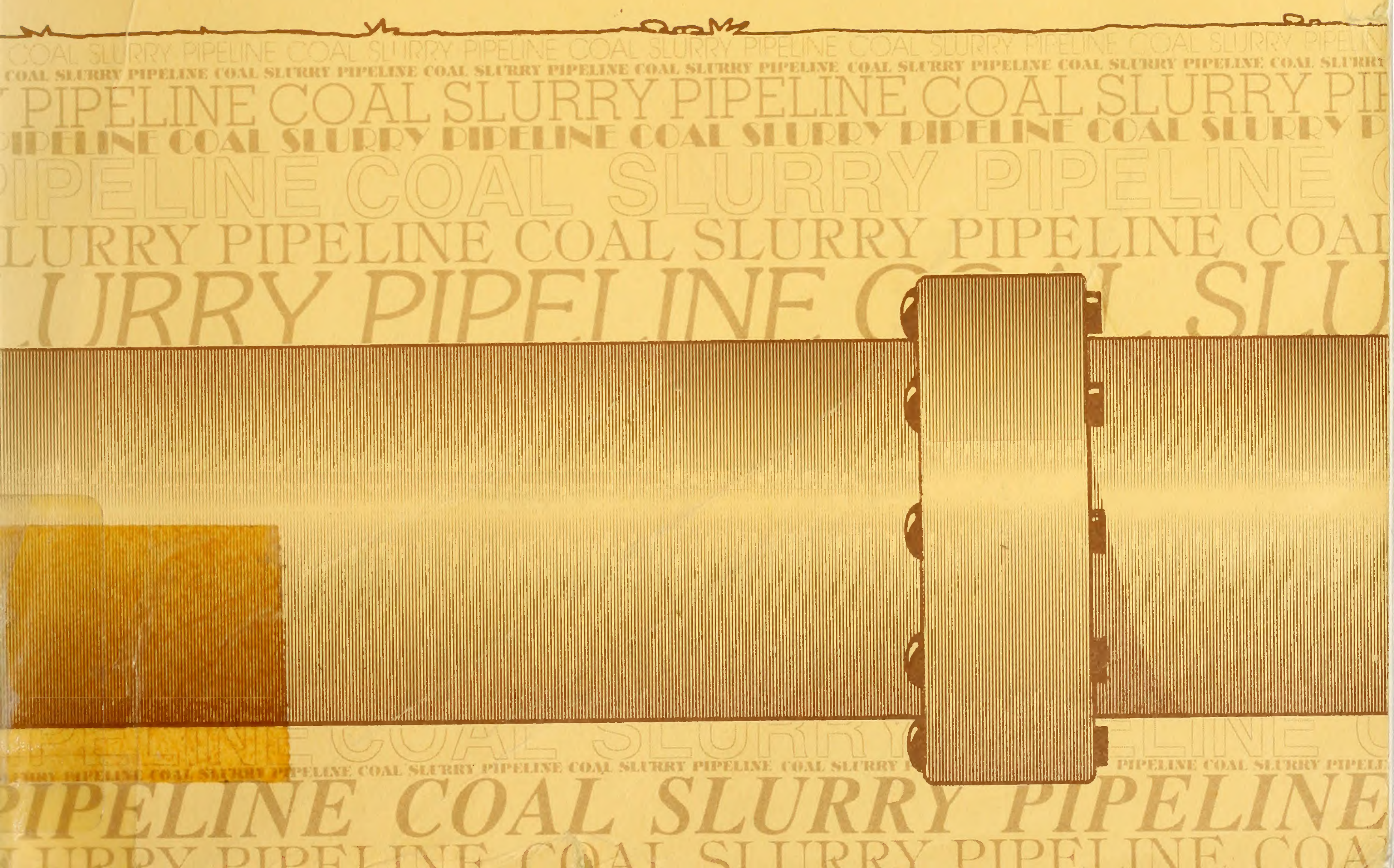
ENVIRONMENTAL IMPACT STATEMENT

ENERGY TRANSPORTATION SYSTEM, INC
BUREAU OF LAND MANAGEMENT

DRAFT
VOLUME 1



United States Department of the Interior
BUREAU OF LAND MANAGEMENT
SPECIAL PROJECTS STAFF
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555 ZANG ST.
DENVER, COLORADO 80228

IN REPLY REFER TO:
1792(142)
ETSI

November 7, 1980

Dear Reviewer:

This draft environmental impact statement (EIS) on the proposed Energy Transportation Systems Inc. coal slurry transportation project is submitted for your review and comment. The draft EIS has two parts, a text volume and a map appendix. Please keep both parts of the draft EIS, as we plan to print only an abbreviated final EIS which will be an addendum to this draft. The final EIS will be prepared considering the comments received through the public review process on the adequacy of the contents of the draft.

All written comments should be received no later than January 6, 1981, at the address shown on this letterhead. Field level agency and bureau offices who receive this draft should contact their headquarters office for review comment coordination procedures. As indicated elsewhere in the EIS a series of public hearings will be held to receive oral comments.

Comments should be as specific as possible and address the adequacy of the scope of the EIS or the impact analyses of the proposed action and alternatives. The purpose of the comment period is to improve the impact analyses, not to discuss the desirability of the proposed action. If methodologies used to predict the impacts are considered inadequate, the reviewer's comment should describe the rationale for and procedures of the alternative methodology preferred.

A copy of the final EIS will be sent to all who provide substantive comments on the draft EIS or who request a copy.

In accordance with the Council on Environmental Quality (CEQ) regulations of November 29, 1978, this draft incorporates a number of other documents by reference. The locations of these other documents are noted in the literature cited section included in the text volume. As noted in this section, the supporting technical reports for the EIS can be obtained from the address shown on this letterhead.

Sincerely yours,

Richard E. Traylor

Richard E. Traylor
ETSI EIS
Project Leader

DEPARTMENT OF THE INTERIOR

DRAFT

ENVIRONMENTAL IMPACT STATEMENT ON THE ENERGY TRANSPORTATION SYSTEMS INC. COAL SLURRY PIPELINE TRANSPORTATION PROJECT

PREPARED BY

BUREAU OF LAND MANAGEMENT (LEAD AGENCY)
AND WOODWARD-CLYDE CONSULTANTS

November 1980

Ed Hastey

ASSOCIATE DIRECTOR, BUREAU OF LAND MANAGEMENT

COVER SHEET

Energy Transportation Systems Inc.
Coal Slurry Pipeline Transportation Project
Environmental Impact Statement

(X) Draft ( ) Final

Lead Agency

U.S. Department of Interior, Bureau of Land Management

Cooperating Agencies

U.S. Department of Interior
Fish and Wildlife Service
Geological Survey

U.S. Department of Agriculture
Forest Service

U.S. Department of the Army
Corps of Engineers

States, Counties, Parishes, and Reservations That Could Be Directly Affected

Arkansas	Louisiana	Nebraska	Kansas	Oklahoma
Crawford	Morehouse	Sioux	Decatur	Grant
Franklin	Ouachita	Box Butte	Norton	Kay
Johnson	Caldwell	Morrill	Graham	Noble
Pope	La Salle	Garden	Trego	Pawnee
Conway	Grant	Deuel	Ellis	Osage
Van Buren	Rapides	Keith	Rush	Washington
Cleburne	Evangeline	Perkins	Barton	Rogers
Independence	Allen	Chase	Stafford	Mayes
Perry	Jefferson Davis	Hayes	Reno	Wagoner
Pulaski	Calcasieu	Hitchcock	Kingman	Muskogee
Saline	Avoyelles	Red Willow	Harper	Sequoyah
Jefferson	St. Landry		Sumner	
Cleveland	Pointe Coupee			
Bradley	W. Baton Rouge			
Ashley	Iberville			
	Ascension			
	St. James			

