REGIONAL COAL DRAFT EIS

Submitted by: F. Clayton Tannenbaum, President and part owner of Coal Creek Mining Co. on August 20, 1981 in Broadus, Montana.

I would first like to comment on the testimony of Martin Holmes of the Burlington Northern Coal & Minerals Subsidiary at the public hearing on the draft Powder River Regional Coal EIS held in Billings, MT on July 30, 1981. Mr. Holmes questioned the advisability of setting aside the the Coal Creek Tract in Montana as a small business tract. He said that the Coal Creek Tract was unsuitable for small business leasing because of Burlington Northerns checkerboard coal holdings in the tract, and the fact that they are leased to another large coal operator. This large coal operator is the Peabody Coal Company with when Coal Creek Mining Co. had to deal, in conjunction with the Burlington Northern, to lease the coal reserves we are presently mining. We point this out to illustrate that this type of leasing activity is relatively common, and that Coal Creek Mining Co., a small coal miner, has done it before with exactly the same two companies.

I would next like to comment on the testimony of Steve Elliot, Vice President of Veco Resources at the same meeting in Billings. Mr. Elliot made much the same objection to the Coal Creek Tract being set aside for small company bidders as had Mr. Holmes of the Burlington Northern, and for the same reasons. These reasons being again, the Burlington Northern checkerboard coal holdings in the tract, and the fact that they were leased to a major coal company the Peabody Coal Company. My response to Mr. Elliot on this issue would be the same as my response to Mr. Holmes.

Mr. Elliot brought up the recent Coal Age article that was written about my partner, William F. Farley. Bill Farley is a minor shareholder of the Chicago White Sox Baseball Team. He is one of app. 40 investors in the syndicate that owns the White Sox. Bill Farley and I are the sole owners of Coal Creek Mining Co. and it is our opinion, as it is the opinion of our attorney, that Coal Creek Mining Co. is a small business, and will be so qualified by the Small Business Administration if we are the successful bidder on the Coal Creek small business tract.

Thank you for allowing me to make these comments.

F. Clayton Tannenbaum

Town of Broadus
Box 647 Broadus, Montana 59317 Ph. 406 436 2405

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RE: Powder River Basin
Draft Environmental Impact Statement
1792-PR EIS

It is not my intention to become an "expert" and nit pick the DEIS, however since several people who are experts in their field will be reading this document, it is my intention to have certain facts brought to light or expanded from those now included in the sociology and economic areas.

Page 14, number 9 (Assumptions). The time frame is acceptable provided all goes well under the Montana permit system, however this time frame has not been incorporated into the alternatives nor has attention been given to "lead time" in regard to revenues and capital expenditures.

Page 62, (Sociology). Community services and facilities are restricted to personnel services. Other community services are defined as water supply, waste-water and solid waste disposal. Here again, little attention has been given to these items which require lead time to develop. Teachers, Doctors, Dentists, Law Enforcement etc. will be needed but no mention is made of where they will conduct their classes, practices etc. and within what facilities.

Page 63, (Economics). "10% of any resulting population increase is expected to reside in Powder River County" would have been sufficient. The word "only" preceding it causes the reader to ignore the facts shown on the tables. Table 4-11 totals 4,723 projected population. Table 4-10 totals 4,005 projected employment. Table 4-9 totals 2,150 dwelling units (projected). Table 3-7 shows 2,523 existing population and 1245 existing employment. Table 3-6 shows 1,123 existing dwelling units. Assuming that you mean total population and not additional population on table 4-11 it means that there will be an 87% increase in population, 222% increase in employment and a 91% increase in dwelling units. Now these are pretty overwhelming figures when you realize that not one dollar is available prior to the actual production of coal. Naturally, Rosebud County statistics are worse.

I am convinced that the key to the inequities of the socio-economics of this particular DEIS are summed up in the first paragraph of ECONOMICS/Montana on Page 63, which states:

> Montana counties, schools or communities do not receive a percentage of the severance tax on mineral production from the state. However, in an effort to tie potential benefits to potential costs in the analysis of Alternatives 2,) and 4, additional revenues to local entities were estimated on the basis of coal production.

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Page 2

Revised with Mineral war 10,20.81 #3 9mm...

That particular paragraph leads me to believe that the entire leasing alternatives were based on Wyoming laws. Montana counties, schools and communities do not receive a direct percentage of the severance tax on mineral production from the state. Montana counties, schools and communities also do not receive direct percentages of the federal mineral royalties. Indirect percentages are received from other federal and state activities but are restricted in use. Another interesting fact which really has not direct effect on the coal leasing is that upon full production of mineral activities, valuations increase, and several millions are expended by mineral producing counties thru a special 40 mill levy for the state school foundation program. All funds returned to counties from foundation and equalization funds are based on ANB and are not available for actual needs. Where, in all of this, can there possibly be a fiscal surplus!

Incorporated cities and towns received no direct revenues from mineral production, and are supported by real estate and portions of state gas, liquor and other miscellaneous taxes. Water, wastewater and solid waste are supported by users charges and are required by law to be self supporting. All unincorporated communities are the responsibility of their individual counties.

Page 3 has one small item which needs clarification. The four new leasing alternatives located in Powder River County are in a joint Rosebud/Powder River school district #32J. Any increase in valuation within that district will help that portion of Rosebud County. The lead time for building schools is still required as well as the money to build it.

I am in full agreement with the statement "Most of these impacts could be mitigated but only through strong community commitment and assistance from both federal and state governments."

The 1981 Powder River County Update to the Comprehensive Plan has covered many of the points just addressed. It has also referenced some state laws, mitigation strategies, and financing alternatives.

In closing, I would like to ask that the final EIS address the differences in state laws, or more specifically, the Montana laws concerning revenues and expenditures. I am particularly concerned with impacts on incorporated small towns because of the double tax structure which they must maintain.

Respectfully submitted,

Helena J. "Lonnie" Beach
Town of Broadus Clerk-Treasurer
Powder River County Planning Board
Town Building Official

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TESTIMONY OF WALTER ARCHER
POWDER RIVER COAL LEASE SALE DRAFT ENVIRONMENTAL IMPACT STATEMENT

August 20, 1981
Broadus, Montana

I am Walter Archer. I ranch near Olive, Montana, in Powder River County. I am President of the Powder River Protective Association, an organization of ranchers and farmers in Powder River County which is affiliated with the Northern Plains Resource Council.

I would first like to address some comments to the leasing target which the Secretary has set at 1.5 BILLION tons. I had occasion to speak to this issue several months ago when the target was 776 million tons. I am resubmitting the statement I made at that time. But I will also summarize some of those points on behalf of those here today and in the additional context of the doubling of an already unjustifiably high level.

The coal lease sale in the Powder River Basin in 1982 can only be likened to "sending coal to Newcastle." The coal industry in the region is plagued with excess capacity already with miners out of work at several area mines. The president of Westmoreland has stated publicly that his Absaloka Mine on Sarpy Creek could double its production if only they could find someone to buy the coal! A 15 million ton capacity mine recently opened in Wyoming can sell less than one-third of that coal. Montana's newest mine, Spring Creek, has approximately three million tons of capacity for which it is seeking a customer. Workers have been laid off at Western Energy's Colstrip mine and at Decker.

Walter Archer
Page Two

That is the situation today. What about ten years from now? Is the . . . sale needed for 1991? Every indication is NO. There are literally billions of tons of already-leased undeveloped federal coal in the Powder River Basin. Of this, 2.9 BILLION tons of reserves have favorable development potential. The potential capacity of those existing leases, preference right lease applications and nonfederal mines in the West far exceeds the likely range of demand for coal over the next 10-20 years.

We now see the Department of Interior in Washington, DC, advocating that diligent development requirements for federal leases be weakened or entirely dropped. It is little wonder that as the 1.5 BILLION Powder River coal sale approaches, Interior should seek to save itself the embarrassment of having to cancel leases that are not being developed because there is no market!

The Secretary this year actually doubled the tonnage to be offered from the Basin. He is now hinting at actually raising that target by an additional BILLION tons!

One of the most appalling things about the Draft Environmental Impact Statement is that it does not even attempt to justify a lease sale of the size contemplated! But then any credible assessment of the market, the over-capacity of existing mines, and the tremendous production potential from existing, undeveloped leases leads to only one, obvious conclusion: The lease sale cannot be justified.

Walter Archer
Page Three

This fundamental flaw in the Draft EIS is compounded throughout the document by an analysis of impacts that is superficial, oftentimes incomplete and in some cases ridiculous.

For example, the conclusion that leasing 1.5 BILLION tons of coal (and opening six major new mines (Percival) would somehow cause less impacts than not leasing 1.5 billion tons is nonsensical. The document never justifies this ridiculous conclusion. Like the coal target, it defies rational explanation.

Broadus and Ashland are the two Montana communities most directly affected. Both communities would be hit hard with boom-type impacts. The EIS, however, overlooks entirely the capital costs of new facilities such as roads, schools, and hospitals, assuming that per capita expenditures will be the same in 1990 as today. In every other boom town in the West costs have skyrocketed because of the need for building new facilities. Montana has a coal tax that would provide some help, but even with that the local taxpayer, on the average pitch up 60% of the tab for coal tax supported projects.

The EIS does not account for the impacts on local government budgets of mines that may open without federal leases in this area.

Having left out major components of the equation, the EIS happily projects a budget surplus in Broadus. Such happy surpluses have been predicted in the past for boom communities - but the fact is that there has never been a boomtown with budget surpluses in the region.

Walter Archer
Page Four

In the areas of groundwater impacts, agricultural impacts, water quality impacts, and land use impacts the document is similarly rosy; and its assumptions (where those are described) are equally deficient!

If ever there was a document that needed to go back to the drawing board, this is it. As I have already pointed out, the need for the sale simply isn't there and thus there is time to at least take an honest and informed look at what we're trading off in these communities, in agricultural productivity, in economic stability and in our future before any lease sale is held.

TESTIMONY OF MARY DANIELS, ON THE POWDER RIVER DRAFT EIS
AUGUST 10, 1981 - Broadus, Montana

55

I am Mrs. E. H. Daniels. We have a ranch east of Birney. I am a member of the Northern Plains Resource Council, and President of the TRI COUNTY Rancher's Assn.

I received a copy of the Powder River Draft EIS on August 5th - 5 days after the hearings were held in Billings. This does not surprise me, I'm sure the BLM is not all that proud of this document anyway.

I have been involved in the issue of strip mining since the publication of the North Central Power Study, that monstrous plan which apparently has been abandon. For the last 10 years I have, as have others equally concerned with agriculture, given testimony at these BLM public hearings. I have faithfully tried to read and digest these EIS drafts, finals, etc, and gentlemen, in all these years we have not ONCE evidence our comments or written testimony was ever seriously considered by you, or that we influenced your decisions whatsoever! Because of this, it is apparent, decisions have already been made before hearings, or public input is received.

A glaring example of omission is never mentioning the plan for the Tongue River railroad and Otter Creek spur, which would necessitate condemnation of land.

Try to imagine how refreshing it would be if some responsible public official would say forcefully:sss: "I recommend no leasing of federal coal when there is nearly 7 billion tons of federal coal already under lease in the Powder River Basin. Further leasing (contrary to statement in this document) would cause more impact, not less, it would deplete our water, condemn land, hinder agriculture, and above all, there is only a demand for equity from federal coal, NOT justifiable national NEED for coal."

- How very fitting, truthful and courageous a statement like that would be!

56

Testimony of Mr. Hayes, on the Powder River Draft EIS, Thursday, August 20, 1981 - Broadus, Montana.

MR. HAYES: My name is Art Hayes, Jr. I am a rancher from Birney and I am representing myself.

I feel this whole document is totally unnecessary for there is no real market for this coal at this time. I also feel that your ground water, your sociological, and other sections of this are totally inadequate. I can see no way that you can disturb that amount of land and ruin that much water and that many aquifers and only say that it's very minimal destruction of water and runoff into Otter Creek and the Tongue River. I think this issue--it shouldn't be called a BLM leasing program. It should be called the great American giveaway.

Thank you.

57

Testimony of Mr. Golder, on the Powder River Draft EIS, Thursday, August 20, 1981 - Broadus, Montana.

MR. GOLDER: I am Nick Golder. I live near Colstrip. My address is Forsyth, Montana.

I will write this down.

MR. McKEE: Thank you.

MR. GOLDER: The Scriptures inform me, gentlemen, that we should be real careful about involving or judging the motives of people. I am trying to avoid being judgmental of anyone's motives. The Scriptures also say that we should judge a tree by its fruit, and this particular EIS, Powder River EIS, strikes me as being the kind of fruit that was picked awfully, awfully green. It hasn't begun to develop. You have already picked it and put it in the statement. You have the barest basics of where you should start, and you put it into a document. It's fantastic to me.

Living near Colstrip, why, I have been to quite a few times in the general area and I have watched coal development. I have been particularly interested in the hydrology and reclamation aspect of the thing. I have a ranch and I have the audacity to think that I know a little bit about the land and some of what's under it in the form of water.

On Page 3 of this EIS it says, "Reclamation success has shown to be good." I guess I wasn't an English teacher. "Reclamation has shown to be good, although some areas could require more intensive and costly management." This is a document written by a fellow by the name of Packer in 1974. Having kept up with reclamation thing as it's gone on I think anybody that's actively involved in reclamation that, anyway, the reclamation people that I have been talking to who are getting something done will tell you that in 1974 they really didn't know anything about reclamation and I believe you gentlemen need to take a long hard look at that, and as far as that goes if you will look into Mr. Packer's document it's--it's based on theory if you will read it carefully. He says so. He makes no bones about that. He thinks because of this kind of soil, this and that and something else, this should work. That's fine. He also has a lot of reservations about problems that could happen. It seems that when it says here that "Reclamation success has shown to be good" maybe somebody didn't read clear through that document. I don't quite know where they get it all but, anyway, this is one of the--this is typical of this whole document. Somebody read someplace in the funny papers about it and then wrote it down it seems to us.

On Page 17 it talks about surface water. It says, "The potential increase in dissolved solids concentration in streams would raise from one-tenth percent in Rosebud Creek to four percent in Armells Creek. However, these increases would have no significant impact on current uses of the water or on aquatic biology downstream, no measurable effect on the salinity of the Yellowstone River." Armells Creek is a small creek and before the mining started over there it was an intermittent stream. It ran when it rained and when there was snow melt. Now it runs the year around. There is waterlogging problem, a severe waterlogging problem, on Armells Creek for many miles. It's killed off big, old cottonwoods that anybody can drive through there and see that it took them many years to grow. Now they are all dead. It's made a frog pond out of what was good hay meadows and it's progressing on down the creek.

I think if you would look into the Montana State Lands EIS on--that they put out on Area E, there--several of these problems are addressed in the kind of language that you are accustomed to reading. I think it would be an eye opener to you--that I could go on for quite some time.