Wyoming	Colorado	South Dakota	Reservations
Campbell	Weld	Haakon	Pawnee
Weston	Logan	Lawrence	Osage
Converse	Washington	Mende	Cherokee
Niobrara	Yuma	Pennington	
Goshen		Stanley	
Crook			
Laramie			

Abstract

This EIS assesses the environmental consequences of approving an 1828-mile right-of-way to construct a proposed 1664-mile main coal slurry pipeline that would use a well field constructed in Niobrara County, Wyoming, as its main water source. Alternatives assessed in detail are: two pipeline routes--a direct route serving an alternative set of markets and a Colorado route bypassing Nebraska; three transportation modes--slurry pipeline plus barge, all-railroad (no-action) and railroad plus barge (no-action); two water sources--Crook County well field in Wyoming and Oahe Reservoir in South Dakota. The proposed action is designed to provide an alternative mode of transportation for coal from the Powder River region of Wyoming to coal-fired generating plants that are existing, under construction, or planned in Oklahoma, Arkansas, and Louisiana.

The key issues raised in the scoping process and which this EIS focuses on are: hydrologic impacts of ground-water withdrawal, socioeconomic impacts of construction and operation, ruptures and spills impacts, and energy efficiency of this mode of transportation.

EIS Contact

Questions and comments on this EIS should be directed to:

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Phone: Commercial: (303) 234-6737 FTS: 234-6737

Date by Which Comments Must Be Received: January 6, 1981

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PUBLIC HEARINGS INFORMATION

GENERAL INFORMATION REGARDING THE PUBLIC HEARINGS ON THE DRAFT ETSI COAL SLURRY PIPELINE ENVIRONMENTAL IMPACT STATEMENT

Public Hearing Locations and Dates

Monday, December 1, 1980 Baton Rouge, Louisiana	State Mineral Board Conference Room Natural Resources Building 404 4th Street
Wednesday, December 3, 1980 Little Rock, Arkansas	Arkansas Game and Fish Commission 2 Natural Resources Drive
Thursday, December 4, 1980 Tulsa, Oklahoma	Agricultural Center auditorium 4116 East 15th Street, Room 107
Monday, December 8, 1980 Hays, Kansas	Ft. Hays State University Black and Gold Room
Wednesday, December 8, 1980 Sterling, Colorado	Sterling City auditorium 120 South 4th Street
Thursday, December 11, 1980 North Platte, Nebraska	Holiday Inn Junction I-80 and Highway 83 Sections A and B
Monday, December 15, 1980 Rapid City, South Dakota	Rushmore Plaza Civic Center 444 Mt. Rushmore Road North
Tuesday, December 16, 1980 Edgemont, South Dakota	Edgemont Parish Hall
Wednesday, December 17, 1980 Lusk, Wyoming	Niobrara County High School auditorium 5th and Iron Street

Note: Hearings will be held at 2:00 p.m. and 7:00 p.m.

Authority

The hearings are held pursuant to the objectives of the National Environmental Policy Act (PL 91-190; 83 Stat. 852, 853).

Purpose

The purpose of the hearings is to receive comments (testimony) on the scope of the EIS and the adequacy of the impact analysis of the proposed action and alternatives. Testimony presented at these hearings will be considered in the preparation of the final environmental impact statement.

Composition of the Hearing Panel

The public hearing proceedings will be conducted by an administrative law judge. The judge will be accompanied by Bureau of Land Management and Woodward-Clyde Consultants personnel involved in preparation of this draft environmental impact statement. The judge or panel members may ask questions of the witness for the purpose of clarifying points in the testimony. All proceedings of the hearing will be recorded.

Oral Statements

Persons wishing to give testimony will be limited to ten (10) minutes, with written submissions invited at the hearing.

Prior to giving testimony at the public hearing, participants are requested to complete a hearing registration form. A registration form is located on the last page of this volume. Additional forms may be obtained from the address shown on the registration form. Registration forms must be returned to that address no later than November 26, 1980. Participants may also register at each hearing, at the registration desk.

Time preferences for presentation of oral statements will be honored whenever possible. A tentative listing of speakers, in the order they will be called, will be available at the registration desk at each hearing.

After the last witness has been heard, the judge will consider the requests of other persons present and wishing to testify. Only one witness will be allowed to present the viewpoints of a single organization at any one hearing. However, any witness will be permitted to give relevant testimony if it is offered as the opinion of a private citizen.

General

Witnesses must direct their testimony to the scope and/or adequacy of the EIS.

PREFACE

The purpose of this environmental impact statement (EIS) is to present facts about the proposed Energy Transportation Systems Inc. (ETSI) coal slurry pipeline transportation project and alternatives to the proposal, and their environmental consequences, in sufficient detail to inform the public and to assist in decision making.

The EIS is structured to comply with the provisions of Section 102(2) (C) of the National Environmental Policy Act of 1969, and contains the following chapter divisions:

Chapter 1: Purpose, Need, and Description of Proposed Action and Alternatives, locating and defining the proposed action and alternative methods of achieving the purpose of the proposed action.

Chapter 2: Comparative Analysis of the Proposed Action and Alternatives, summarizing the energy efficiency and impacts of the proposed action and its alternatives.

Chapter 3: Affected Environment, describing the aspects of the existing environment that would be significantly affected by the proposed action or its alternatives.

Chapter 4: Environmental Consequences, Mitigating Measures, and Monitoring, describing direct and indirect impacts of construction, operation, maintenance, and abandonment of the proposed action and its alternatives, and measures to mitigate these impacts.

Chapter 5: Relationship Between Local Short-Term Use of Human Environment and the Maintenance and Enhancement of Long-Term Productivity and Irreversible and Irretrievable Commitment of Resources, discussing the extent to which the proposed action and alternatives involve compromises between short-term commitments of resources and the long-term maintenance and availability of these resources; and summarizing those aspects of the proposed action and alternatives that could produce an irreversible and irretrievable commitment of resources.

Chapter 6: Response to Public Comments on the Draft, outlining the responses to written comments on the draft environmental impact statement and how the comments were used in preparing the final environmental impact statement. (Included only in the final environmental impact statement.)

References, Glossary, Abbreviations, Index, and Appendices, including detailed technical data and supporting studies.

SUMMARY

Energy Transportation System Inc. (ETSI) has applied to the Bureau of Land Management for a right-of-way permit to cross approximately 36 miles of federal land in Wyoming that would be needed to construct and operate an 1828-mile coal slurry transportation project. This project would transport coal from mines located near Gillette, Wyoming, to power plant customers in Oklahoma, Arkansas, and Louisiana. The coal would be crushed to a powder consistency, mixed with water to form the coal slurry, and pumped through a pipeline to a dewatering plant located at each power plant. The dewatering plants would remove the water from the coal slurry so that the coal could be used by the power plants.

The slurry transportation project would require 20,500 acre-feet of water per year, including 300 acre-feet that would be supplied from local wells at some pump stations. ETSI proposes to obtain 20,200 acre-feet of Madison Formation water per year from a well field to be constructed in Niobrara County, Wyoming. Part of this water could also be obtained from a reserve water source, a well field owned by the city of Gillette. As much as 20,000 acre-feet of this water would be mixed with the coal to form the slurry and would be exported from Wyoming. The water would be used by the power plants as cooling-water makeup after being separated from the coal at the dewatering plants.

In addition to this proposed action, several alternatives were identified. The alternatives that were considered in detail include two pipeline routes (a route serving an alternative set of markets and a Colorado route bypassing Nebraska), three transportation modes (pipeline plus barge, all-railroad, and railroad plus barge), two water sources (a well field in Crook County, Wyoming, and the Oahe Reservoir in South Dakota), and two processing alternatives (coal cleaning and water discharge).

These alternatives are of two types: those chosen by BLM for analysis; and those specifically requested by ETSI which are system design changes that may be required, depending on the final set of committed markets ETSI proposes to supply.

The alternatives chosen by BLM for analysis, referred to in this EIS as "Decision Maker's Options," are alternatives for which the Department of Interior has had analytical responsiblity. They are not necessarily options to be presented for Secretary of Interior and/or Secretary of Agriculture decision. The actual options presented in the Secretarial Issue Document will depend on the findings of this DEIS, public comments on the draft, and formal actions of the applicant and public agencies.

AREAS OF CONTROVERSY

In the scoping process conducted during the early stages of the environmental impact statement (EIS) development, several areas of controversy related to the proposed action were identified. Of major concern were the possible ground-water impacts to present and future users of Madison aquifer water. A related concern was the transportation of water from an area where readily available water is relatively scarce to an area where it is abundant.

The effect of pipeline ruptures and slurry spills on vegetation and wildlife habitat, especially near rivers, streams, or wetlands, was identified as another area requiring detailed analysis.

A number of issues related to a comparison of coal transportation by a slurry pipeline as opposed to a railroad system were identified: energy efficiency, loss and/or creation of jobs, and economic benefits of competitive coal transportation systems.

MAJOR IMPACT CONCLUSIONS

The major environmental impacts of the proposed action and alternatives discussed here are detailed in Chapter 4 of this EIS and are compared in Chapter 2. A summary of the impacts comparison is presented in Tables 2-3 and 2-4.

HYDROLOGY

The predicted impacts of withdrawing 20,200 acre-feet of water annually from the

Madison aquifer over a 50-year period were calculated using a numerical model that contains estimates of aquifer system properties. Conclusive assessments of impacts can be made only when the effects of large-scale, long-term withdrawal are carefully observed and documented.

Wyoming state law and stipulations that authorize the withdrawal of Madison Formation water require that ETSI compensate any existing Wyoming water users that are affected by ETSI pumping (Appendix C-2,3).

Niobrara County Well Field

The major environmental impact identified for the proposed action would result from pumping 20,200 acre-feet of water per year from the Madison Formation at the proposed Niobrara County well field. Pumping this volume of water for the 50-year project life would decrease the potentiometric (pressure) surface of the Madison aquifer within a region extending north, south, and east from the Niobrara County well field. This region would encompass the western half of Fall River and Custer counties, South Dakota; the northern part of Sioux and Dawes counties, Nebraska; and the eastern half of Niobrara County, the extreme southern part of Weston County, and the northeastern corner of Goshen County, Wyoming (Map 4-1).

The greatest drawdowns would occur at the well field and drawdowns would decrease away from the well field. After 50 years of pumping, drawdowns greater than 100 feet would occur in the Madison aquifer in over a 3800-square-mile area of Niobrara and Goshen counties, Wyoming, and in Sioux and Fall River counties, South Dakota. Drawdowns greater than 200 feet would occur in over a 2000-square-mile area of Niobrara, Sioux, and Fall River counties. Drawdowns greater than 400 feet would occur only within a radius of 15 miles north, south, and east of the Niobrara well field (Map 4-1).

These drawdowns would affect some existing Madison water users, primarily the city of Edgemont, South Dakota (Table 4-2). The city of Edgemont currently obtains its water supply from several free-flowing and pumped Madison wells with a present potentiometric surface about 200 feet above the ground. The hydrologic studies conducted indicate that after 50 years of pumping by ETSI, Edgemont would have to pump from below a depth of about 103 feet in order to obtain Madison water).

The predicted drawdowns would also affect ground-water discharge to several surface waters. After 50 years of pumping, the base flow of the Cheyenne River, Cascade Springs, and springs in the Hot Springs area of South Dakota would be reduced by 1 cubic foot per second (cfs), 4 cfs, and 2 cfs, respectively (Table 4-3).

Niobrara County Well Field and Gillette Well Field

If part of the required water was purchased from the city of Gillette, Wyoming, to reduce the amount of water pumped from the Niobrara County well field, drawdowns at and near the Niobrara well field would be reduced. The area affected by the Niobrara well-field pumping would be similar to that described for pumping the total 20,200 acre-feet from Niobrara (Map 4-2). However, drawdowns near the well field would be about 30 percent less (Table 4-2). In addition, drawdowns resulting from pumping from the Gillette well field would increase, extending over most of Crook County and over the northwestern part of Campbell County.

Crook County Well Field

The withdrawal of 20,200 acre-feet of water per year from the Madison aquifer at the Crook County well field for the 50-year project life would cause the Madison potentiometric surface to decrease more than 25 feet over a 16,700-square-mile area, including parts of Crook, Campbell, Johnson, Sheridan, and Weston counties in Wyoming; Carter, Powder River, and Rosebud counties in Montana; and Butte, Harding, and Lawrence counties in South Dakota (Map 4-3).

The greatest drawdowns would occur at the well field, and drawdowns would decrease away from the well field. After 50 years of pumping, drawdowns greater than 100 feet would occur in more than a 3000-square-mile area of Weston, Powder River, and Carter counties. Drawdowns greater than 200 feet would occur only within a radius of 10 miles from the Crook county well field (Map 4-3). These drawdowns would affect some existing Madison water users, primarily the Bell Creek oil field water wells in Montana, a well at Devils Tower National Monument, a well at Hulett, and the Gillette well field (Table 4-2). Flow may decrease from 1 to 4 cfs in some streams and springs that receive ground water from the Madison Formation (Table 4-3).

Crook County Well Field and Gillette Well Field

If part of the required water was purchased from the city of Gillette to reduce the amount of water pumped from the Crook County well field, the area affected would be somewhat smaller overall but would extend farther south than that described for pumping the total 20,200 acre-feet from Crook county (Map 4-4).

Oahe Reservoir

There would be no ground-water impacts as a result of pumping water from the Oahe Reservoir.