For instance, a thing that goes with mining they have a slurry pond there, a final waste disposal slurry pond--slurry pond of highly alkaline substance that they are putting out in a pond that seeps very badly, and that stuff is moving out into the surrounding area and being taken down into Armells Creek, and when it connects in Armells Creek, why, the figures here are going to be kind of sick, and it's just a matter of time till that happens. I don't see any solution to it unless somehow they will finally get around to stopping the leak in that waste disposal pond. That--that touches on one of the problems, but it also again, gentlemen, describes some of the glaring inadequacies of this document.

On Page 33 of Chapter 3 it talks about ground water. It says, "The occurrence of ground water within the Montana and Wyoming areas of the Powder River region is similar. Therefore, both areas will be assessed as a single unit." I have spent quite a little time in the Powder River area and I am interested in agriculture. I know a little about farming and a little more about ranching and aware of the aquifers, the springs, the streams, and the similarities are similar in that, yes, the water is H_2O, what's in it, the way it runs, the way it's used.

Gentlemen, you are talking about an awful large area that you haven't begun to touch on what's going on there. It's like as if we are talking about all those folks living in Florida and you could sweep them into one sentence. It doesn't work that way.

I see on Page 36 it says, "Most wells in the region have a fairly good reclamation potential based on reclamation success of other mines in the region." I wonder if you are aware that in Montana that there has been no bond release on reclamation and the reason to that, well, there is the time element is kind of up, but it's kind of a scary thing. It isn't quite done yet, folks, that statement just doesn't cut the--it doesn't--it doesn't fit what's going on.

Here is one that I laughed at. "Overall people who were interviewed within the region favored coal development." I believe I could find a community of people all right that would favor coal development, but if you are talking about the folks that live on the land, why, I think you had better take another look at that and if you don't think there are some around I suspect that I can get you a few thousand signatures of people that aren't very excited about it, but maybe they aren't very great in number compared to some of the cities, but I--I kind of agree with Mrs. Daniels. I have listened to this stuff a long time and I don't know if there is any point in my saying anything because our statements don't seem to make any difference. The BLM historically in this thing has come closer to having a closed mind and a deaf ear than any of the other agencies we have talked to, but perhaps we have some in Washington now that will do you one better, so we can take comfort in that.

Thank you, gentlemen.

1

Purpose and Need

Issue 1-1:

The premise that new coal leasing is necessary is dubious.

Raised by:

Richard Cauble, National Wildlife Federation (Letter 26)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Walter Archer, Powder River Protective Association (Statement 54)

Response:

The DEIS need analysis rests upon the need established in the Federal Coal Management Program, Final Environmental Impact Statement (FEIS) which is incorporated by reference into the present document on page 5 under Purpose and Need. A discussion of the methodologies used by the DOE in projecting demand can also be found in the FEIS. The actual derivation of the leasing target was published in the *Federal Register* Notice dated December 3, 1980.

2

Scoping, Baseline, and Assumptions

Issue 2-1:

The proposed North Antelope Mine was not included in the baseline.

Raised by:

Terry O'Connor, North Antelope Coal Company (Letter 22)

Response:

The North Antelope Mine has been included in the DEIS baseline for cumulative analysis. The site of the North Antelope Mine will be on existing state and federal leases between two PRLA groupings. These PRLA groupings are the North Antelope and the Rochelle area.

Issue 2-2:

Shell's proposed Young's Creek Mine was not included in the baseline.

Raised by:

Robert M. Ballou, U.S. Fish and Wildlife Service (Letter 3)

Response:

This was acknowledged on page 7 of the DEIS; however, it is not felt that the population changes that will result from the Young's Creek Mine would justify restructuring the baseline. The Crow/Shell DEIS, published by the Bureau of Indian Affairs, projects a maximum increase in Big Horn County employment of 490 (primary and secondary) during construction in 1987, under the proposed action. This would result in an increase of 36 residents in Big Horn County and 400 residents in Sheridan County, Wyoming. When compared to 1990 baseline population in the Powder River DEIS this equates to a 0.2 percent increase for Big Horn County and a 1.2 percent increase for Sheridan County. The maximum increase projected for Big Horn County employment in 1998 is 1,120 (primary and secondary), which would result in population increased of 70, in Big Horn County, and 1,400 in Sheridan County. Comparing this to the Powder River DEIS baseline population for 1990 it can be seen that this is only a 0.5 percent and a 4.2 percent increase for Big Horn and Sheridan Counties respectively.

Issue 2-3:

What is the source of information on which projected PRLA production is based?

Raised by:

John D. Wiener, Sierra Club (Letter 24)

Response:

Projected production for the PRLAs is based on information contained in initial showings submitted by PRLA holders, and in 1990 is only 12 percent of the projected baseline production.

Issue 2-4:

It is erroneous to assume that the PRLAs will be in production by 1990.

Raised by:

Philip L. White, Texas Energy Services, Inc. (Letter 13)

John D. Wiener, Sierra Club (Letter 24)

Richard Cauble, National Wildlife Federation (Letter 26)

Response:

The 67 PRLAs, which form the 15 mine groupings in Table 2-2, have been held in abeyance since the early 1970s. Without exception, the initial showings, which were submitted on the mine groupings by the mid-1970s, envisioned production by the early 1980s. The Secretary of the Interior has announced that all PRLAs will be processed by December 1984. As a result, the following assumptions were made in the DEIS;

1) The PRLAs in Wyoming would be processed in 1982.

2) A three year licensing period would follow leasing.

3) Construction would require two years.

4) The mines would reach full operation capacity by 1990.

Issue 2-5:

It is dubious to assume that all PRLAs and existing leases will be developed.

Raised by:

Richard Cauble, National Wildlife Federation, (Letter 26)

Response:

The reasons for assuming that the PRLAs will be fully functional by 1990 are contained in response number 2-4 above. Inclusion of other leases in the baseline is based on research into mining and other industrial planning, as well as a concensus of state and local officials. At this point there is the distinct possibility of existing leases, which could form potential mines, but which were not included in the baseline. If existing leases or PRLAs are not developed the need or demand for new leasing is increased.

Issue 2-6:

Overestimating the impact of the No-Action Alternative blurs the contrast between the impact of stable or moderate coal development and that of massive new coal development.

Raised by:

Richard Cauble, National Wildlife Federation, (Letter 26)

Response:

The baseline consists of the best information available from the best sources available, namely industrial and mine planning as well as a consensus among state and local officials. There can be no doubt that the baseline does represent massive new coal development; however, the DEIS still manages to present clear, concise comparisons among the alternatives, as can be seen in Table 4-10, 4-11, and 4-12, on employment, population, and budget levels, respectively.

Issue 2-7:

The DEIS does not fully explore and evaluate all reasonable alternatives such as maintenance leasing, break-through leasing, land trading, or phase-in leasing.

Raised by:

Richard Cauble, National Wildlife Federation, (Letter 26)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The DEIS has clearly and concisely evaluated the alternatives which are reasonable to the proposed leasing action. Alternative leasing arrangements were considered in the FEIS on the Federal Coal Management Program.

Potential alternatives which pertain to the proposed lease actions, are limited for the following reasons.

1) Maintenance leasing would increase mine life, not production.

2) Break-through leasing would increase mine life and not production.

3) Land trading is already practiced to the extent possible under our Federal Land Management Program.

4) In a sense, the 1982 lease sale followed by a 1984 lease sale should be considered "phased in leasing"; however, any form of phased in leasing would need to meet DOEs 1990 production goal.

5) PRLAs are to be processed by 1984 and therefore must be considered in the baseline as to their effect on the 1990 production level.

In short, there is a projected need (high and medium) for a given level of production in 1990. After comparing projected production capacity to that need, and the availability to coal leasing, the alternatives were formulated.

Issue 2-8:

The three year lead time assumption (DEIS page 14) appears substantially flawed.

Raised by:

Philip L. White, Texas Energy Services, Inc. (Letter 13)

Response:

Contact with Wyoming's Industrial Siting and the Department of Economic Planning and Development provided the following information: If a company accomplishes the various required studies concurrently, licensing and permitting can be done within 18 to 24 months. It has been done in less than 18 months. Coal mines can, and do, arrive at full production capacity within 5 or 6 years after leasing. In the worst case it would require 8 or 9 years.

It should be noted that market conditions and sales contracts determine whether a mine will produce, as well as production levels. If the mines in question do not produce at full capacity it would be an indication that the lease level selected by the RCT was too high. However, assumptions in the DEIS on lead time and production levels remain valid.

Issue 2-9:

TESI questions the need for production maintenance tracts for existing mines with reserves in excess of 300 million tons.

Raised by:

Philip L. White, Texas Energy Services, Inc. (Letter 13)

Response:

There may be some confusion over the number and type of tracts considered in the DEIS. There are 5, 6, and 11 tracts under Alternatives 2, 3, and 4, respectively, which could result in new mine openings. There are also 5 exchanges and noncompetitive leases, in the baseline, which were authorized under congressional legislation. Finally, there are 8 maintenance tracts contained in Alternatives 2, 3, or 4. It should be noted that the maintenance tracts are assumed to extend mine life only and do not contribute toward the leasing target. Therefore, the leasing target would not increase in their absence. They were delineated in an effort to prevent future bypass or shut down situations, which would cause additional public administrative costs under the emergency leasing program or disruptions to localities through layoffs.

Issue 2-10:

Site specific analysis was not completed or specific tracts were analyzed only in "Tract Profiles" which did not accompany the EIS.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Reed Zars, Powder River Basin Resource Council (Statement 43)

Bill Mackay, Jr., (NPRC) (Statement 45)

Response:

The Tract Profiles, which were incorporated by reference in to the DEIS (pages 6, 8, 13, and 51), provided Site Specific Analysis of the tracts. The DEIS provided cumulative analysis on the combinations of tracts under the alternatives. The DEIS indicated that Tract Profiles were available to the public since January 1, 1981, at the Miles City District Office and the Casper District Office of BLM.

Issue 2-11:

Factors such as water resources, air quality, socio-economics and tranportation were brought out in the scoping process. Why aren't the tract ranking factors the same as the concerns "scoped"?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The ranking process was rather detailed and did consider these factors as sub-ranking criteria. In other words these factors were reviewed in selection of the ranking facotrs. They were not included on Table 1-2 if they did not provide clear distinction between tracts.

Issue 2-12:

The EIS was prepared under an accelerated schedule, which is partly responsible for the inadequacy of the document.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The DEIS was prepared under a time efficient schedule. The task was accomplished by analyzing issues that were potentially significant to the decision making task, and incorporating by reference other documents which explored less significant topics more thoroughly. We believe the document provides an adequate basis for the coal leasing decision.

Issue 2-13:

The No-Action Alternative would have impacts considerably greater than any of the other alterntatives in the EIS.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Mark Gordon, Wyoming Chapter Sierra Club (Letter 37)

Bill Mackay, Jr., NPRC (Statement 45)

Response:

This sentence was mis-stated and has been changed.

Issue 2-14:

The statement fails to mention that the feasibility studies have in many cases resulted in postponment of plans for power plants. The WyCoalGas project has been dropped.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The fact that a particular project succeeds or fails has no real bearing on coal production goals. The short-fall projection continues to exist and new coal leasing will be necessary to meet demand. The WyCoalGas project has been shelved pending a more equitable financial situation.

Issue 2-15:

The EIS assumes all relevant laws will be followed. Presumably, one main purpose of the EIS is to assess the practicability of compliance.

Raised by:

John D. Wiener, Sierra Club (Letter 24)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

To provide a sound basis for analysis, it must be assumed that all relevant laws will be obeyed; however, the purpose of the EIS is to assess the possible results of compliance.

Issue 2-16:

How can something as important to the assessment of the leasing alternatives be assumed? This is in reference to the 60-40 basis for dividing population increases between Rosebud and Powder River Counties.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

The percentage distribution was adopted after consulting with the Powder River County Clerk's Office. It allows for a clear, concise assessment of one possible scenario which we feel is the most probable.

Issue 2-17:

Post-mining land use will be the same as pre-mining land use except for the lands used for housing or public facilities.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Assumption Number 12 has been amended to read: Postmining land use is expected to be the same as the premining use, except for the lands used for housing, public facilities, transportation rights-of-way and permanent changes due to development.

Issue 2-18:

The premise of comparing the marginal impacts of leasing to the baseline impact of changes that will occur with or without leasing is faulty.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Baseline, increment, and cumulative impacts are presented in the DEIS. However, a major purpose for the DEIS is to assess and compare the impacts of the alternatives; therefore, a comparison of marginal impacts remains valid.

Issue 2-19:

It is not valid to use one of the alternatives (No-Action Alternative) as a baseline.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

It is possible that the format of the DEIS has caused some confusion on this point. The future affected environment has been projected and presented as the No-Action Alternative. However, we believe that the procedure of comparing the affects of an action to the situation that would exist without that action is valid.

Issue 2-20:

The EIS overstates Montana coal production. Analysis prepared in conjunction with the ICCs EIS on the Tongue River Railroad indicates that the coal production in Montana will be lower.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

Since the demand analysis and the EIS cited above will not be published until the end of 1981 it is impossible to respond on that basis. The ICC will not make the referenced information available and therefore we are unable to varify the data reliability. A thorough research of on going possible/probable coal production was made in developing the No-Action Alternative.

Issue 2-21:

In light of the difference in quality between Tongue River and Decker/Sarpy/Colstrip coal it is not likely that coal development in the

Tongue River area will capture 65 percent of the new Montana sales.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

Coal contracts are normally the result of a negotiated effort with prices reflecting the quality of the coal. Therefore, if DOEs high production goal is valid there will be a market for the coal.

Issue 2-22:

Can the mines opening in the Tongue River area achieve a production level of 32.8 million tons in 1995?

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

A mine should reach full production capacity within 8 or 9 years leasing; however, it is market conditions and sales contracts that determine actual production levels.

Issue 2-23:

Erroneous impact analysis has resulted from an overstatement of coal production in the Tongue River area and an understatement of coal production in the Decker-Colstrip area.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

Production was projected based on available information on existing operations and other sources (ref. Montana Tract Profiles).

Issue 2-24:

The BLM DEIS does not account for induced employment in Forsyth and Miles City, nor is it sensitive to the location of indirect employment.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

The amount of induced employment in Forsyth or Miles City would not be measureable. Induced and indirect employment was distributed on the basis of the probable place of residence of the primary employment.

Issue 2-25:

The document is difficult to interpret because organization of tables and the Tract Profiles not being physically attached to the DEIS.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

The format of the document derives from the need to present a concise statement with a minimum of redundancy. The Tract Profiles were available to any interested party.

Issue 2-26:

The Peter Kiewit CX Mine is in Big Horn County, not Rosebud.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

This has been changed in the EIS.

Issue 2-27:

The Preferred Alternative as discussed in the DEIS, is not what the Regional Coal Team recommended. Why was Alternative 3 selected over Alternative 2?