SOCIOECONOMIC CONSIDERATIONS

Of greatest concern for all the pipeline systems (proposed action and market, Cypress Bend pipeline-barge, and Colorado alternatives) are the impacts that would be associated with the influx of construction workers to Campbell, Converse, Weston, and Niobrara counties in Wyoming. Construction of a slurry pipeline system would generate about 1624 additional jobs (direct and secondary) and bring over 2600 new people into the four-county area of Wyoming during the peak construction period (last quarter of 1984). These increases in population and employment would be absorbed in the overall growth of the area, with only minor impacts on the regional economy. There would be significant short-term impacts on selected communities and counties within the region.

The influx of construction workers to the Niobrara County well field would significantly affect the economic and population base of Niobrara County, particularly the town of Lusk. Because the pipeline-related facilities would be located in the county but outside Lusk, the town would receive little of the increased tax revenue but much of the increased population. Fixed-site and pipeline construction workers would increase the town's population by 21 percent for a period of 1 to 2 years. Substantial short-term housing shortages are anticipated in Lusk as well as in the Gillette Planning Area, especially during the peak construction period of 1984.

No significant impacts are anticipated from the addition of about 243 permanent workers and their families to the affected Wyoming counties during the operation phase of the project. The addition of pipeline facilities for the proposed action or any of the pipeline alternatives would have beneficial effects on assessed valuations and property tax revenues in Converse and Weston counties, and a significant impact (52 percent increase) in Niobrara County. However, there would be a negative net fiscal impact on Campbell county, the city of Gillette, and the Campbell County school district (Table 4-10), with significant deficits projected for Gillette and the school district. Pipeline systems contribute relatively less to the tax base than do other types of projects under the present Wyoming tax structure.

Given the fast pace, short duration, and geographically linear spacing of pipeline and pump station construction, and given the existing capacities in the host counties and selected communities, no significant impacts would result from construction of facilities outside Wyoming for the proposed action or any of the pipeline alternatives. During operation there would be beneficial effects associated with increased revenues to counties and parishes. Generally, increases in annual revenues would range from $70,000 (Norton, Kansas) to $1,190,000 (Morril, Kansas) in 1980 dollars, and from a 2 percent increase over the 1976-77 property tax revenues (Reno, Kansas) to 144 percent (Sioux, Nebraska) (Table 4-13). The amount of revenue would vary with the portion of pipeline located within a given jurisdiction and the means by which a given state and county calculate taxes. The significance of the revenue increase would vary, depending on the size of the existing tax base and decisions on how to incorporate the new source of revenue into the county tax structure.

Dewatering plants would be built adjacent to power plants and within easy commuting distance of cities or large metropolitan areas that have an available local construction labor pool. Construction would take eight quarters and have a peak demand of 150 to 260 workers. Because of the moderate demand for construction labor and the availability of construction workers from local labor pools, construction of the dewatering plants would not be expected to cause substantial in-migration of construction workers or to stimulate significant secondary employment for any of the pipeline systems. Pipeline construction in the dewatering plant areas would not be expected to cause significant socioeconomic effects, either independently or in combination with the dewatering plants, with one exception. For the pipeline-barge alternative, construction of the dewatering plant and barge loading facility at Cypress Bend, Arkansas, would create a significant localized impact during the construction phase. The impact would be due to a peak population increase of 1593 for less than two years, which would affect housing and some public services in the towns of Arkansas City, McGehee, Dermott, and Dumas, Arkansas.

Operation rather than construction impacts would be of most concern for the no-action all-rail alternative. The movement of 37.4 MMTA would result in increases in employment, rail accidents, and community disruption in towns along the railroad route. The no-action alternative would require approximately 2500 workers for operation of the unit trains and an additional 3200 for maintenance and support. Due to existing overemployment in some of the affected railroads and expected future gains in productivity, the number of new jobs that might be involved is unknown. Alliance, Nebraska, is the only town identified as likely to be significantly affected by an increase in population. While housing construction has increased with the population, there has not been a similar growth in retail services, particularly entertainment. Any population increase due to the all-rail alternative would further stress these services.

Approximately 17 rail accidents per year would be expected from the no-action all-rail alternative. This would be equivalent to less than 1 accident every 10 years at any one crossing.

The all-rail alternative would add an estimated 20 daily trains to the existing traffic between Wyoming and Kansas City. The maximum increase south of Kansas City would be 8 trains. This increased traffic would affect approximately 500 communities.

The impacts of the rail part of the railroad-barge alternative would be similar to those identified for the all-rail alternative. The 2 to 3 barge tows per day that would be required for the barge part would not significantly increase traffic, congestion, or accidents on the Mississippi River and would not affect recreational use of the river.

RUPTURES AND SPILLS

The coal slurry pipeline would be designed and operated to specifications that would minimize the probability of a break or rupture in the pipeline. A break or rupture could occur and result in the release of large quantities (4000 to 544,000 barrels) of coal slurry into the environment even though valves would be located at each pump station.

A coal slurry spill is not expected to result in any risk to the health or safety of any humans. Coal slurry, unlike other pipeline contents such as oil and gas, is nonexplosive, nonflammable, and essentially nontoxic since nearly half of the slurry is water.

A spill would result in some environmental consequences, with the severity dependent on the spill location. Large-volume spills in small streams would result in the largest losses to fish and other aquatic life. Small-volume spills or spills in larger streams would result in more localized losses to aquatic organisms and short-term changes in the aquatic habitat, since the concentration of the coal slurry would be more quickly diluted to harmless levels.

One location on the Colorado alternative route is of major concern. A major spill at Deception Creek in Barton County, Kansas, could cause a reduction in suitable whooping crane habitat in Cheyenne Bottoms. The whooping crane is a federally listed endangered species.

Spills on land would result in the loss of some small animals such as rodents. Such a spill is expected to have only a short-term effect, since the coal could be removed if necessary after the water has seeped into the ground or evaporated. Spills on wetlands would be more severe and could result in localized significant changes in the vegetation and wildlife habitat.

ENERGY EFFICIENCY

The amount of energy consumed during transportation of the coal would vary according to the mode of transportation (pipeline, rail, or barge) as well as the route and the source of water used to form the slurry. An energy analysis indicates the following efficiencies (arranged in descending order):

1. All-rail mode (no-action) (570,000 Btu/ton)

2. Proposed action with water from the Crook County well field (659,000 Btu/ton)

3. Proposed action with water from the Niobrara County well field (664,000 Btu/ton)

4. Market alternative (669,000 to 689,000 Btu/ton, depending on water source)

5. Rail-barge mode (no-action) (697,000 Btu/ton)

6. Cypress Bend pipeline-barge alternative (776,000 to 796,000 Btu/ton)

Depending on the pipeline route considered, using water recycled from the Mississippi River back to Wyoming as the water source would result in a system that would consume about 849,000 to 978,000 Btu/ton of as-mined coal, compared with about 659,000 to 792,000 Btu/ton using water from the Madison aquifer well fields and 679,000 to 796,000 Btu/ton using water from the Oahe Reservoir.

VEGETATION

While vegetation concerns would be locally significant during construction of any of the pipeline systems, actual impacts on vegetation would be generally insignificant and for the most part temporary with a successful reclamation program. The erosion control and revegetation plan outlined by ETSI (Appendix C-1) would be expected to ensure successful revegetation and reestablishment of grazing along any disturbed right-of-way acres. A few small areas where adequate vegetation cannot be established and maintained would require continuing management and intensive erosion control measures. The acres of vegetation permanently removed by surface facilities would be small for any of the pipeline systems: 853 acres for the proposed action, 843 acres for the market alternative, and 818 acres for the Cypress Bend pipeline-barge alternative. Construction of the Colorado alternative pipeline segment would not change the acres of land permanently removed by any of the pipeline systems.

Because no new track construction would be required for the all-rail no-action alternative, vegetation would not be affected. The expansion of the barge loading facilities required for the rail-barge alternative would remove an unknown number of acres from production.

Neither the proposed action nor any of the alternatives would affect any federal or state threatened or endangered plant species (FWS 1980a), except for the Colorado alternative. The Colorado butterfly-weed, which may occur on the Colorado alternative route, will be added to the federal list of threatened and endangered species by December 1980. Once the exact location of this plant is identified, the possible impacts and mitigation measures will be determined.

WILDLIFE

The most direct construction impact on wildlife would be the clearing of wildlife habitat from the pipeline right-of-way and facility sites. Other construction impacts on wildlife include interruption of the habitat continuum and secondary impacts associated with human presence and activity.

For much of the vegetative habitat that would be affected, construction impacts would be temporary (less than 5 years). A temporary impact would exist for the pipeline right-of-way, since the presence of an underground pipeline would not preclude use by wildlife when vegetation is reestablished, except in the case of larger trees growing directly over the pipeline. However, because of the small number of trees potentially involved relative to the number available in a given area, this loss of habitat would not be considered significant.

Several animal species of concern (classified as threatened or endangered by either the federal or a state government) are or could be found along the various pipeline routes (Table 4-17). Nine species could be affected by the proposed action, eight by the market alternative, ten by the Cypress Bend pipeline-barge alternative, and six by the Colorado alternative. One species could be affected by the Crook county alternative water supply system and five by the Oahe alternative. Potential impacts to these species would be minimized through compliance with regulations associated with their protected status.

A Memorandum of Understanding between the Bureau of Land Management and the Fish and Wildlife Service (FWS) outlines the procedures that would be followed to ensure that federally listed threatened and endangered species would be adequately protected (Appendix D-4). Five species from the FWS list of 13 that could occur along any of the pipeline routes have been determined to be in a "may affect" category (WCC 1980f): black-footed ferret, red-cockaded woodpecker, bald eagle, American alligator, and whooping crane. The first four of these species would not be affected by any of the pipeline alternatives. The whooping crane would be affected if the Colorado alternative pipeline ruptured and spilled into Cheyenne Bottoms State Waterfowl Refuge in Barton County, Kansas.

No significant impacts on wildlife would be expected from the no-action alternatives.

AQUATIC BIOLOGY

The major concerns associated with any of the pipeline systems would be the loss of benthic (river- or stream-bottom) habitat and increased turbidity at stream crossings, and the effects of slurry spills. About 111 square yards of river or stream bottom and its complementary fish food potential would be temporarily lost during construction for each 10 feet of river crossed. These impacts would be expected to be localized, short-term, and of limited biological significance.

Increased turbidity levels would be anticipated to last for only a few hours after completion of construction and to affect a relatively small section of a river or stream within 1000 feet of the dredging activity. Fish would be expected to temporarily move to less turbid areas and would not be affected. Effects on less mobile species such as freshwater mussels would range from death to temporary weakening. However, these impacts would also be expected to be localized, short-term, and of limited biological significance.

Impacts on aquatic species that would result from a slurry spill are summarized under Ruptures and Spills, above. No significant impacts on aquatic species would be expected from the no-action alternatives.

CULTURAL RESOURCES

The magnitude of impact resulting from construction of any of the pipeline systems cannot be determined until a site-specific inventory and evaluation is conducted for areas delineated by the appropriate State Historic Preservation Officers. However, because of mitigation procedures outlined in a Memorandum of Agreement between the Bureau of Land Management, the Advisory Council on Historic Preservation, and the appropriate State Historic Preservation Officers (Appendix D-3), impacts are not expected to be significant.

No impacts on cultural resources would be expected from the all-rail no-action alternative, because no new rights-of-way would be required. Expansion of barge loading facilities, the only construction required for the railroad-barge no-action alternative, could cause significant impacts if any cultural sites are present.

AGRICULTURE

Construction impacts along any of the pipeline rights-of-way would be generally insignificant and temporary. Successful restoration of cropland areas and revegetation of native rangeland areas would be expected with implementation of ETSI's Erosion Control and Revegetation Plan (Appendix C-1). The primary agricultural concern associated with any of the pipeline systems would be long-term loss of crop production on prime or other important agricultural lands at surface facility sites. However, the impact of this potential crop production loss would be relatively minor from a regional standpoint for any of the pipeline systems, since it would range from 305 acres to 375 acres spread over 5 or 6 states. The largest potential loss of cropland at any one surface facility location would be 35 acres (pump station and dewatering plant) except for the Cypress Bend dewatering plant and barge loading facility which would remove 205 acreas.

An additional agricultural concern would be the long-term loss of grazing production at surface facility sites and reduction in grazing capacity in localized areas where right-of-way revegetation resulted in less vegetation density.

There would be no agricultural impacts associated with the no-action alternatives.

AIR QUALITY

Construction of any of the pipeline systems would cause temporary increases in fugitive dust and gaseous pollutants but no significant impacts on air quality. The increases would not be expected to exceed federal secondary or state air quality standards. Operation of the preparation plants would lead to increases in pollutant concentrations, but these increases would not exceed any air quality standards.

Impacts from operation of coal unit trains would include coal dust blown off hopper cars and pollutant emissions from locomotive engines. Coal losses would be spread over the entire route, and violations of the total suspended solids standards would not be expected. Locomotive emissions would lead to temporary increases in ambient pollutant concentrations during every round trip. However, these short-term ambient concentrations would be expected to be below federal ambient air quality standards (OTA 1977).

RECREATION RESOURCES

For all pipelines, the increase in project-related newcomers to the Gillette, Wyoming, area during the construction period would cause an increase in local hunting activity, impairing the quality of the hunting experience. The construction phase of pipeline activity would result in short-term (approximately 4 weeks) disruption to recreational resources such as state scenic rivers, state and national trails, National Natural Landmarks, and state parks and recreation areas (lying within 5 miles of the pipeline).

Of particular concern for the proposed action would be temporary construction-related impacts due to crossing the proposed Walnut Creek recreation area in Kansas. Similarly, temporary impacts to the Caney River and Illinois Bayou would be of concern for the market and Cypress Bend pipeline-barge alternatives, because they are recognized as the most important recreation rivers in Kansas and Arkansas, respectively.

There would be no significant impact to recreation resources with either of the no-action alternatives.

TRANSPORTATION NETWORKS

It is not expected that any major traffic disruptions or roadway deteriorations would result from activities related to construction, operation, or maintenance of any of the pipeline systems. In most places construction would occur in rural areas and would last only a few days. Because there would be little traffic along the affected roadways, impacts would be considered insignificant. Assuming equipment movement near urban centers would be scheduled around prime commute hours, traffic disruptions would also be short-term and considered insignificant.