Raised by:

Ed Herschler, Governor of Wyoming (Letter 27)

Jack L. Mahaffey (Shell Oil Company) (Letter 38)

Steve Elliot (Statement 46)

Bill Lowery (Statement 47)

Response:

Alternative 3C as recommended by the Regional Coal Team is the Preferred Alternative. The reason Alternative 3 was selected over Alternative 2 is that a section of state (Wyoming) coal could be developed in conjunction with the Kintz Creek tract, competitive leasing would be delayed until the Carter I-90 Exchange negotiations were completed and Alternative 3 keeps new competitive leasing south of Gillette.

The FEIS has been amended to show the RCTs recommendation at their October 2, 1981 Meeting.

Issue 2-28:

It appears that the preferred alternative is designed to meet the DOEs high production goal. Why is the DEIS written to suggest that leasing is meant to prevent a production shortfall?

Raised by:

Gary B. Glass, Geological Survey of Wyoming (Letter 28)

Response:

Due to the uncertainties regarding coal consumption over the next 10 years, especially for electric utilities and in light of the situation in the mid-east, a statement that the DOEs high production goal may not represent the 1990 market requirement for coal could be ill-conceived. If the market conditions materialize that justify the DOEs high produciton goal the preferred alternative would be preventing a production shortfall.

3

GEOLOGY

Issue 3-1:

There was inadequate discussion of coal resource geology in the EIS.

Raised by:

James E. Hawkins, Bureau of Mines (Letter 1)

Barbara Kennedy, Miles City, Montana (Letter 8)

James Paone, Bureau of Mines (Letter 16)

Response:

We believe that sufficient data was available for impact analysis and identification of alternatives. Before the EIS was started, the USGS developed tract delineation reports which included all relevant geology and mining methods based on those already in use in existing coal mines. The tract delineation reports became part of the individual tract profiles which are the site specific environmental analyses for the EIS. The tract profiles are readily available from the BLM Office in Casper and the listed references can be found in most geologic libraries.

Issue 3-2:

The statement "that a 5,500 foot cretaceous shale section overlies the Madison aquifer" is wrong.

Raised by:

James E Hawkins, Bureau of Mines (Letter 1)

Response:

The observation is correct and the necessary correction was made in the EIS.

Issue 3-3:

Conflicts between coal production and other mineral resources have not been discussed.

Raised by:

James Paone, Bureau of Mines (Letter 16)

Response:

The statements in paragraph three (Letter 6) indicates a lack of understanding concerning coal and other mineral resource conflicts. None of the minerals mentioned have been in conflict with coal. All of the bentonite mined lies well outside the coal fields on the basin edge. Except for pumice, little in the way of construction materials lie within the coal fields. The impact of coal on construction materials has been to increase the demand, most of which has to be brought in from other areas. We do not know where the information was found on silver and lead. As far as we know, none has ever been produced in the Powder River Basin, and the conflict potential is nonexistant.

Issue 3-4:

Modifications to the Timber Creek and Spring Draw tracts was suggested.

Raised by:

Mitchell F. Keamy, Hamphire Energy (Letter 12)

Joe M. Hamner, The Carter Mining Company (Letter 23)

R.E. Golkosky, Royal Land Company (Letter 36)

Response:

The Regional Coal Team (RCT) recommended in their October 2, 1981 meeting that lands in sections 31, 32, 33, T. 49 N., R. 70 W. be omitted from the Timber Creek tract. They also recommended that all lands selected for I-90 Exchange falling in the Spring Draw tract remain available for competitive leasing pending resolution of the Exchange. The decision on which lands would be exchanged to the Carter Mining Company of coal lands crossed by I-90 would probably be made in 1982.

4

Water Resources

Surface Water

Issue 4-1:

Given EPA regulations, how can you state that sewage effluent will increase 0.07 percent in the Tongue and North Platte Rivers by 1990?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

The subject in the DEIS is municipal sewage effluent, and the calculated increases in dissolved solids in the rivers represent the impact of discharging the projected increase in sewage effluent into the rivers. We assumed that National Pollutant Discharge Elimination System (NPDES) permits for all unnatural polluting sources must be applied for and approved by appropriate state agencies.

Issue 4-2:

The increase in dissolved solids in Armells Creek is closer to one percent than four percent as stated in the DEIS.

Raised by:

William J. Robinson, Western Energy Company (Letter 18)

Response:

The projected 4 percent increase in dissolved solids in Armells Creek is the upper limit for base-flow conditions at maximum development; it is based on data which show that water in the Colstrip spoils contains concentrations of dissolved solids that are about double those in adjacent aquifers. Presumably, the spoils contribute a proportionate share of the base flow.

Issue 4-3:

Impacts to aquatic biology have not been adequately assessed.

Raised by:

W. Donald Dexter, Wyoming Game and Fish Department (Letter 20)

Response:

An amendment was added to the Surface Water Section of the Environmental Consequences Chapter.

Ground Water

Issue 4-4:

Why do units change from acre feet when discussing water to acres when discussing aquifers?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

It is not customary to use a term like acre feet of aquifer destroyed because this would require detailed knowledge of the thickness of all the aquifers in the region. This information is not available because the aquifers in the Powder River Region are usually lenticular. Also, the water bearing characteristics of the aquifers vary greatly both vertically and horizontally thereby making a term like "acre feet of aquifer" meaningless.

Issue 4-5:

How many acres of aquifer would be removed by existing mines?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

Shallow aquifers would be removed in an area of approximately 67,000 acres by existing mines. This figure has been added to the final EIS.

Issue 4-6:

The EIS should refer to number of wells destroyed or acres of aquifer removed by state or county.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

The number of wells affected and acres of aquifers disturbed is listed site-specifically in the Tract Profiles and cumulatively in the DEIS. The DEIS is regional and county or state segregation of these facts would serve no purpose in the analysis.

Issue 4-7:

Your comment that Broadus water supply is adequate presently is inaccurate.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

In a telephone conversation in June 1981, Lonnie Beach, Clerk of Broadus stated that the well capacity of 385 gpm was adequate for the current population of 900 but that a new well

field 6 miles away would be necessary to secure additional water.

Issue 4-8:

What is the extent of the impact of mining on ground water?

Raised by:

John D. Smillie, Northern Plains Resources Council (Letter 35)

Response:

The reduction in dissolved solids concentration with increasing distance from a mine has been documented in certain areas (Riffenburg, 1925; Qayyum and Kemper 1962). The decrease in dissolved solids with increasing depth in the Powder River Basin is well established, and lends support to the contention that the dissolved concentration in water from spoil aquifers probably will also decrease. The actual change in water quality with distance from the mine is dependent on the quality of water in the spoil aquifer, the character of the natural sediments surrounding the mine, the water table gradients and the recharge rate. These factors are all site specific and would be collected and assessed during mine plan preparation and approval. Further studies of the movement of ground water in the vicinity of many existing mines in the Powder River Basin would be highly beneficial in predicting the impact on ground water of new mines. What data are available indicate that heavy minerals and dissolved solids concentrations in ground water decrease with distance from the spoil aquifer.

Issue 4-9:

The effects of poorer quality water and of having to drill deeper wells on agricultural productivity was not addressed.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Poorer quality water in spoil aquifers would probably reduce agricultural productivity in some site specific areas but normally this effect can be mitigated by drilling deeper wells-as stated:

The development of ground water from deeper zones would require additional expense for well construction, where cause and effect can be established. However, this expense would be born by the mine owner. Deep ground water development would also entail greater pumping costs in recharge areas where static water levels are lower than in shallow zones. This would not necessarily reduce agricultural productivity but could increase the cost of production and thereby reduce marginal agricultural activity. On the otherhand, if the water quality in the deep aquifers is better than it is in the shallow aquifers the better quality water possibly could increase agricultural productivity to an extent that would more than offset the increased pumping costs. The effects of deeper wells are site specific and will be analyzed once information is collected for the individual mine plan.

Issue 4-10:

The probability, frequency and location of reappearing springs after reclamation and their beneficial or harmful effects was not discussed.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The probability, frequency and location of reappearing springs is site specific and requires an examination of the mine plan and the area in question. This will be accomplished during M&R plan development for each mine. As reclamation practices are relatively new, meaningful data on the reappearance of springs are not available. The beneficial or harmful effects of the reappearance of springs would depend on their location and the quality of the water. Again this is site specific and will be covered in the EIS for each individual mine.

Issue 4-11:

Data from real situations such as water quality degradation associated with the mine at Colstrip were not provided in the DEIS. The draft Department of State Lands EIS predicted similar problems in Area E and a comparison should be made in the Powder River EIS.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Ground water quality problems are local in nature and site specific. Further examination of the data on ground water in the vicinity of the Western Energy Company's Rosebud Mine (Area E extension near Colstrip) has led to a revision of the perceived impact of the mine on the water quality as stated in the Montana Department of State Lands (MDSL) DEIS. The final MDSL EIS states on page II-15 3a under Current Mining Impacts, "After reevaluating hydrologic information, some of which was gathered by Western Energy since the draft EIS was issued, Department of State Lands concludes that Cow Creek has not been affected by mining to the extent indicated in the draft. Nevertheless, seepage of water from mine spoil has degraded bedrock ground water and may have degraded alluvial ground water. At present detectable effects of mining on water quality in Area E are confined to the shallow alluvium within a mile or two of the existing mine and to bedrock aquifers within a few hundred feet of the mine."

Issue 4-12:

There is inadequate site-specific (water) information to evaluate the possibility of localized impacts.

Raised by:

Louis E. Allen, Wyoming State Engineers Office (Letter 31)

Response:

This information is included in the individual Tract Profiles available from the Casper BLM Office.

Issue 4-13:

The Yellowstone River Compact and the Wyoming Water Appropriation System was not discussed.

Raised by:

Louis E. Allen, Wyoming State Engineer's Office (Letter 31)

Response:

Administration of water and the appropriation system is the State of Wyoming's responsibility. The DEIS states that compliance of all state laws is assumed.

5

Air Quality

Issue 5-1:

It is vauge to report no specific affect of Alternatives 1, 2, 3, and 4 for none of the Alternatives in Air Quality.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

The site-specific air quality effects were analyzed and are reported in each Tract Profiles. This information plus, projected baseline conditions were analyzed cumulatively and reported by alternative in the EIS.

Issue 5-2:

How many tons of particulates by 1990?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

As shown on Table 2-1, the total particulate production from the existing PRB, region coal mines would range from 69,300 tons for Alternative 1 to 94,900 tons for Alternative 4.

Issue 5-3:

Alternatives 2, 3, and 4 show 4,800 tons per year of total suspended particulates (TSP) being added at Colstrip. Air Quality Permit Number 1483 indicates 4,583 tons per year.

Raised by:

William J. Robinson, Western Energy Company (Letter 18)

Response:

The 5 percent difference in emmission estimates becomes relatively insignificant when compared to the errors in air quality modeling. It must be remembered that for leasing consistant emissions and modeling analyses from tract to tract is essential for comparison from tract to tract of the impacts. Specific needs and/or requirements for a specific mine will be addressed during the State's PSD review of the mine plan.

Issue 5-4:

The statement of 4,800 tons to be added by the tracts in Area D, Areas A & B, and Area C is completely out of the question. There should be no significant increases in TSP levels when the Area D operation is brought into light since at that time Area E will no longer be operated.

Raised by:

William J. Robinson, Western Energy Company (Letter 18)

Response:

In general the comment is correct. The text was changed in Alternatives 2, 3, and 4 to read: "about 4,800 tons per year would be added to the Colstrip area; however, this increase will be effectively offset by the completion of mining other locations within the area".

Issue 5-5:

Under the terms of Air Quality Permit No. 1483, Western Energy Company has committed to a mine-wide dust management plan which has made a significant reduction in the amount of particulate emitted at the Rosebud Mine. Data from the first two quarterly reports required as a condition of this permit suggests that the air shed in the Colstrip area is improving. It is Western Energy's contention that the Colstrip area was improperly designated a non-attainment area and has petitioned the Air Quality Bureau for a redesignation.

Raised by:

William J. Robinson, Western Energy Company (Letter 18)

Response:

The Montana Department of State Land indicated on October 15, 1981, that Colstrip is still non-attainment (NA) with respect to TSP. They also feel it is too early to determine whether or not a significant reduction in TSP emissions has been achieved in the NA area. However, the words "which is not expected to improve in the near future" were deleted from the text.

6

Soils, Vegetation, and Reclamation

Issue 6-1:

The DEIS does not address the problems concerning the disruption of habitats of high wildlife value where existing reclamation technology has not been proven. Ponderosa pine forest, rock outcrops, wetlands, and riparian habitats are habitat types of concern.

Raised by:

Robert M. Ballou, U.S. Fish and Wildlife Service (Letter 3)

W. Donald Dexter, Wyoming Game and Fish Department (Letter 20)

Response:

Our research has shown that the reclamation technology does exist for specific wildlife habitats. This is supported by Reclamation for Wildlife (The Wyoming Viewpoint, H.J. Harju) which was published in Adequate Reclamation of Mined Lands? (Symposium, Soil Conservation Soc. of Amer. and WRCC-21, Billings, Montana, March 26-27, 1980.)

Issue 6-2:

In the DEIS the Soils, Vegetation, and Reclamation sections are vauge.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

This comment is based only on information given in the summary which is meant to be short and concise.

Issue 6-3:

In the DEIS the reference (Packer, 1974) that is used to support the possibility of reclamation success is relatively old and out of date. This section would be more convincing if reference was made to a more recent publication or to ongoing studies.

Raised by:

W. Donald Dexter, Wyoming Game and Fish Department (Letter 20)

John D. Wiener, Sierra Club (Letter 24)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Nick Golder (Statement 57)

Response:

Two new publications which support and expand Packer's conclusions and the reclamation section of the DEIS are: Adequate Reclamation of Mined Lands? (Symposium, Soil Conservation Society of America and WRCC-21, Billings, Montana, March 26-27, 1980.)

Draft Tongue River, Montana, Petition Evaluation Document, Montana Department of State Lands and OSM, September, 1981.

Issue 6-4:

There has been no reclamation bond released on any coal mines in the Powder River Basin in recognition of "successful reclamation".

Raised by:

John D. Wiener, Sierra Club (Letter 24)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Bill Mackay, Jr. (NPRC) (Statement 45)

Nick Golder (Statement 57)

Response:

It is true there have been no reclamation bonds released in the Powder River Basin, but it is because no mines have had the time to reach this point.

Issue 6-5:

In the DEIS there was no site-specific discussion or comparison between tracts of soil quality.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

There was no significant difference between soils on the tracts, therefore there was no need to compare them.

Issue 6-6:

The DEIS did not reflect that mined and or reclaimed land would require more intensive management than unmined land.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Our research has not revealed documentation supporting this statement.

7

Wildlife

Issue 7-1:

Disagree with the statement: "...wetlands,...would not be regionally affected or do not occur within the region."

Raised by:

Robert M. Ballou, U.S. Fish and Wildlife Service (Letter 3)

Response:

We agree that there are some major riparian zones adjacent to the area of analysis. Our statement that wetlands and other physical and biological resources would not be regionally affected was based on the following premise.

Wetlands and riparian resources would be affected by other actions in the region (e.g. Tongue River Railroad). However, new federal leasing alternatives would not contribute to those impacts. The only exception is the Spring Draw Tract where the Little Powder River riparian system would be affected by construction of a railroad spur. This site-specific effect has been analyzed and reported in the Tract Profile.

Table 4-3 as amended gives, the acres of riparian lands that would be affected.

Issue 7-2:

The statement that no threatened or endangered species are known to exist within the Montana area is incorrect.

Raised by:

Robert M. Ballou, U.S. Fish and Wildlife Service (Letter 3)

Response:

The statement has been changed to read: The bald eagle, peregrine falcon, and black-footed ferret may occur in the Montana portion of the study area.

Issue 7-3:

There is concern that meaningful information on wildlife habitat is not included.

Raised by:

Robert M. Ballou, U.S. Fish and Wildlife Service (Letter 3)

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

A more thorough discription of the major habitats found in the Powder River Basin may be found in the 1979 Eastern Powder River Basin Coal FEIS. Tiering of environmental assessment has been achieved for the Powder River Basin and is included in documents such as the Federal Coal Management Program FEIS, Northern Powder River Basin Coal FEIS, and the Eastern Powder River Basin Coal FEIS. To avoid duplication of material and ensure production of easily readable documents previous EISs are referenced and not repeated. Significant impacts germane to the proposed action have been discussed in this DEIS.

Issue 7-4:

Disagrees with the statement: "...13 percent...of golden eagles would move to new nesting sites."

Raised by:

Robert M. Ballou, U.S. Fish and Wildlife Service (Letter 3)

Response:

The statement on page 59 is not intended to infer that these birds would move to other natural nest sites. In a few cases there may be alternate nests within the territory of a particular pair. However, in most if not all cases, it will be necessary to construct nesting platforms away from active mining areas in order to provide replacement nesting sites. Initital experimentation with moving nest sites is promising.

Issue 7-5:

The environmental consequences section failed to mention fish.

Raised by:

W. Donald Dexter, Wyoming Game and Fish (Letter 20)

Response:

Fish were not mentioned because the only fishery of consequence in the Wyoming portion of the region that would be affected by proposed development is Caballo Reservoir. This reservoir would be destroyed by the development of fee coal even if the Duck Nest Creek tract is not leased and developed. Degradation of water quality due to mine run-off or pumping the mine pit should not occur if current OSM and DEQ regulations are enforced.

There are no significant fisheries on the tracts in Montana. Off-site impacts due to water quality degradation would be controlled by Department of State Lands and the Office of Surface Mining regulations.

Issue 7-6:

Will all disturbed areas be reclaimed to wildlife habitat?

Raised by:

W. Donald Dexter, Wyoming Game and Fish (Letter 20)

Response:

At a minimum, the 22,000 disturbed acres will be reclaimed to OSM and state standards. Currently most mining companies are using seed mixtures of native grasses with some shrub seeds added. In some cases in the region, containerized shrubs and trees are being planted in reclaimed areas.

Issue 7-7:

What is proposed to mitigate wildlife losses that are unavoidable?

Raised by:

W. Donald Dexter, Wyoming Game and Fish (Letter 20)

Response:

Unavoidable wildlife losses are considered to be those which would still occur after all attempts at mitigation are completed (e.g. using antelope type fencing). Therefore there is nothing that can be done to mitigate unavoidable wildlife losses.

Issue 7-8:

The DEIS should contain a more thorough discussion of mitigating measures for terrestrial wildlife.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

Impacts to wildlife on a site specific and cumulative basis were pointed out in the DEIS. The assumption made on page 13 of the DEIS assumes that all mitigation required by OSM and state regulation will be applied.

Issue 7-9:

Potential impact of increased human populations on wildlife was not discussed.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

The major impacts of increased human populations in the coal development areas would be increased road kills, higher poaching losses, and habitat loss from new subdivisions and other development. Based on a study by Vilkitis (1975) there is a low (5 percent) probability of even detecting a poaching violation. This makes prediction of poaching losses difficult (for one methodology see EPRB Coal FEIS 1979). Road kill losses are also difficult to project because there is no complete data source and because many road kills are not reported. In addition, road kills which are reported are not reported proportionally by species because antelope are smaller and cause far less damage during a collision than do heavier, taller mule deer.

8

Cultural Resources

Issue 8-1:

Calculation of land disturbance: Total disturbance of artifacts on all tracts vs. disturbance of mineable area within the tract was not made.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

Total acres potentially disturbed are listed several places within the DEIS and specifically in Table 2-1 and 4-3. The percentage of a lease tract that would be disturbed cannot be determined until a mine and reclamation plan is developed and approved. Therfore, in accordance with CEQ guidelines, the entire tract is assumed disturbed in order to present a 'worse case' analysis (see Table 2-1 and 4-3).

Issue 8-2:

Calculation of site density ratios based upon previous surveys of different levels of intensity-this adjustment wasn't addressed.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

Most of the surveys upon which these ratios are based were conducted at the Class III level (100 percent inventory of project areas). Much less fieldwork was conducted at the Class II level (100 percent inventory of 10 percent of project area). A Class I inventory is a files and document search of all existing data from Class II and III reports, as well as from other sources (historic, etc.). Therefore, the above density figures are significantly based upon the existing documented data base made up of numerous sources. However, the data base is in some cases incomplete and inadequate for cultural resource management purposes. This limitation is acknowledged. Specific information on cultural resources and inventories conducted may be found in the Tract Profiles.

Issue 8-3:

There is no attempt to determine the total number of significant sites that would be disturbed or eligibility determination by site that could be considered a resource loss.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

A significant resource loss would be the loss of cultural sites of *National Register* quality or eligibility. But because so often in the past, recommendations were to avoid sites without evaluating them for *National Register* eligibility,

we don't know in quantifiable terms what the real resource loss would be. Any site located during the post-lease phase (i.e. Mining and Reclamation Plan Review) will be evaluated on a case by case basis and a determination of significance will be made at that time. If a site is significant appropriate mitigation will be prescribed in the M&R Plan.

Issue 8-4:

BLM states in the DEIS (page 59) that the SHPOs of Wyoming and Montana and the Advisory Council on Historic Preservation will determine significance.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

BLM agrees that it is the keeper of the *National Register* who actually determines significance, that is, eligibility to the *National Register* of Historic Places. This has been changed in the FEIS.

Issue 8-5:

"Buried sites will be lost."

Raised by:

Mark Junge, Wyoming Recreation Commission (Letter 29)

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

BLM is concerned with identifying and protecting *National Register* quality cultural resources on federal lands, and where federal actions occur. A *National Register* site need not be preserved if site data collection is complete. Its value or significance to history or prehistory will be known through documentation. In such cases a determination of "no adverse affect" may be made by BLM and the SHPO as per Section 106 of the National Historic Act of 1966.

Issue 8-6:

Section 106, not Section 6, mandates that "any site identified as potentially eligible for listing on the National Register would be protected."

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

While the goals of BLMs Cultural Resource Management Program are to identify and protect or mitigate significant (National Register eligible sites) on federal land, or on lands when federal actions occur, Section 106 (there is no Section 6) says only that the federal agency will take into consideration the effects of its actions on National Register eligible resources and afford the Advisory Council on Historic Preservation, established under Title II of the National Historic Preservation Act of 1966, the opportunity to comment on such actions. This change has been made in the FEIS.

Issue 8-7:

The following quote (page 2) is too vague. "Federal and state regulations protect these (cultural) resources. Historic and architectural resources on private lands may not be protected unless steps are taken by local governments and private citizens."

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

BLM acknowledges that several federal laws, such as the National Environmental Policy Act of 1969, the National Historic Preservation Act of 1966, and the Federal Land Policy and Management Act of 1976 address cultural resource protection, as referenced in the FEIS.

Part two of this issue is addressed as follows: Cultural resources occurring on private surface are the property of the landowner. BLM can mitigate adverse effects on the cultural resource caused by a particular federal action. BLM cannot however, afford protection for the same cultural resource if a nonfederal action would cause an adverse effect.

9

Visual Resources

Issue 9-1:

The DEIS implies that mines are to be managed as visual resources.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The BLM does not manage mines as visual resource and the DEIS does not make this statement. It does state that the most intrusive mines (along high-use roadways, recreation areas, and near population centers) also provide a source for interpreting mining procedures, geological formation, and reclamation procedures. These factors relate to the "visual sensitivity" of an area used in BLM Visual Resource Management.

Issue 9-2:

The DEIS states that no irreversible or irretrievable committments of visual resources were identified.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

With the mitigation or restoration of contours and reseeding, we believe that mined areas and support facilities can today be reclaimed to successfully meet the visual quality of the premining environment.

10

Land Use

Issue 10-1:

The assessment of impacts to agriculture, regionally and on a site-specific basis, is totally inadequate.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Impacts to agricultural production on a county basis from the preferred alternative would reduce production by two percent or less. If this agricultural loss was computed on a regional basis, it would be far less than one percent. We realize the effects on individual ranch or farm operations and this problem was discussed in the Tract Profiles.

It must be pointed out that not all the land proposed to be mined would be removed from production at one time. Areas not undergoing mining operations or rehabilitated after mining would be available for agricultural production.

Impacts of associated facilities (those directly associated with surface coal mines) were assessed site-specifically and cumulatively. The Tongue River Railroad was not assessed because it is related to actions other than the proposed action for this EIS and will be analyzed as a separate action by the Interstate Commerce Commission (see response to simi-

lar comment in Transportation section). Minemouth utilization has not been proposed for the coal tracts under assessment with exception of the Colstrip maintenance tracts. These tracts would not result in a new mine and the present mine and power generation plant have been subjected to several levels of environmental assessment.

Disruption of parts or all of 44 ranch units has been recognized in site-specific analysis (tract profiles) and cumulatively in the EIS. The individual ranch operators (if qualified surface owners) are protected by the provision that they have total denial to mining through consent to mining procedures as specified by the Surface Mining and Reclamation Control Act. They can decide individually and independently whether or not to sell their property to a mining company. Compensation to landowners wishing to sell to mining companies has been adequate based on cases examined to date (Ref. Appendix G).

Impacts from mines adjacent to agricultural operations (off-site impacts) have been assessed and summarized in Table 2-1. Numbers of wells that would be affected and acres of aquifers removed are listed. Montana law requires mining companies to monitor groundwater and wells adjacent to their operation. Wells made unuseable by mine operations must be replaced by the mining company (section 22(3), Title 50, Chapter 10, R.C.M. Montana 1947). Similar laws exist in Wyoming to protect groundwater and shallow wells.

Issue 10-2:

Productivity of agricultural land is not estimated in the EIS.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Site specific analysis as shown in the Tract Profiles gives a detailed breakdown of acres of croplands and estimated production of hay, grain, and livestock forage. Table G-2 in the DEIS provides production of barley, corn, oats, all wheat, all hay and cattle in Powder River and Rosebud Counties of Montana, the State of Montana and the U.S.A.

Issue 10-3:

Table 4-3 in the DEIS is confusing.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

We agree and the totals for Alternative 1 have been removed from the action alternative totals to clarify the table in the final EIS.

Issue 10-4:

The statement that "underground utilities, pipelines, and overhead powerlines would modify agricultural land use but not remove acres from production" is not accurate.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

We agree and have changed the statement to read "would not remove significant amounts of acreage from production".

11

Recreation

Issue 11-1:

The recreation section should point out the land access problems, the increasing recreation demand and impacts on the edges or outside the region.

Raised by:

W. Donald Dexter, Wyoming Game and Fish (Letter 20)

Richard C. Moore, Industrial Siting Administration (Wyoming) (Letter 32)

Response:

The first paragraph on page 39, DEIS, mentions the problem of access. The effect of increased recreational use is discussed in Chapter 4 and would be felt in those areas described in Chapter 3.

The effects of coal leasing as related to recreation demand are discussed in Chapter 4. Based on information gathered during the inventory stage (Montana State Comprehensive Outdoor Recreation Plan, Wyoming State Comprehensive Outdoor Recreation Plan, and existing use statistics in federal, state, and local areas) the present facilities are adequate for present use (as stated in Chapter 3).

Regional impacts would increase and then level off as the tax base increased. Facilities would be provided from these additional revenues (i.e. the recent developments in Gillette, Wyoming).

Issue 11-2:

The statement that new federal leasing would not appreciably affect dispersed recreation is questionable (depending on the scope considered--national vs. local).

Raised by:

W. Donald Dexter, Wyoming Game and Fish Department (Letter 20)

Response:

Estimated population increase in a seven county area of the Powder River Region from new coal leasing would be 4,190 people. This is two percent of the total population projected to live in the same area in 1990. We believe that this number is insignificant in comparison to the total recreation demand.

Issue 11-3:

Fishing demand in Wyoming was not addressed.

Raised by:

W. Donald Dexter, Wyoming Game and Fish Department (Letter 20)

Response:

All recreation activities were inventoried for capacity and present use. When future projections (population vs. use) were examined it was found that all activities would experience increases, some more than others. The effects of use on water-based recreation was addressed and found that the existing facilities are adequate.

12

Transportation

Issue 12-1:

The proposed Tongue River Railroad would have an additional affect on train traffic on the Burlington Northern lines leaving the region.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

The Tongue River Railroad would add traffic to the Burlington Northern line and this is discussed. The numbers are shown in Figure F-3. The statement in Chapter 2 refers to the fact that the Chicago-Northwestern line would carry coal trains to the Union Pacific line thus reducing trains and impacts on the Burlington Northern line. The Tongue River Railroad would act as a spur to the Burlington Northern line.

Issue 12-2:

The Tongue River Railroad was either not mentioned or mentioned in the No-Action alternative in error.

Raised by:

John D. Smillie, Northern Plain Resource Council (Letter 35)

Bill Mackay, Jr., (NPRC) (Statement 45)

Mary Daniels (Statement 55)

Response:

The Tongue River Railroad is mentioned in the "Affected Environment Section" and not as an existing situation. The affected environment is what we anticipate will be present in the region by 1990. The Montco-Nance coal mine is in process of being permitted. Because the Montco mine plan calls for nine million tons of coal production by 1990, the Tongue River Railroad was included as the "proposed" link to the Burlington Northern rail line. Impacts and routing of the Tongue River Railroad will be assessed in an EIS to be prepared by the Interstate Commerce Commission.

Issue 12-3:

It appears that an assumption was made that all rail traffic flows east on the Burlington Northern rail line through Miles City.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

This is not entirely true. It was assumed that the primary markets for the coal were to the east and the predominant flow of coal would be easterly. For this reason the rail traffic is projected at a higher level going east. There was some allowance for westward traffic although it was a very few trains per day.

Issue 12-4:

If coal leased in the Nichols spur area is to be used for mine maintenance the trains per day from Nichols spur would not vary among Alternatives 1, 2, 3, or 4.

Raised by:

Carole Dawkins, Interstate Commerce Commission (Letter 39)

Response:

Your comment is correct. Train per day rates should be the same for all alternatives. The correction was made in the FEIS.