It is anticipated that pipeline-related construction would have no significant impacts on the railroads, because it is assumed that in gaining permission to cross railroad rights-of-way there would be agreement on the timing of construction activity to assure no disruption in rail traffic.

The no-action alternatives would cause some transportation impacts, because approximately 500 communities could be affected by delays near at-grade crossings. The movement of 37.4 MMTA alone would not cause significant community disruption; however, considered with other rail traffic and expectations for growth in this traffic, it could cause significant disruption, especially in towns where public service facilities such as schools and hospitals are separated from residential areas by railroad tracks.

VISUAL RESOURCES

For the pipeline systems, surface disturbance and removal of vegetation during construction and the addition of structures would affect the visual character of some areas seen by the public. The effects would be considered significant at 36 locations along the proposed action route, 33 for the market alternative, and 23 for the Cypress Bend pipeline-barge alternative.

Increased train traffic through inhabited areas would detract from the visual character of these communities. Motion would not be a new element in the affected scene; rather, its frequency would increase. The no-action alternative would add an estimated 20 daily trains to the existing traffic between Wyoming and Kansas City. The maximum increase south of Kansas City would be 8 trains.

NOISE

Noise levels generated by the proposed action and alternatives were found to be insufficient to product impacts, except for the no-action alternative. Noise levels resulting from railroad operation would range from 50 to 100 decibels (PMM 1977) depending on train speed and weight, numbers and types of locomotives, and track type. Where train noise levels would exceed EPA-suggested noise levels for protection of public health and safety (55 decibels), persons located closer than about 2000 feet from the tracks would be exposed to levels above this limit. Thus unit train operation would have a significant noise impact, but the number of people affected would depend on population distribution along the rail route.

WILDERNESS

No impacts on wilderness would result from construction or operation of the proposed action or alternatives, because no Bureau of Land Management Wilderness Study Areas, Forest Service Second Roadless Area Review and Evaluation areas, or state wilderness/natural areas would be affected.

GEOLOGY, SOILS, TOPOGRAPHY

The geology and topography would not be affected by the proposed action or any of the alternatives. Soils would be affected by construction activities associated with any of the pipeline systems. Major concerns would be disturbance of topsoil, soil compaction, alteration of soil profile along the excavated pipeline trench, and accelerated soil erosion. Impacts would be minimized or eliminated by implementation of reclamation procedures described in the Erosion Control and Revegetation plan (Appendix C-1).

ISSUES TO BE RESOLVED

The decision maker must resolve two issues: (1) Is an additional mode of transportation for coal desirable; and (2) if so, which of the available water sources for a coal slurry system would be preferable.

AGENCY-PREFERRED ALTERNATIVE

After assessing the impacts and issues associated with the Energy Transportation Systems Inc. proposed coal slurry transportation project and its alternatives, the Bureau of Land Management has determined that the agency-preferred alternative is the proposed action, as identified below:

- Route. The proposed route was selected, because there were no major environmental differences between the proposed route and the Colorado alternative.

- Water source. The Niobrara well field was selected, because determination of water rights is a state responsibility. The state of Wyoming has already issued well-field permits for the Niobrara well field.

CHAPTER 1

PURPOSE, NEED, AND DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

1.A INTRODUCTION

Energy Transportation Systems Inc. (ETSI) proposes to construct a coal slurry pipeline transportation project. The complete transportation project would involve 1828 miles of right-of-way for water and coal slurry pipelines. The 1664-mile main slurry pipeline would carry a coal-water mixture, called a slurry, from the Powder River Basin of northeastern Wyoming to locations in Oklahoma, Arkansas, and Louisiana. Ultimately the coal would be dried for use in electric power generating plants. Construction is proposed to begin in 1983 and would continue in phases through 1989. Limited operation of the system would start in 1985. A project life of 50 years is planned.

In order to construct the pipeline, ETSI is required to obtain right-of-way permits to cross public land in Wyoming--6 miles of land administered by BLM and 27 miles within the Thunder Basin National Grassland administered by the Forest Service--as well as 18 miles of Indian-allotted land in Oklahoma. In addition, Section 404 (Clean Water Act) and Section 10 (Rivers and Harbors Act) permits to cross certain rivers, streams, and wetlands are required by the U.S. Department of the Army, Corps of Engineers. Before decisions on any of these permit applications can be made, the environmental impacts of the proposed project must be assessed. The Bureau of Land Management (BLM) was assigned lead responsibility for the impact assessment, which is documented in this environmental impact statement (EIS).

In accordance with Council on Environmental Quality (CEQ) regulations, BLM involved the public in identifying significant issues and potential impacts of the proposed action that would be analyzed in the EIS. This was done through public scoping meetings held in various locations. The major issues identified were water, socioeconomics, energy efficiency, and ruptures or spills. Thus the EIS places the most emphasis on the impact analyses for these areas. Analyses of impacts on vegetation, wildlife, aquatic biology, cultural resources, agriculture, air quality, recreation resources, transportation networks, wilderness, visual resources, geology, soils, and topography are also presented, although in less detail. The coal slurry transportation project is considered as a new transportation mode, because Wyoming coal would be transported to southern markets, regardless of whether the project is built. The EIS assesses impacts from the time the coal is delivered to the ETSI coal piles until it is delivered to the power plants. Because the proposed pipeline has not been staked, impacts along a 1-mile corridor of the route shown on the Appendix A maps are considered. (See Appendix B for a more detailed discussion of public involvement and other consultation and coordination in the preparation of this EIS.)

This chapter includes background on the ETSI proposal; the purpose and need of the proposed project; an overview of the proposed action and alternatives to the proposal; and a detailed description of the proposed action and alternatives, stressing impact-causing features. Information in this chapter has been summarized from the Project Description Technical Report (WCC 1980a), which is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado 80228, telephone (303) 234-6737.

1.B BACKGROUND

ETSI, a joint venture of Bechtel, Lehman Brothers Kuhn Loeb, Kansas-Nebraska Natural Gas Co., United Energy Resources, and Atlantic Richfield Co. (ARCO), was organized in 1973 to develop and construct a coal slurry pipeline to transport low-sulfur western coal to power plants in Oklahoma, Arkansas, and Louisiana. The initial concept of the ETSI system involved the construction of a 1000-mile coal transportation system from Wyoming to Arkansas that would deliver 25 million (short) tons annually (MMTA) of coal.

In 1974 ETSI filed a formal application with the Department of the Interior (DOI) to cross approximately 33 miles of federal land in Wyoming. DOI advised that, in accordance with the National Environmental Policy Act (NEPA) of 1969, an EIS would be required before any decision regarding the application could be made. In 1975 the BLM was designated as the lead agency responsible for the preparation of the EIS. BLM deferred actual start-up of the EIS until ETSI developed more detailed plans for an adequate water supply and resolved the constraints put on the pipeline route by the refusal of the railroad industry to grant easements for crossing under tracks.

In the ensuing period, the U.S. Congress debated the desirability of granting eminent domain to slurry pipeline systems so that the railroad crossing problems could be resolved. As of October 1980, no federal legislation on granting eminent domain has been passed. However, eminent domain rights for coal slurry pipelines have been established by Oklahoma, Louisiana, and Texas. ETSI also won, through the courts, permission to cross all railroad lines along the route and obtained approval from the state of Wyoming to export the necessary water from the Madison Formation, a deep aquifer underlying the Powder River Basin. With these major obstacles removed, BLM initiated action on ETSI's request for a right-of-way permit and prepared the EIS.