Issue 12-5:

The fiscal impacts of road improvement should be quantified and included in projections for county budget and state expenditures.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

We do not have the ability to analyze the costs of these impacts. Sources with the Montana and Wyoming Highway Departments state that increased costs and budget cuts were making it difficult for them to keep up with needed maintenance. They also said it was virtually impossible to calculate traffic volumes and related maintenance costs for specific routes for 1990 and beyond. For this reason impact as related to the alternative leasing levels were pointed out in the DEIS with no discussion of costs.

Issue 12-6:

Current rail traffic was not given.

Raised by:

William P. King, Wyoming State Highway Department (Letter 30)

Response:

This information was presented in Table 3-4 and Figure F-3 in the DEIS.

Issue 12-7:

Mitigating measures for "at-grade" crossings were not proposed.

Raised by:

William P. King, Wyoming State Highway Department (Letter 30)

Response:

Specific mitigating measures are more appropriately placed in the mine plans and assessments of individual operations, in which more specific information on the distribution and timing of effects will be available.

13

Noise

Issue 13-1:

Are you stating that Broadus is within the 55 dBA noise zone of railroad traffic?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

We agree that the comment on the 55 dBA noise zone is confusing and we have clarified it in the EIS. The impact in Broadus and other communities not along rail lines would be from increased traffic on state highways, city streets, and county roads. The 55 dBA zones for most routes would fall between 500 and 1,000 feet from the road centerline.

Issue 13-2:

The costs of noise pollution (reduced weight gain in cattle, etc.) are not but should be included in the EIS.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

We do not believe that costs of noise pollution as related to the proposed action is a significant impact on the region. Additionally we know of not evidence that noise levels from this type of mining or transportation would impact cattle causing weight loss.

14

Sociology

Issue 14-1:

Because the City of Gillette plans to pursue a more lenient annexation policy, population projections should be adjusted upward.

Raised by:

Michael B. Enzi, Mayor of Gillette (Letter 6)

Response:

It is quite possible that a more lenient annexation policy could increase the city's share of the county's population. On the other hand there has been a pronounced downward trend in that ratio in the last three census counts (1960, 1970, and 1980), dropping from 61.08 through 55.52 to 49.79. It is felt that the 1980 ratio will serve as a better indicator than some other unknown.

Issue 14-2:

Alternative 1, No-Action, is shown to affect Rosebud and Powder River Counties. Is Sheridan unaffected under this alternative?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

Alternative 1 is shown to affect Rosebud and Big Horn Counties. By comparing the 1979 data for Sheridan (Table 3-8) to the projected baseline data in Tables 4-10, 4-11, and 4-12 it can be seen that Sheridan will be affected by developments under the No-Action Alternative.

Issue 14-3:

Under the No-Action Alternative please state which mines create this level of impact by year.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

Since there is a projected trend upward in the region, 5 year "benchmark" increments were used. Any additional analysis under the No-Action would be superfluous, because there would be no new federal action as it relates to the leasing alternative.

Issue 14-4:

Under the No-Action do you still assume 40 percent of the socio-economic impacts to be in Powder River County?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

Careful comparison of the data provided in Tables 3-7, 4-10, 4-11 and 4-12 will indicate that impacts to Powder River County are considered non-existent under the baseline.

Issue 14-5:

What is the number of houses in Ashland in 1981? Is it less than 50?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

Table 3-6 of the DEIS indicates that in 1980, the year used as a benchmark for Montana counties, there were 248 housing units in the Ashland District.

Issue 14-6:

Upon what population increase do you base the need for 1,813 additional housing units in Rosebud County under the No-Action Alternative? If Ashland increases by 540 people, assuming one person per added house, where are the other 1,273 units forecast to be needed?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

Tables 3-7 and 4-11 indicate a projected population increase of 4,735 under the baseline alternative between 1980 and 1990 for Rosebud County. The same tables indicate a projected population increase of only 231 for the Ashland District during the same time frame. It can be seen that the changes to the Ashland District represent only a small part of the changes to the overall county under the No-Action Alternative.

Issue 14-7:

The DEIS has overstated regional socio-economic impacts due to overestimating coal production in the baseline and understated the longer term impacts to the region and the nation which could result from likely shortages in the coal supply.

Raised by:

Philip L. White, Texas Energy Services, Inc. (Letter 13)

Response:

Answers to this issue may be found in previous responses.

Issue 14-8:

Population increases are not expected for southeastern Montana without new Federal Coal Leasing.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Please see response 15-7 (paragraph 3) which points out that even without new federal leasing population will increase in Rosebud and Big Horn Counties due to developing coal mines.

Issue 14-9:

Mitigation of social effects is not adequately addressed in the DEIS.

Raised by:

Michael Enzi, Mayor, City of Gillette (Letter 6)

Barbara Kennedy, Miles City, Montana (Letter 8)

Margaret Ottoy, Assistant Planner, Miles City, Montana (Letter 10)

Richard C. Moore, Industrial Siting Administration (Wyoming) (Letter 32)

Response:

There are no "special" mitigation measures for social effects in the EIS. Impacts were based on a "worse case" basis. And, if measures are developed after leasing, the identified impacts would be reduced.

Issue 14-10:

The DEIS contains an error in its description of Ashland's school situation.

Raised by:

William J. Robinson, Western Energy Company (Letter 18)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The text under Community Services and Facilities, Chapter 3 (Page 41, second paragraph) has been changed to: Ashland (Rosebud County) does not currently have a public high school for non-Native Americans. Students from the area attend public schools in Colstrip and Broadus.

Issue 14-11:

The DEIS does not adequately address potential problems associated with rapid population growth.

Raised by:

John Wiener, Sierra Club (Letter 24)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The text under social organization, Chapter 4 (page 62) has been changed with the addition of the following: Rapid population growth in the Ashland area and the Broadus area would result in visible stresses such as personal property crime, family instability, (divorce, spouse abuse, child abuse and neglect), alcohol and drug abuse, interpersonal conflict, and similar behaviors.

While it is uncertain as to whether the rate would markedly change, the increased population levels would virtually insure that the stress incidents would increase. These stresses of adaptation, affecting both long-time residents and newcomers, would be most evident and intense during the initial construction phase of the mine development under Alternative 4. However, at least until construction is completed and stability is re-established, they would also exist in the Ashland and Broadus areas under Alternative 2 and 3 development.

Issue 14-12:

Regional attitudes toward coal development are not as favorable as the EIS portrays.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Nick Golder (Statement 57)

Response:

The text under Attitudes, Chapter 3 (Page 41) has been changed to: Overall, people who were interviewed within the region favored coal development. There was a higher level of unqualified support for coal development in Wyoming than in Montana. Some respondents stated they would be in favor only if it was certain the coal was needed to help meet the nation's energy requirements. (The remainder of the discussion is accurate.)

Issue 14-13:

Table 4-8 in the DEIS describes only personnel needs and it is inconsistent with the Powder River Comprehensive Plan.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Lonnie Beach, Town of Broadus (Statement 53)

Response:

Table 4-8 provides general indicators of the magnitude of personnel-facility requirements under the various alternatives. That table has been revised to state that the projections are based on continuation of current levels of service.

Issue 14-14:

Housing quantity effects are addressed in the DEIS but not housing quality-costs.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Table 4-9 in the DEIS displays housing requirements for cities and counties in the impact area. It was designed to provide a general indication of the magnitude of housing needs associated with the various alternatives. This level of analysis does not permit valid projections of housing costs and quality.

Issue 14-15:

The DEIS lacks detailed social and economic effects information.

Raised by:

Margaret Ottoy, Assistant Planner, Miles City, Montana (Letter 10)

Response:

These remarks call for a level of specificity that is inappropriate for a regional document. The EIS is not designed for detailed, location-specific planning.

Issue 14-16:

The purpose of the description of potential relations between Native Americans and newcomers in the Ashland area is unclear.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

The purpose of the description is to point out a potential social impact. Representatives of the BLM EIS team met with Northern Cheyenne tribal officials. These officials expressed concern over potential Native American newcomer conflicts in the Ashland area.

Issue 14-17:

The numbers in Table 2-1 (Sociology) do not match the text and are of unknown origin.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

The figures in Table 2-1 (Sociology), developed by taking the existing ratio of residents to service personnel and facilities and applying this ratio to projected future populations, appears to be consistent with the text (pages 15-21 in the DEIS).

15

Economics

Issue 15-1:

How were the deficit balances arrived at in the fiscal analysis? What assumptions were made?

Raised by:

Michael B. Enzi, Mayor of Gillette (Letter 6)

Response:

The preliminary purpose of the analysis is to provide a comparison of the relative magnitudes of deficits (or surpluses), and to point out localities where potential costs would exceed potential benefits or vice versa. The assumptions and methods are explained in the footnotes on Tables 2-3 and 4-12.

Issue 15-2:

State public sector coal revenues and expenditures related to revenue distributions as per statute; for example, severance taxes.

Raised by:

Margaret Ottoy, Assistant Planner, Miles City, Montana (Letter 10)

Reponse:

The DEIS provides a clear, concise comparison among the alternatives of potential benefits and potential costs for localities. A presentation of revenue distribution among Montana's accounting funds would be pointless in terms of providing the decision maker with comparisons of relative, potential, local benefits because Montana's local governments do not receive a direct apportionment of coal revenues.

Issue 15-3:

Compare agricultural employment and predicted coal industry employment.

Raised by:

Margaret Ottoy, Assistant Planner, Miles City, Montana (Letter 10)

Response:

Table 4-10 of the DEIS provides a comparison of predicted coal employment to all other employment and in this manner provides a relative measure of the increasing importance of coal employment to the region. However, it is not felt that an additional breakdown of employment would aid in the decision making process.

Issue 15-4:

Revenues from agricultural land should be compared with revenues from coal acreage since taxable valuations are of importance to regional economics.

Raised by:

Margaret Ottoy, Assistant Planner, Miles City, Montana (Letter 10)

Response:

Table G-1 has now been changed to reflect the potential loss of agricultural sales per acre compared to the potential gain per acre to the agricultural land owner from coal royalties. The relative value of coal acreage to agricultural acreage can be inferred from the information provided.

Issue 15-5:

The DEIS is inadequate in treatment of: income, relative importance of industrial sectors, purchase of labor as a percent of the economy, local per capita revenues and expenditures by industrial share, distribution of Federal mineral royalties, employment and employment breakdown, inflation, workforce participation rates, and population forecasts, and other adverse impacts.

Raised by:

Margaret Ottoy, Assistant Planner, Miles City, Montanas (Letter 10)

Richard Jones, Miles City, Montana (Letter 11)

Richard Cauble, National Wildlife Federation (Letter 26)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The DEIS provides existing levels of employment, population, and budgets. Projections of employment, population, and fiscal balance for the year 1990 are also provided for the No-Action Alternative (which is the baseline) and for the other alternatives.

Issue 15-6:

It is false to assume that the development of coal would commit the southeastern Montana region to a single economic base.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

This statement has been changed.

Issue 15-7:

Under "Land Use," the DEIS states: "Land use patterns are expected to shift from agricultural toward mining and urbanization without new Federal coal leasing and implementation of the preferred alternative would change this very little."

"The DEIS does not state which way this would change."

"The conclusion, in any case, contradicts the finding that 44 more ranches would be impacted under the preferred alternative."

"It also ignores all off-site impacts, including the impacts to ranches along Tongue River and Otter Creek which would result from the construction of the Tongue River Railroad, due to adoption of the preferred alternative."

"Further, it ignores the fact that without Federal Leasing, land use patterns would not shift to industrial uses in southeastern Montana, since no new mines would open without Federal Leasing."

Raised by:

Mr. and Mrs. Herb Mobley, Tongue River Agricultural Protective Association (Letter 25)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Table 4-3 and the discussion on land use on page 60 of the DEIS point out that a total of 221,400 acres (both on-site and off-site) in the region will be disturbed by industrialization under Alternative 1. Under the Preferred Alternative, an additional 65,000 acres would be disturbed by both on-site impacts and off-site impacts. Land use patterns on approximately one percent of the region would shift towards industrialization. This includes both on-site and off-site disturbance.

Impacts of the Tongue River Railroad are included under Alternative 1, as the railroad may be built with or without additional Federal Leasing.

This may be true of Powder River County; however, the Spring Creek, Consol CX, and Peter Kewitt CX mines will all become reality in Big Horn County, and the Montco-Nance and Greenleaf-Miller mines will become operational in Rosebud County, In addition, there will be increased power plant capacity in Rosebud County as well as increased oil and gas activity in both Rosebud and Big Horn Counties.

Issue 15-8:

Economics-The DEIS discusses only 1990 budget levels. The years between 1985 and 1990-when impacts are at their peak, but income from the mines (still under construction) will be at a minimum--is much more critical in terms of local budgets than 1990.

Raised by:

Mr. and Mrs. Herb Mobley, Tongue River Agricultural Protection Association (Letter 25)

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

This is true; however, in Montana local budgets will be highly dependent on the lobbying efforts of local governmental entities in all years since Montana statutes do not provide a mechanism to assure local governments of a percentage of coal revenues. The year 1990 does represent the expected peak in demand on services and facilities that may be induced by population increases resulting from Alternatives 2, 3, or 4. Admittedly, the outlay for capital construction may occur prior to this peak demand; however, the burden of debt servicing will occur afterwards. It is for this reason that every effort was made to include debt servicing in the basis for projecting public expenditures.

Issues 15-9:

The DEIS assumes budgets without new leasing, although the No-Action Alternative assumes increases in coal production of roughly 200 percent over current production. Obviously, some communities will be greatly impacted.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

The assumption that the budget would be balanced is misleading. The assumption has been changed to state that revenues would equal expenditures through taxation, user fees, grants or debt (Ref. Table 4-12).

Issue 15-10:

The greatest problem with the economic fiscal analysis is that the tables provided do not have the existing baselines and the Alternative 1 baseline together for comparison. This makes the comparison of leasing impacts misleading, and understates the overall impact of mining.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Impacts from new leasing are measured from the No-Action Alternative baseline not the existing baseline (Chapter 3).

Issue 15-11:

On page 21 is found the only reference in the DEIS to the impacts of leasing on agricultural economics. "Impacts to agricultural economics are considered insignificant" under Alternatives 2, 3, and 4, according to the DEIS; the DEIS then cites Appendix G, and refers to the tract profiles for the methodology used. This information (methodology) should be in the DEIS itself, at least in an Appendix; NPRC has been unable to get a single answer as to how the figures in Appendix G were arrived at. It is clear that different methodologies were used, and possibly different data, between the calculations in the Tract Profiles and those in Table G.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Tables G-1 and G-2 in Appendix G contain the logic and methodology used in arriving at the conclusion that impacts to agricultural economics are considered insignificant for the Montana section of the Powder River Region. Impacts to Wyoming agriculture were analyzed in the Tract Profiles for Wyoming tracts. The statement on page 21 (DEIS) is being changed to reflect this information. Table G-1 is also being changed to provide a better analysis of impacts to the agricultural landowner.

Issue 15-12:

The discussion (on agricultural impacts) is misleading, in any case, since the analysis only considers impacts to agriculture on the mine sites. Furthermore, the DEIS elsewhere states that the Preferred Alternative will remove 293,500 acres from production and cause a total change in the economic base of the region from agriculture to coal. How BLM can, nonetheless, conclude that "impacts to agricultural economics are considered insignificant" is past understanding.

Raised by

John D. Smillie, Northern Plains Resouce Council (Letter 35)

Response:

Table 4-3 on page 70 of the DEIS points out that under Alternative 4 (the maximum leasing alternative) 293,500 total acres would be disturbed, including 210,000 acres in the baseline which will be disturbed even without additional leasing. 55,100 acres of rangeland and 9,100 acres of agricultural land would be disturbed under Alternative 3. The discussion on land use on page 60 (DEIS) points out that an additional 800 acres would be disturbed for off-site impacts under Alternative 3. The discussion further points out that, in terms of total crop acreage disturbed under Alternative 3, only two-tenths of one percent would be disturbed in Big Horn County, and only 1 percent would be disturbed in Rosebud and Powder River Counties. See Table G-2 for the relative significance of 1979 crop production and cattle inventory in these counties to Montana and the U.S. It should be noted that the statement on the shift in economic base has been revised.

Issue 15-13:

The analysis of fiscal impacts in Table 2-3 leaves out impacts to Ashland because it is an unincorporated community without formal budgets. It would seem logical to project expenses and revenue on a per capita basis, as was done with the incorporated communities. This would at least provide some analysis of likely fiscal impacts to Ashland, which could experience the greatest impact of any locality under the Preferred Alternative. To ignore these impacts, as the DEIS does, because of the inconvenience involved in measurement is inadequate and innaccurate.

Raised by:

John D. Smillie, Northern Plains Resource Council (Letter 35)

Response:

Because Ashland is unincorporated there was no existing budget on which to base a per capita projection. Relative population increases for the Ashland District are pointed out. Because all of the population increases to Rosebud County under Alternatives 2, 3, or 4 will occur in the Ashland District it can be validly asusmed that the expenditures resulting under these alternatives to Rosebud County and Rosebud County schools will be related to the Ashland District.

Issue 15-14:

There will be some overwhelming impacts to Powder River County, resulting from Federal Coal Leasing actions, which may be overlooked by the reader due to the inclusion of the word "only" in the phrase "only 40 percent of any population increase..." on page 63.

Raised by:

Lonnie Beach, Town Clerk, Broadus, Montana (Statement 53)

Response:

Agreed. The word has been deleted.

Issue 15-15:

The fiscal analysis in the DEIS doesn't properly address the potential time lags between the incidence of socio-economic needs and possible remedies.

Raised by:

Lonnie Beach, Town Clerk, Broadus, Montana (Statement 53)

Response:

We believe that the socio-economic analysis in the DEIS has provided clear, concise comparisons of the employment, population, and potential fiscal changes that could result from the alternatives and has provided a measurement of the severity of potential impacts to local communities. The fact that the DEIS only defines one probable scenario must be acknowledged; however, the possible variations of revenue lags and required lead times would be infinite and analysis of all possible cases would fill volumes. In addition, due consideration of the role of local authorities, in their lobbying efforts to reduce revenue lags and lead time requirements, indicates that the problem may not be insurmountable.

Issue 15-16:

The fiscal analysis for Montana's localities appears to be based on Wyoming's tax laws, and the differences in tax laws between Montana and Wyoming should be addressed.

Raised by:

Lonnie Beach, Town Clerk, Broadus, Montana (Statement 53)

Response:

By presenting the fiscal analysis in the manner presented, the DEIS achieves the purpose of comparing potential benefits to potential costs. This is pointed out on page 63 (DEIS) and cannot be overemphasized. The fact that Montana statutes do not directly apportion coal revenues to local communities could evoke the temptation to explore only the costs to local communities. However, this would be highly misleading as the potential for public revenues from coal production is significant, especially in view of the 30 percent severance tax levied by the State of Montana.

It would not be productive to address the differences between Wyoming's tax laws and Montana's tax laws, and the fiscal analysis for Montana's localities is not based on Wyoming's tax laws. But the analysis is presented in a manner that ties the potential costs of coal production to the potential benefits.

Issue 15-17:

Fiscal surpluses will not occur in Montana, and the DEIS should acknowledge the existence of the joint Rosebud-Powder River School District at Ashland.

Raised by:

Lonnie Beach, Town Clerk, Broadus, Montana (State 53)

Walter Archer, Powder River Protective Association (Statement 54)

Response:

The fiscal analysis, as presented in the DEIS, achieves the purpose of comparing potential costs to potential benefits. A fiscal deficit or a fiscal surplus should be viewed only from the perspective that the potential exists for the costs to a locality to exceed the benefits, or vice versa, the benefits to a locality may exceed the costs. With this in mind the magnitude of a surplus or a deficit becomes irrelevant, and the importance of a analysis shifts to the question of whether benefits of the alternative will cover the costs of the alternative or not. A paragraph has been added under the Economics heading in Chapter 2 to point this out.

In addition, although it is good that a mechanism such as the joint Rosebud-Powder River School District exists to alleviate impacts to the school system at Ashland, the analysis should still only serve to point out the localities where potential costs could exceed potential benefits.

Issue 15-18:

Table G-1 implicitly assumes a multiplier of 2.58 times loss in agricultural sales to achieve loss to gross regional production. What justification is offered for this assumption.

Raised by:

Richard W. Jones, Miles City, Montana (Letter 11)

Response:

The multiplier in question (2.58) was originated by the Regional Economic Analysis Division of The Bureau of Economic Analysis, U.S. Department of Commerce. It was published by the Water Resource Council in the Regional Industrial Multiplier System in January, 1977. It should be noted that the information in Table G-1 has been replaced in order to provide a more in-depth analysis of the impacts to the agricultural landowner.

Issue 15-19:

On page 5 and 6 of the letter referenced below there exists much confusion regarding employment under Sub-Alternatives 2A, B, and C.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

The employment data presented under the analysis of the sub-alternatives is entirely in error. This has been changed under Alternative 2 or 3. In a worst case scenario, coal employment will reach 3,985 in Montana and 13,300 in Wyoming.

Page 41 of the DEIS provides the level of coal employment as it existed in the 3 counties in 1980. Table 4-10 provides the baseline coal employment projected for those counties in 1990 as well as coal employment projected under the alternatives.

Issue 15-20:

The DEIS does not account for the impacts of mines that may open in the area without Federal Leases.

Raised by:

Walter Archer, Powder River Protective Association (Statement 54)

Response:

All proposed or potential mines, that were considered legitimate possibilities, were included in the baseline. Therefore, the population changes induced by these mines are reflected in the baseline expenditure levels.

Issue 15-21:

How many new jobs are forecast in the Montana sectors other than mining?

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

By comparing the data on page 41 (DEIS) and in Tables 3-7 and 4-10 it is readily apparent that 2,426 new jobs are projected in the baseline for 1990 outside of coal employment.

Issue 15-22:

Clarify how the employment figure of 9,100 was arrived at.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

The statement under Alternative 4 has been changed to read 4,675 for Montana and 14,300 for Wyoming (Ref. Table 4-10). The data on the housing was derived in Table 4-9).

Issue 15-23:

Since you do not report coal employment for Alternative 1, employment projections under the other Alternatives are not easy to accept.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

Coal employment is projected for Alternative 1 in Table 4-10; however, the data is now included in the introduction to Alternative 1 in Chapter 2.

Issue 15-24:

Table 2-1, Economics: Please give sources and calculations; why is Broadus population excluded.

Raised by:

Barbara Kennedy, Miles City, Montana (Letter 8)

Response:

Table 2-1 is merely a summary of the more significant changes pointed out in the rest of the DEIS. Because revenue/expenditure projections were not made for Ashland it was necessary to provide population projections.

16

Other Issues

Issue 16-1:

It is difficult to determine the actual area covered and regional boundary on the map of regional activities.

Raised by:

W. Donald Dexter, Wyoming Game and Fish Department (Letter 20)

Response:

The map shows the overall area of concern in Montana and Wyoming with the boundary of the map being the general boundary of the region. Regional boundaries do vary for each resource discussed in the DEIS. Geology is essentially site specific or at least limited to the high to moderate areas of the coal seams. Recreation is discussed for the entire region; soils, vegetation and reclamation is essentially the region of the existing and proposed mines; wildlife covers the herd units and areas affected by existing and proposed mines plus major access facilities. Water resources considers site specific uses and effects as well as the region as a whole. Waters such as Alcova, Glendo, Keyhole, etc. were not discussed because no potential impacts to these waters were identified. Air quality was analyzed site specifically and cumulatively for the region. Other resource discussions follow the same trend with discussions focusing on that portion of the region believed to be significantly affected.

Issue 16-2:

The regional maps contains errors on some of the tracts near Colstrip.

Raised by:

Patty Kluver (Letter 42)

Response:

The Colstrip D tract is mapped properly in the Tract Profile but improperly on the regional map. This fact has been witnessed on the map erratta sheet in the FEIS.

MAP ERRATTA

1. None of the Colstrip D tract falls within section 18 of Township 2 North, Range 42 East, in Montana.

2. The North Antelope Mine should appear as a nonproducing mine adjacent to the North Antelope Preference Right Lease Application group in Township 41 North, Range 70 West, in Wyoming.

3. The Crow/Shell Mine should be located in Townships 8 and 9 South, Range 37 and 38 East, in Montana.

4. The North Decker tract (in Montana) should be amended by omitting the following land:

   Township 8 South, Range 40 East
   - Section 21: SE 1/4 SE 1/4
   - Section 26: SW 1/4 NE 1/4, W 1/2 SE 1/4, S 1/2 NW 1/4, SW 1/4
   - Section 27: All
   - Section 28: E 1/2, E 1/2 NW 1/4
   - Section 34: NE 1/4 NE 1/4
   - Section 35: N 1/2 NW 1/4

5. A black triangle should be added to the map to depict the Gas Draw Oil Field.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1981—576-053/25 Region No. 8

RELATED MATERIALS
ATTACHMENT 8

The Big Sky Co.

MONTANA HOUSE OF REPRESENTATIVES

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Montana Land Board
P.O. Box 201601
Helena, Montana 59620-1601

December 18, 2009

Honorable Members of the Montana Land Board,

We the undersigned 22 Democratic legislators write to rebut the recent claim by a handful of our Republican colleagues that the debate about climate change continues.

For several years we have tried in vain to engage Republican colleagues in a useful dialogue about the relationship between energy policy and climate change. Every time we connected relevant "dots", our Republican colleagues simply expressed doubt about the relationship and claimed that the debate about climate change was unsettled. When we asked them to provide credible, science-based evidence supporting their claim they grew silent. They have never responded usefully to the simple fact that all major scientific societies along with over 2,500 scientists working with the Intergovernmental Panel on Climate Change have endorsed the notion that increasing atmospheric concentrations of greenhouse gases are causing the climate to change.

Who cares? We all should, given that a small group of Republicans has now publicly questioned climate change based on nothing more than opinions. And while everyone is entitled to an opinion, there is only one set of facts.

The facts, as carefully assembled by countless scientific papers published in peer-reviewed journals over the last 30 years, are clear: climate change is real, the pace of change is quickening, and the effects are increasingly widespread, disastrous, and destined to spread across the landscape with great indifference to the impacts on humanity.

In Montana our own Nobel laureate, Dr. Steve Running, has identified troubling trends for our great state. For example, March temperatures are now 6° to 7° F hotter, resulting in unusually early snowmelt leading to disastrous wildfires, bone dry agricultural fields, and hot, slow moving rivers unfamiliar to coldwater trout and other native species. The best climate models indicate that in 50 years Missoula will get no snow and that our coolest summers then will be hotter than our hottest summers now.

From extinctions to persistent and deep droughts, record setting wildfire seasons, insect outbreaks (pine beetles), disruption of water supplies, and increasingly volatile and intense weather we will not escape the life altering effects of the new climate. Montana, like nearly every corner of the world, is ground zero for climate change.

In deciding whether to lease the Otter Creek coal, you must consider many complex issues, including climate change. The physical properties of coal (which are not debatable) are such that burning 575 million tons of it from the Otter Creek Valley in existing power plants would result in emission of over 1 billion tons of carbon dioxide. That amounts to about 30 times the annual emissions of carbon dioxide statewide. In short, a billion tons of carbon dioxide is an enormous amount that would contribute to environmental problems for decades to come.

With all due respect to our Republican colleagues, advocating for traditional use of coal based on ill-informed opinions about the reality of climate change is a great disservice to Montana.

It is past time for Montana to fully embrace a new energy future that emphasizes renewable sources of energy and promotes national security, environmental integrity, and thousands of good paying, long-lasting clean energy jobs that are increasing favored by the marketplace. A first step in crafting such a future is recognizing the reality of climate change.

Sincerely,

Mike Phillips, State Representative, Bozeman
Ron Erickson, State Senator, Missoula
Dick Barrett, State Representative, Missoula
Brady Wiseman, State Representative, Bozeman
Franke Wilmer, State Representative, Bozeman
Margaret MacDonald, State Representative, Billings
Michele Reinhart, State Representative, Missoula
Sue Malek, State Representative, Missoula
Bob Hawks, State Senator, Bozeman
Christine Kaufmann, State Senator, Helena
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Gary Branae, State Senator, Billings
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Teresa Henry, State Representative, Missoula
Frosty Boss Ribs, State Representative, Heart Butte
Wanda Grinde, State Representative, Billings
Tim Furey, State Representative, Missoula
DOD EBINGER, STATE REPRESENTATIVE
CLIFF AARSON, STATE SENATOR

Waste Land: Meditations an a Ravaged Landscape (Hardcover)

~ David T. Hanson (Author, Photographer), Wendell Berry (Preface), Mark Dowie (Afterword)

Editorial Reviews

Review

"The history of Western industrial society's assault on the earth and the devastation it has wrought are the subjects of Hanson's aerial photographs....Hanson's photographs of this ongoing drama are among the most powerful and disturbing images ever to be seen, perhaps because their eerie, abstract beauty almost seems to negate the sinister life that glimmers in them...."--Suzi Gablik, Art historian and critic

-- *Review*

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RELATED MATERIALS
ATTACHMENT 10

-WOHEHIV-
The Morning Star

NORTHERN CHEYEN
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-WOHEHIV-
The Morning Star

December 15, 2009

Governor Brian Schweitzer
Montana State Capitol Building
P.O. Box 200801
Helena, MT 59620-0801

Re: Letter of Support for Otter Creek Coal Tract Leasing

Dear Governor Schweitzer:

I am writing to strongly support Otter Creek coal tract leasing.

As you know, when Otter Creek coal leasing and subsequent development goes forward, the Northern Cheyenne Tribe will receive the benefits of the Settlement Agreement between the Montana State Land Board and the Tribe. The Tribal Council has enacted a Tribal Council Resolution in support of the Settlement Agreement and I believe that the majority of our community is in favor of the proposed leasing and development.