In the meantime, ETSI expanded the proposed main slurry pipeline from 1000 miles to 1664 miles, extending from near Gillette, Wyoming, to Baton Rouge, Louisiana. Nine delivery sites were proposed. Each site is the existing or planned location of a coal-fired power plant. The proposed throughput of the system was also increased, from 25 MMTA to 37.4 MMTA.

1.C NEED FOR PROJECT

At present, railroad transportation is the only option available to utilities using or planning to use western coal. To augment this form of transportation, the development of coal slurry pipeline systems has been supported by many U.S. senators and representatives in congressional hearings. This testimony was based on the reasoning that pipeline transportation could provide considerable savings to consumers of electric energy. Much of the cost savings would be due to the fact that slurry pipelines are capital-intensive; in this case, fixed costs are projected to be 70 percent of the total cost of operation. Thus once the pipeline is constructed, its operations would not be significantly affected by inflationary factors. A further argument from an economic viewpoint is that competitive transportation systems provide an incentive to transport at the lowest possible price. The development of competitive systems also offers the option of choice based on reliability. In addition, diversity of transportation alternatives is of vital importance from the standpoint of national security.

Much of the area to be served by the proposed slurry pipeline project derives its electric power from plants that were designed to use natural gas. Because the use of this fuel has been curtailed as a result of diminishing supplies, many gas-fired power plants have been converting to oil-burning systems. Utilities are now turning to coal, the most abundant fuel in the United States, since dependence on oil is becoming increasingly risky and construction of nuclear power plants is being delayed by safety and financial constraints. The Carter administration has called for increasing national coal production from about 780 million tons per year in 1979 to about 1.1 billion tons by 1985 to help reduce our dependence on foreign sources of energy. More than half of this increased production would take place in the western states. Interest is primarily focused on these coal reserves because western coal has a low sulfur content, thus helping to meet stringent air pollution requirements, and it is less expensive to produce. However, the present transportation system will have to be expanded to ship sharply increased volumes of western coal to distant markets where the demand is the greatest. The Federal Power Commission (1977) (now Federal Energy Regulatory Commission) has noted that by 1985 the demand for coal in Oklahoma, Arkansas, Louisiana, and Texas is estimated to reach about 124 million tons annually (MMTA) for electric generating plants alone, compared with only 9 MMTA in these four states in 1975. If the replacement of gas by industrial users is added, a market in these states approaching 200 MMTA by 1985 could be anticipated.

Thus, the requirement for low-sulfur coal in Oklahoma, Arkansas, and Louisiana is large and the slurry pipeline would augment the existing rail transport, providing both competition and another option for transporting coal to the region.

1.D PURPOSE AND OBJECTIVE OF PROPOSED ACTION

The purpose of the proposed coal slurry transportation project is to transport 37.4 MMTA of low-sulfur western coal from Wyoming to power plants in Oklahoma, Arkansas, and Louisiana beginning in early 1985. The coal transported by the proposed project would be used to generate electric power for major portions of these states.

1.E OVERVIEW OF PROPOSED ACTION AND ALTERNATIVES

The proposed coal slurry transportation project and alternatives to the project are discussed in detail in the rest of this report. Map 1-1 shows the general arrangement of the major components of the system and the major alternatives. A larger-scale map is provided in the back cover pocket of Appendix A, the map volume.

Table 1-1 shows a very simplified overview of the proposed action and alternatives. It is not intended to be definitive, rather, it is intended to emphasize the differences among the proposed action and alternatives and to illustrate the relationships between them.

The proposed action would involve the transportation of Wyoming coal via a coal slurry pipeline to nine power plants in Oklahoma, Arkansas, and Louisiana.

The market alternative, which is being analyzed because ETSI is considering several market configurations, would follow a some what different route to serve a slightly different set of power plants.

The Cypress Bend pipeline-barge alternative would involve the transportation of coal slurry by pipelines to a barge loading facility at Cypress Bend, Arkansas, with deliveries in Oklahoma and Arkansas. The remaining coal would be dewatered and transported by barge on the Mississippi River to delivery sites in Louisiana.

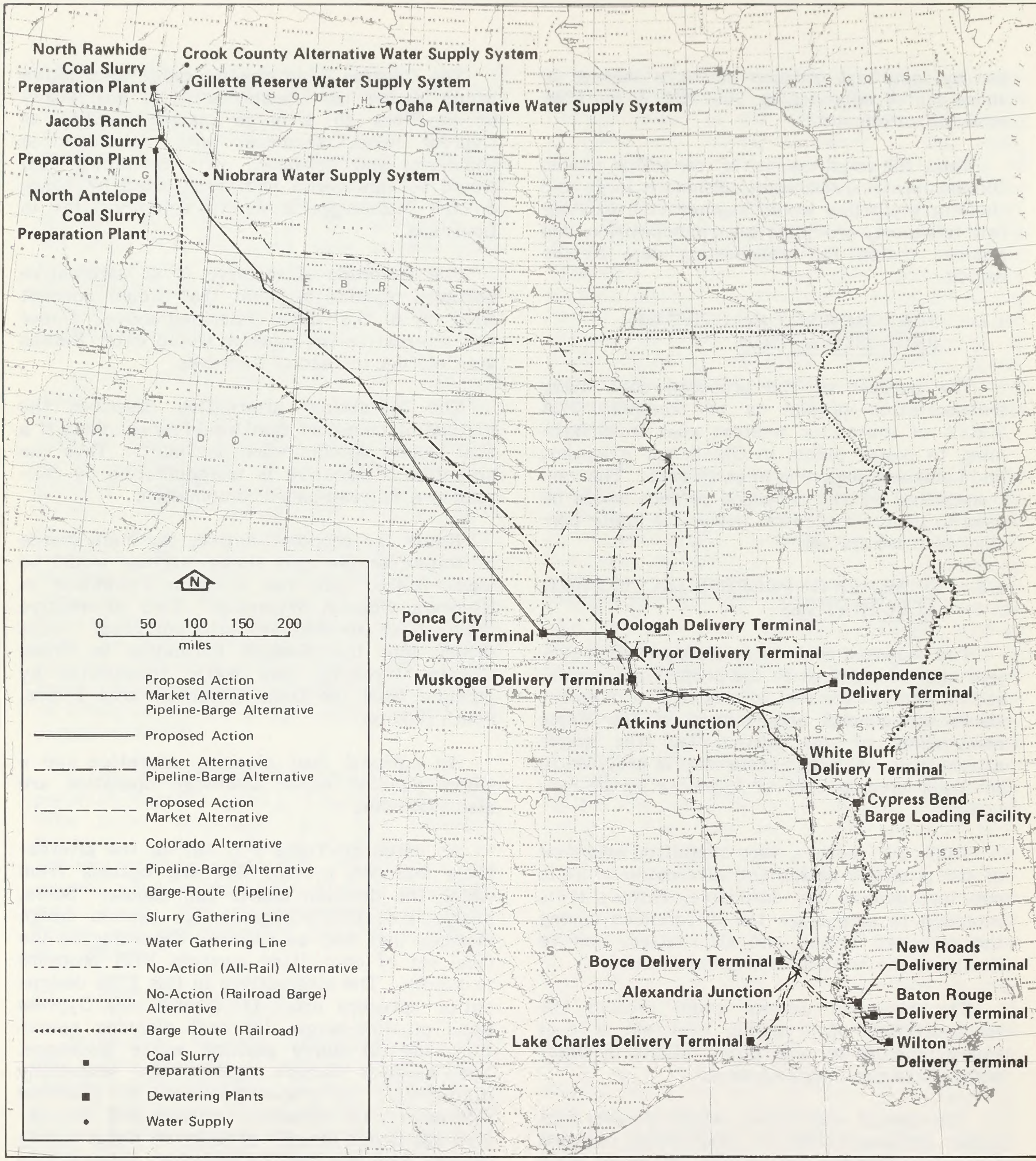
The Colorado alternative is an alternative northern pipeline segment that would connect with any of the routes described above. Under this alternative the pipeline would enter Kansas via Colorado instead of Nebraska.