As Tribal President, I wish to state my clear and strong support for the development of the Otter Creek Coal Tracts. Such development would provide critical economic development for the whole southeastern Montana region, including the Northern Cheyenne Reservation and surrounding communities. The Northern Cheyenne Reservation suffers the most worst economic circumstances in southeastern Montana. Employment and contracting opportunities and other benefits detailed in the Settlement Agreement would be a tremendous boon to our community. Indeed, leasing and development of the Otter Creek Coal tracts would be an economic "shot in the arm" to all of southeastern Montana, State Government and public education.

In closing, I urge you to move forward with leasing of the Otter Creek coal tracts. Thank you for your consideration.

Sincerely,

Leroy A. Spang

Leroy Spang, President
Northern Cheyenne Tribe

LITTLE WOLF AND MORNING STAR - Out of defeat and exile they led us back to Montana and won our Cheyenne homeland that we will keep forever.

RELATED MATERIALS
ATTACHMENT 11

International Brotherhood of
BOILERMAKERS • IRON SHIPBUILDERS

ROBERT WINGER
PRESIDENT

104 WEST MAIN
P.O. BOX 1286
EAST HELENA, MT 59635
PHONE: (406) 670-8714
FAX: (406) 227-6721
mbwinger@bresnan.net

December 13, 2009

Dear Land Board,

I am writing in support of the Otter Creek Coal Lease. The importance of these coal leases, in fact the importance of moving ahead with any and all coal development, cannot be over stated. The future of coal associated jobs in Montana depends on portraying a positive "coal attitude". Frankly our nation's economy is in the toilet. Jobs are disappearing, some never to return. Unfortunately it is catching up to us in Montana. We already rank very near the bottom in per capita income. We need good high paying jobs, the kind of jobs produced by the Coal industry. Coal is a job producer from mining, all the way to producing electricity. It provides excellent paying blue and white collar jobs. Currently Boilermakers (in Montana) make around $51.00 per hour counting fringe benefits, does that sound like the kind of jobs Montana needs? Are those the kind of wages that will encourage excellent second tier jobs in areas surrounding the primary development? In October, Senator Baucus invited me to testify at a committee hearing on the SB 1733 (Cap and Trade). I've attached my oral testimony.

Wind energy may someday have a place in the energy portfolio, but presently there has been way too much hype of the wind energy industry and associated job opportunities'. Attached is an article from October 29, 2009 issue of the Wall Street Journal. 3,000 jobs in the biggest wind farm in the US. Unfortunately 85% will be in China. What else would you expect? Companies always go to the cheapest labor when they can. There goes the idea that wind parts will be manufactured in the US. There will be token manufacturing, but the cheap foreign labor will be utilized anytime it can be. Putting up a wind farm takes about 80 to 90 workers about 3 months. Hardly the 1,000 highly skilled, highly paid workers needed to build a coal fired power plant. This same plant that needs highly trained and highly paid workers to operate and maintain it. Did you know that the average (annual) turnaround at the Colstrip facilities employs around 300 to 400 workers for 6 to 10, 70 hour weeks? These are the types of job opportunities this economy needs. Not found on wind farms. Even with these high paying jobs coal power is inexpensive second only to hydro power.

While there are good level headed environmental groups such as "The Environmental Defense Fund", I am fed up with the likes of MEIC, Earth Justice, The Sierra Club and other fringe groups.. It seems their primary goal is to shut down any and all coal fired plants. Attached is a flyer bragging about their success in killing the Highwood Generating Station. They took much needed, high paying jobs right out of Montana. There are over 600 coal fired plants in the US alone with new ones coming on-line in China and India every other week. Wouldn't someone sincerely wanting to curb CO2, embrace Carbon Capture and Storage as the only viable way to actually reduce CO2? New coal plants coming on line in the US reduce 30% off the top just with increased efficiency. Ignoring Coal's vital prominence in power generation is just not facing the realities that coal will be here for decades.

Local 11 of the Boilermakers is opening a training facility in Colstrip Montana. We will train apprentice applicants in welding as well as the other skills a Boilermaker needs. We would hope to attract Northern Cheyenne, Crow and others in Eastern Montana. This is in addition to our Center in East Helena. We work closely with and have had success recruiting through the states COTs. The training will position

them to get in our apprenticeship. Guess what? We need the jobs before we can put them to work. All the training in the world won't matter until the jobs are there.

These leases of our state land will provide much needed funds for our public schools, funds for a future of education in Montana. Montana also needs these leases to show willingness to work with the coal industry. Highwood was a fiasco for our "business image". Wyoming on the other hand is very cooperative. We need to attract the jobs to Montana therefore shouldn't we cooperate? There is over $150 billion for cleaning up CO2 in coal in the Cap and Trade. We need some of that in Montana. We need every single bit of pro willingness to work cleaning up coal to attract projects. These leases are a part of showing we want the jobs. While it is important to get the very highest bid for these leases, we should not demand an overly high price. I am not advocating selling out Montana. Conversely I want Montana to take its role in leading the world; in the real effort to clean up the CO2 thereby creating those high paying jobs. When evaluating the leases keep in mind that it is standard practices for communities and even states to give huge $ incentives to attract a particular company or factory, knowing that the jobs and development will make that upfront investment worthwhile. These leases can and should be used in the same way. Combine good jobs, development, lease money for public schools, the opportunity for Montana to truly lead in CO2 clean up and you have a win-win situation. I encourage you to open up Otter Creek. Show that we want good employment for our citizens. Don't make the construction worker (Boilermaker, Pipefitter, Electrician etc) those jobs that leave and won't come back.

Sincerely,

Robert K. Winger

Robert K. Winger
President Boilermakers Local 11

International Brotherhood of
BOILERMAKERS • IRON SHIPBUILDERS

ROBERT WINGER
PRESIDENT

BLACKSMITHS • FORGERS & HELPERS
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mbwinger@bresnan.net

Senate Bill 1733: The Clean Energy Jobs and American Power Act
Oral Testimony to Committee on Environment and Public Works, United States Senate
October 29, 2009

My name Bob Winger, I am President of the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths Forgers and Helpers, Local 11, located in East Helena, MT. On behalf of the members of my local and our Union's International President Newton B. Jones, I want to thank Chairwoman Boxer, Senator Baucus and the members of the Committee for the opportunity to testify at this important hearing.

I have been a Boilermaker for 28 years. Boilermakers are a highly skilled highly paid trade: Welding, Rigging, Fitting steel in heavy industry. I have worked in over 20 States building and maintaining Power Plants, Refineries and Paper Mills It is a career that has allowed me to be solidly in the middle class with good health insurance, a fixed pension, annuity and above average wages, enabling me to help 2 daughters through college and the youngest in her 3rd year. Good blue collar work. Opportunities for Americans to get and hold these types of jobs have disappeared. These are the types of jobs that can flourish with the passing of this legislation. Coal power generation is clean, cheap, dependable and job intensive. Over the years the coal industry has met the challenges of cleaning up emissions: SO2 with scrubbers, NOX with SCR's, particulates with bag houses, and in some states, including Montana, mercury reduction units. As emissions were identified, regulations enacted, solutions were created. Those solutions are the jobs this country desperately needs. Take scrubbers, as soon as rules identifying levels of SO2 that must be met and a reasonable time frame was set, American ingenuity kicked in. General equipment and methods are designed. This equipment is then engineered to fit specific power plants, blue prints are drawn up, good white collar jobs for our college graduates. Steel is made in steel mills then sent to shops where it is fabricated into parts which are shipped to the plant where it is put together. The new unit is then put on line reducing the targeted emission. Very job intensive throughout the blue collar sector. As scrubbers were built they became cheaper and more efficient through lessons learned. Once these add ons to existing plants are built they must be operated and maintained creating more jobs. This same process will work for carbon capture and storage.

There are over 600 coal fired plants in the U.S. Think of the millions of man years of work to build, operate and maintain CCS Units on these plants. Happily this legislation addresses the need to help our main base load power generation source (coal) clean up. Any legislation to reduce green house gasses that does not recognize the reality that coal is, will and should be our primary fuel for power generation is misleading. We need to take the lead in developing the technology and building of the CCS units. As leaders we can sell our technology to the developing countries resulting in actual global reduction of CO2.

This legislation sets the ground rules, thereby removing the uncertainties.

In Montana we had the Highwood generating station, a 250 mw, fluidized bed, coal fired power plant forced to be cancelled by lawsuit after lawsuit and an uncertain regulatory environment. This plant would have been one of the cleanest in the nation, for the pollutants already regulated by the EPA. In addition, I was assured by the Developers, Southern Montana Electric , that they would install CCS when it became commercially available. The developer cited the "Aura of Uncertainty" surrounding the US regulation of CO2 as a key factor in their decision. Building this plant would have employed Boilermakers for 4 years peaking at about 160. It's replacement? A natural gas "peaker" that will employ 4 Boilermakers for about 3 weeks.

I've been talking in job number relating to Boilermakers. That same 250 mw power plant would have required hundreds of Electricians, Pipefitters, Iron Workers, Operators, Carpenter, Millwrights, Sheet Metal Workers and Laborers. Add to this the secondary jobs in the communities where the construction takes place and we are talking jobs recovery!

Our International has recognized the need to train and recruit workers. In cooperation with PPl Montana we are building a training center in Colstrip Montana. This borders the Northern Cheyenne and Crow Reservations. We plan to train applicants in pre apprentice programs, basic welding and other skills necessary for a career in our craft.

I am not an expert on this or any legislation. I rely on my Government Affairs Department for that expertise. I am an expert on being employed providing energy to our country as well as the satisfaction of meeting the environmental challenges during my career.

Please get this legislation moving with rules and deadlines to remove the uncertainties and get the investments going. Supply the incentives to jump start the technology through pilot projects. Keep the wages even and fair utilizing prevailing wages through the consistent application of the Davis Bacon Act. Protect our manufacturers by preventing Carbon Leakage at the border. Don't forget our smaller refiners as we divvy up the allowances.

Once again I want to thank you for this opportunity to testify.

Bob Winger

Lines Inc. and other carriers.

Chinese-Made Turbines to Fill U.S. Wind Farm

By Rebecca Smith

A Chinese wind-turbine company, with financing help from Beijing, has struck a deal to be the exclusive supplier to one of the largest wind-farm developments in the U.S., a sign of how Chinese firms are aggressively capitalizing on America's clean-energy push.

The 36,000-acre development in West Texas would receive $1.5 billion in financing through Export-Import Bank of China. Shenyang Power Group, a five-month-old alliance, would supply the project with 240 of its 2.5-megawatt wind turbines, among the biggest made in the world.

The Obama administration is hoping a shift to renewable energy will inject new life into the U.S. manufacturing base and provide high-paying jobs, making up for losses in other sectors. But while the U.S. has poured money into renewable energy through tax credits and other subsidies, China has positioned itself to reap many of the benefits by ramping up its export machine.

Global manufacturing of wind turbines shifted primarily to Europe from the U.S. after the 1980s, as nations such as Spain created special pricing for renewable power. By 2005, less than a quarter of components going into turbines installed in the U.S. were made domestically.

The extension of a production tax credit stimulated domestic output during the past few years. But Elizabeth Salerno, a spokeswoman for the American Wind Energy Association, said that in the first three quarters of 2009, there were 33% fewer announcements of U.S. turbine-factory expansions than in the comparable period of 2008.

U.S. officials and domestic suppliers have been concerned that the U.S. wouldn't reap the full benefit of the country's rapid expansion in renewable energy. Sen. Jeff Bingaman (D., N.M.) has voiced concern that the U.S. has outsourced much of its clean-energy manufacturing capacity. As part of the stimulus bill earlier this year, he earmarked a $2.3 billion tax credit for domestic producers of clean-energy equipment.

Another hurdle is that many renewable-energy projects in the U.S. are having trouble securing financing because of tight credit markets and lower prices for power sales. As a result, many privately funded projects have been scaled back or canceled.

The federal government is trying to breathe new life into the industry and last month handed out more than $500 million in grants to a dozen wind and solar-energy projects.

Cappy McGarr, managing partner of **U.S. Renewable Energy Group**, a private-equity firm that is lead partner on the 600-megawatt development, said the partnership would seek tax credits and support from the federal stimulus package, which should amount to millions of dollars. Mr. McGarr said the project should create 2,800 jobs—of which 15% would be in the U.S. The rest would flow to China, where Shenyang employs 800 people.

Meanwhile, China is planning on future investments in the U.S. renewable industry as a way of creating a market for Chinese wind and solar equipment manufacturers.

"This is just the beginning," said Lu Jinxiang, chief executive of **A-Power Energy Generation Systems** Ltd., which controls Shenyang Power. He said the U.S. "is an ideal target" as it seeks to shift to renewable energy from fossil fuels.

The West Texas project exclusively would use 2.5-megawatt turbines made at Shenyang's turbine-manufacturing facility. The Texas project would soak up more than half of Shenyang's current annual production of 1,125 megawatts of turbine capacity.

The project still must garner the necessary permits, but developers hope to have turbines in service in March 2011.

—Ben Casselman contributed to this article.

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RELATED MATERIALS
ATTACHMENT 12

D.N.R.C.

SETTLEMENT AGREEMENT

SETTLEMENT AGREEMENT ("Agreement") entered into effective February 19, 2002, by the MONTANA STATE BOARD OF LAND COMMISSIONERS ("Board"), whose address is P.O. Box 201601, Helena, MT 59620-1601, and the NORTHERN CHEYENNE TRIBE ("Tribe"), whose address is P.O. Box 128, Lame Deer, MT 59043.

Recitals

A. Section 503 of the Department of the Interior and Related Agencies Appropriations Act of 1998, Pub. L. 105-83 ("Section 503"), provides that the Secretary of the Interior ("Secretary") must transfer to the State of Montana ("State") either (1) $10 million in federal mineral rights agreed to by the Secretary and the Governor of Montana ("Governor") through negotiations conducted in accordance with section 503(b) of the Act or (2) all federal mineral rights in three federal coal tracts (which federal mineral rights are referred to herein as the "Otter Creek Tracts").

B. The Governor has advised the Secretary that the State has opted for transfer of the Otter Creek Tracts, that the Secretary therefore has a non-discretionary duty to transfer the Otter Creek Tracts to the State, and that such a transfer is overdue and would not violate any federal or other law. Accordingly, the Governor has asked the Secretary to make such a transfer.

C. The Otter Creek Tracts consist of Otter Creek Tracts Nos. 1, 2 and 3 in Powder River County, Montana, which are legally described in Exhibit A attached hereto. In total, the Otter Creek Tracts encompass approximately 8,350 acres and are estimated to contain approximately 533 million tons of recoverable federal coal. At their closest point, the Otter Creek Tracts are approximately 3 miles from the Tongue River, which serves as the eastern boundary of the Northern Cheyenne Reservation ("Reservation").

D. The Tribe is asserting the following claims in the United States District Court for the District of Columbia in the case *Northern Cheyenne Tribe v. Gale Norton, Secretary of the Interior*, Case No. 1:02CV00146 TPJ:

- that coal-related development of the Otter Creek Tracts and adjoining areas will impose severe environmental, socio-economic and cultural impacts on the Tribe, its members and its Reservation; and

- that the Secretary has a degree of discretion with respect to whether to transfer the Otter Creek Tracts to the State, and that the transfer, as currently sought by the State, would violate a number of federal laws, including without limitation Section 503 itself, the National Environmental Policy Act, the National Historic Preservation Act, and the Federal Land Policy and Management Act, and their implementing regulations, as well as the federal trust responsibility to the Tribe.

E. The Board has concluded that, unless special measures are adopted, Indians may be excluded from employment and contracting opportunities in off-Reservation coal-related projects in the vicinity of the Reservation, such as the anticipated coal-related development at Otter Creek.

F. The Tribe has made substantial efforts to resolve its claims about the Otter Creek transfer through negotiations with the Governor, the Board, the Montana Congressional delegation, and the owner of the private coal checkerboarded with the Otter Creek Tracts (Great Northern Properties LP). As a result of these negotiations, a settlement proposal consisting of the following has been developed:

- the Operating Plans provisions set forth in Exhibit B attached hereto, to be agreed to by the Board in section 1 of this Agreement;

- certain commitments of support by the Board set forth in section 2 of this Agreement; and

a commitment separately made by the Montana Congressional delegation to the Tribe to seek enactment of the federal legislation described in Exhibit C attached hereto.

G. The Tribe advises that, in its view, realization of these settlement objectives will for the first time provide the Tribe with a net positive stake in nearby off-Reservation coal-related development and therefore generate Tribal support for coal-related development at Otter Creek carried out in accordance with applicable law.

H. The Board has concluded that the interests of the State are best served by resolving the Tribe's claims against the Otter Creek transfer by negotiated agreement, rather than by litigation which may disserve the State's coal-related development aspirations in the Otter Creek area, and that the terms of settlement set forth below are reasonable.

Terms and Conditions

The Board and the Tribe agree as follows:

1. **Operating Plans.** The Board agrees that when it authorizes the leasing of: (a) any portion of the Otter Creek Tracts for coal mining, or (b) any State surface lands within or in the vicinity of the Otter Creek Tracts for electric generating facilities to be fueled in whole or in part by coal mined from the Otter Creek Tracts, the Board will require, separate from the terms of the lease, that the State Department of Natural Resources and Conservation require that the Operating Plans described in the attached Exhibit B be established and thereafter implemented. Upon the establishment of an Operating Plan, the Board as necessary will direct the enforcement of such Plan.

2. **Commitments of Support.** The Board agrees to support:

   a. improvement by the State of the following off-Reservation roads (listed in descending order of priority), to provide viable off-Reservation options for truck and other traffic engendered by coal-related development in the Otter Creek area:

Ashland to Birney
Ashland to Miles City
Birney to Decker

b. cooperative and/or cross deputization agreements among the Tribe, the counties and, if appropriate, the State Highway Patrol, to improve the effectiveness of Reservation law enforcement with respect to non-Indians; and

c. the enactment of the federal legislation described in the attached Exhibit C.

3. **Release of Claims.** The Tribe hereby waives, releases and discharges any and all claims it may have that the transfer of the Otter Creek Tracts to the State under Section 503 is in any respect unlawful. The foregoing includes any and all Tribal claims or causes of action in any administrative or judicial action or proceeding against the United States, the Secretary, the State, the Board and the Governor, and their respective officials, employees, agents and other representatives, alleging that the transfer of the Otter Creek Tracts to the State is in any respect unlawful. Upon execution of this Agreement by the Tribe and the Board, the Tribe shall dismiss with prejudice its complaint in the case *Northern Cheyenne v. Norton* described in recital D above.

4. **Entire Agreement.** This Agreement constitutes the entire agreement between the Board and the Tribe.

5. **Applicable Law.** The validity, construction, interpretation, and administration of this Agreement shall be governed by the substantive laws of the State.

6. **Modification.** This Agreement shall not be modified or amended except by an instrument in writing signed by the Board and the Tribe. The Programs required under the attached Exhibit B may only be modified by the Lessee in close consultation with the Tribe and with the approval of the Board.

7. **Warranty of Authority.** The Board and the Tribe each warrant that each person signing this Agreement on its behalf has all necessary power to execute and deliver this Agreement; and that this Agreement constitutes a valid, binding agreement, enforceable in accordance with its terms.

8. **Severability.** If any provision of this Agreement is determined by a State or federal court to be unlawful or otherwise unenforceable under State or federal law ("Affected Provision"), the remaining provisions of this Agreement shall remain in full force and effect and the Board and Tribe shall promptly, diligently and in good faith negotiate and agree on provisions in lieu of the Affected Provision which are designed to achieve, to the fullest extent possible, the intended purposes of the Affected Provision in a manner consistent with State and federal law.

DATED this 19th day of February, 2002.

NORTHERN CHEYENNE TRIBE

By: Geri Small
GERI SMALL, President

STATE OF MONTANA)
) ss.
COUNTY OF L&C)

This instrument was acknowledged before me on the 19th day of February, 2002 by Geri Small as President of the Northern Cheyenne Tribe, on whose behalf the instrument was executed.

Shannon H. Stevens, Shannon H. Stevens
Notary Public
Shannon H. Stevens
[Type/Print Name]
Residing at: Helena MT
My Commission expires: 1-10-2006

(NOTARY SEAL)

MONTANA STATE BOARD OF LAND COMMISSIONERS

By: _____
JUDY MARTZ
Governor of the State of Montana

(GREAT SEAL OF THE STATE OF MONTANA)

_____
BOB BROWN
Secretary of State

(SEAL OF THE SECRETARY OF STATE)

_____
ARTHUR R. CLINCH
Director, Department of Natural Resources and Conservation

(SEAL OF THE STATE BOARD OF LAND COMMISSIONERS)

kw:c:mydocuments:0065:
OtterCreekTracts-SettlementAGM-Revised-2-15-02:
0065.09642

EXHIBIT A

Legal Description of Otter Creek Tracts

The Otter Creek Tracts consist of all federal mineral rights in the tracts described below, all of which lie in Powder River County, Montana:

OTTER CREEK TRACT # 1:
Township 3 South, Range 45 East, MPM
Section 26: All
Section 34: All
Township 4 South, Range 45 East, MPM
Section 2: Lots 1, 2, 3, 4, S½N½, S½

OTTER CREEK TRACT # 2:
Township 4 South, Range 45 East, MPM
Section 10: E½, E½W½
Section 12: All
Section 14: Lots 1, 2, 3, 4, 5, 6, 7, 8, W½
Section 22: N½NE¼, SE¼NE¼, E½SW¼
Section 24: Lots 1, 2, 3, 4, 5, 6, 7, 8, W½E½, E½W½
Section 26: All

OTTER CREEK TRACT # 3:
Township 4 South, Range 45 East, MPM
Section 6: Lots 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, SE¼
Section 8: Lots 1, 2, 3, 4, 5, 6, 7, 8, E½
Section 18: All
Section 20: Lots 1, 2, 3, 4, E½, E½W½
Section 22: W½W½

* * * *

EXHIBIT B

Operating Plans

After the conclusion of any exploration operations and before conducting any mining, construction or other operations on any portion of the Otter Creek Tracts (singly and collectively "Operations"), the project operator in close consultation with the Northern Cheyenne Tribe ("Tribe"), shall develop and submit for approval to the Montana State Board of Land Commissioners ("Board"), obtain Board approval of, and thereafter implement, the following written Operating Plans:

1. **Employment Program.** A written Employment Program designed to provide meaningful and substantial employment opportunity in Operations, without any preferences or quotas, to enrolled members of federally-recognized Indian Tribes who resided on or near the Northern Cheyenne Reservation during the one-year period preceding their application for employment ("Indians") and to non-Indians who resided on the Reservation, in the off-Reservation communities of Ashland or Birney, or in Powder River County during the one-year period preceding their application for employment ("Other Local Residents"), to the extent such Indians and Other Local Residents are qualified and available and reside no more than 50 road miles from the Operations. The Employment Program shall address recruitment, training, hiring, promotion, reductions in workforce and termination for cause, in all categories of employment, and shall include:

   a. Programs for recruitment of Indians and Other Local Residents.

   b. Programs for training Indians and Other Local Residents, including entry-level training, on-the-job training, and training for advancement into supervisory positions.

   c. Preservation of the project operator's authority to establish reasonable, even-handed and job-validated training programs, employment criteria, and work rules for all project employees including Indians and Other Local Residents.

d. Workshops for other project workforce to develop an awareness of relevant Indian culture and concerns and an understanding of the need for and requirements of the Employment Program.

e. A requirement that contractors and subcontractors engaged in Operations assume and comply with all terms and conditions of the Employment Program reasonably adaptable to their own employment practices.

f. Notification to any involved labor union of the existence of the Employment Program and the project operator's duty and intent to abide by its terms, and accommodation of the Employment Program in any union collective bargaining agreement covering Operations.

g. Employment by the project operator of a Facilitator, who shall be a qualified and available enrolled member of the Tribe approved by the Northern Cheyenne Tribal Council and acceptable to the project operator, whose principal and primary duties shall be to: (a) serve as liaison between the project operator and the Tribe with respect to the Employment Program and the Contracting Program established under section 2 below; (b) assist in facilitating the successful implementation of the Employment Program and Contracting Program; and (c) assist in resolving any problems which may arise in implementing the Employment Program or Contracting Program.

h. A board of Administrators, consisting of equal numbers of Administrators separately designated by the Tribe and the project operator, which shall monitor compliance with and serve as a forum to discuss and resolve by agreement any disputes regarding the interpretation or implementation of the Employment Program or the Contracting Program.

2. **Contracting Program.** A written Contracting Program designed to provide meaningful and substantial opportunity, without preferences or quotas, to qualified and available businesses majority-owned and controlled by the Northern Cheyenne Tribe or its members ("Tribal Contractors"), to obtain contracts and subcontracts for services or goods in the conduct of Operations at competitive prices. The Contracting Program shall include:

a. A certification procedure under which a business entity applying for the status of Tribal Contractor must seek certification from the Administrators in the following two respects:

i. as majority-owned and controlled by the Tribe or Tribal Members; and

ii. as capable of competently providing particular kinds of contract services or goods.

b. Notice to certified Tribal Contractors of Operations contracts and subcontracts to be awarded for which they are qualified.

c. A requirement that project contractors and subcontractors involved in Operations assume and comply with all terms and conditions of the Contracting Program reasonably adaptable to their own project contracting activities.

3. **On-Reservation Conduct.** A written On-Reservation Conduct Program designed to encourage employees and truckers involved in Operations, while on the Northern Cheyenne Reservation, to comply with all relevant standards of conduct generally applicable to Northern Cheyenne Tribal members on the Reservation.

4. **Environmental Monitoring.** To the extent not independently required by applicable federal or State environmental law or regulations, a written Environmental Monitoring Program for state-of-the-art monitoring of air quality, visibility, water quality and biological resources on the Northern Cheyenne Reservation which may be affected adversely by Operations, including:

a. Baseline monitoring for at least one year before the initiation of any surface disturbing Operations.

b. Ongoing monitoring thereafter throughout the conduct of Operations, and thereafter until the completion of all required reclamation on the lands on which Operations were conducted and the release of all related reclamation bonds by regulatory agencies.

c. Training and employment of qualified and available Indians to assume responsibility, to the fullest extent feasible, for the operation of the monitoring programs on the Reservation.

d. In addition, full compliance by the project operator with all applicable federal and State environmental laws and regulations.

5. **Cultural Resources.** To the extent not independently required by applicable federal or State law or regulations, a written Cultural Resources Program designed to avoid disturbance or damage to Northern Cheyenne historic, cultural, religious and burial sites or items, including plants having cultural or religious significance, in the conduct of Operations, including:

a. A program carried out in consultation with the Tribe, to identify, record, and protect, in accordance with Northern Cheyenne standards and protections, all Northern Cheyenne historic, cultural, religious and burial sites on the lands covered by the Lease.

b. Re-burial, in consultation with the Tribe and in accordance with all Northern Cheyenne standards, of all Northern Cheyenne human remains and funerary objects jeopardized or disturbed by Operations.

c. In addition, full compliance by the project operator with all applicable federal and State laws and regulations that protect Northern Cheyenne historic, cultural and religious interests and values implicated by Operations.

* * * *

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OtterCreek-Settlement.AGM-Exh-B-Revised-2-15-02:
0065.09642

EXHIBIT C

Proposed Federal Legislation

Federal legislation will be sought which will: (a) provide federal funding to the Tribe for Reservation public services and facilities; (b) provide federal funding for certain Tribal cultural activities relating to Otter Creek and the surrounding area; and (c) rectify a claimed 100-year old federal error which deprived the Tribe of ownership of 8-½ sections of Reservation subsurface:

1. **Impact Funding.** The Montana Congressional delegation has advised that, in consultation with the Tribe, it will endeavor to secure the promptest possible enactment of federal legislation which will provide adequate federal funding to the Tribe for use in planning, maintaining, improving and expanding Reservation public services and facilities. The Tribe has proposed that the funding be equivalent to an average of $6 million per year (1/1/02 dollars) and that it come from an allocation from the federal share of bonuses, rents and royalties on federal coal leases within 25 miles of the Reservation.

2. **Funding for Cultural Programs.** The Montana Congressional delegation has advised that, in consultation with the Tribe, it will endeavor to secure the promptest possible enactment of federal legislation which will provide specified and adequate federal funding to the Tribe to pay for:

   a. a Tribally-conducted oral history program regarding Tribal historic, cultural and religious interests and sites in the Otter Creek area;

   b. a Tribally-conducted archival research program regarding the original Northern Cheyenne homesteads in the Tongue River Valley;

c. storage at Chief Dull Knife College of the products of the above programs and of the program under paragraph a of the Operating Plan item; and

d. consultation by the Northern Cheyenne Cultural Commission with respect to the foregoing and all other cultural matters arising under the Operating Plan item.

3. **GNP Exchange.** The Tribe alleges that 100 years ago, the United States made an error which has deprived the Tribe of ownership of 8-1/2 sections of valuable Reservation subsurface (the only Reservation subsurface not owned by the Tribe). Great Northern Properties LP ("GNP") is the current owner of that subsurface. To rectify this claimed error and to give the Tribe a potentially positive stake in off-Reservation coal development, the Montana Congressional delegation has advised that, in consultation with the Tribe and GNP, it will endeavor to secure the promptest possible enactment of federal legislation which will provide that, in return for conveyance of the 8-1/2 subsections to the United States (it is the Tribe's preference that the conveyance be to the United States in trust for the Tribe), the United States will convey to GNP uncommitted federal coal in the State of Montana satisfactory to GNP and the Tribe. GNP will provide to the Tribe an economic interest (to be negotiated by the Tribe and GNP) in the proceeds of development of the exchange coal received by GNP.

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