The "no-action" alternative describes the method of transport that would be available if a coal slurry pipeline were not built. Thus the no-action alternative is transportation by railroad or a railroad-barge combination.

Under the proposed action, the main source of water for the coal slurry mixture would be wells drilled into the Madison Formation in Niobrara County, Wyoming. Two alternative main water sources are also analyzed: wells drilled into the Madison Formation in Crook County, Wyoming, and water transported by pipeline from the Oahe Reservoir near Pierre, South Dakota.

An optional coal cleaning operation and a slurry pipeline water discharge operation are also evaluated.

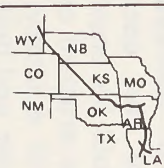
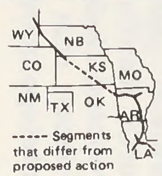
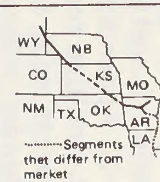
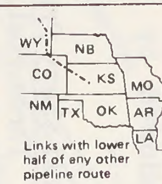
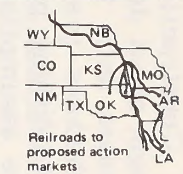
As noted on Table 1-1, not all the alternatives included in this EIS are options from which the decision maker can choose. Some, analyzed at ETSI's request, are system design changes that may be required depending on the final set of committed markets ETSI proposes to supply. The alternatives in this ETSI design-option category are: (1) market, (2) Cypress Bend pipeline-barge, (3) coal cleaning operation, and (4) slurry pipeline water discharge. The decision maker's options are essentially limited to: (1) proposed action, (2) Colorado alternative, (3) no-action (all-railroad) alternative, (4) Crook County alternative water supply system, and (5) Oahe alternative water supply system. Before the decision maker reaches a decision, ETSI will be required to specify which



Map 1-1. LOCATION AND GENERAL ARRANGEMENT OF PROPOSED COAL SLURRY TRANSPORTATION PROJECT AND ALTERNATIVES

TABLE 1-1

PROPOSED ACTION AND ALTERNATIVES OVERVIEW[a]

Project Components	Proposed Action[b]	Alternatives: Market[c]	Cypress Bend Pipeline-Barge[c]	Colorado[b,d]	Coal Cleaning Operation[c]	Crook County Water Supply System[b]	Oahe Water Supply System[b]	Slurry Pipeline Discharge[c]	No-Action[b] • All-rail • Rail-barge
Slurry Preparation Plants (number)	3 (coal crushing only)	3 (coal crushing only)	3 (coal crushing only)		Coal crushing and cleaning before slurry preparation				
Water Supply System (major source)	Niobrara County well field	Niobrara County well field	Niobrara County well field			Crook County well field	Oahe Reservoir		
Main Slurry Pipeline Route									
Slurry Pump Stations	23	22	15	5					
Dewatering Plants (number)	• 9 (extracted water to power plants)	9 (extracted water to power plants)	5 (extracted water to power plants, except at Cypress Bend, where it would be treated and discharged)					Extracted water treated and discharged into rivers	
Markets Served				Can be linked to any other pipeline route to serve any market listed					Can serve any market listed
Ponca City, OK	X								
Oologah, OK		X	X						
Pryor, OK	X	X	X						
Muskogee, OK	X								
Independence, AR	X	X	X						
White Bluff, AR	X	X	X						
Boyce, LA	X	X							
Lake Charles, LA	X	X							
New Roads, LA	X	X	X						
Wilton, LA	X	X	X						
Baton Rouge, LA		X	X						

[a] Not intended to be definitive. Simplified to emphasize differences.

[b] Decision-maker alternative.

[c] ETSI system-design alternative.

[d] Colorado alternative is only an alternative northern pipeline segment.

of its design options should be considered to be part of its proposed (preferred) action.

1.F PROPOSED ACTION

1.F.1 GENERAL DESCRIPTION

The proposed coal slurrry transportation project would consist of four major operating facilities: (1) coal slurry preparation plants, (2) water supply system, (3) coal slurry pipelines and pump stations, and (4) coal slurry dewatering plants. These facilities are shown conceptually on Figure 1-1. The delivery locations and the proposed delivery schedule are shown in Table 1-2. It is anticipated that limited deliveries would be made to all markets but Wilton prior to the proposed operation of the pipeline. (See Table 1-24 for tonnages.)

During construction of the project, approximately 22,730 acres would be disturbed. Approximately 1 percent of this land is federally controlled. All of the approximately 21,777 right-of-way acres would be reclaimed, including reseeding when required by the landowner or surface management agency, as outlined in Appendix C-1. These acres would be returned to their preconstruction use wherever possible. Exceptions would be in the case of large trees growing directly over the pipeline. Construction of the surface facilities would require approximately 953 acres, but only 853 acres would be used during the operational phase. The land use of the 853 acres required for the surface facilities during the operational phase would be changed for the life of the project, approximately 50 years, which is based on the minimum design life of the project.

At project termination, all surface facilities associated with the project would be removed. The disturbed acreage would then be reclaimed according to the procedures outlined in Appendix C-1.

The water requirements for the proposed project are shown in Table 1-3. The sources and use of this water are discussed in more detail in the Water Supply System section.

Construction of the proposed project would begin about January 1983 and would continue in phases until 1989 (Figures 1-2 and 1-3). The schedules presented in this EIS and used in establishing parameters for impact assessment are assumptions provided by ETSI and are subject to change.

Table 1-4 shows the work force needed for construction of the proposed coal transportation project. Table 1-5 lists the operating personnel required for the 37.4-MMTA throughput.

1.F.2 PROJECT COMPONENTS

This section summarizes the construction, operation, and maintenance of the coal slurry preparation plants, water supply system, slurry pipelines and pump stations, coal slurry dewatering plants, and ancillary facilities. The general construction, operating, and reclamation procedures that would be followed by ETSI are detailed in Appendix C-1.

Coal Slurry Preparation Plants

Three coal slurry preparation plants would be located on private land in the Powder River Basin of northeastern Wyoming (Maps A-2 and A-3, Appendix A). A plant with a capacity of 22.4 million tons annually at Jacobs Ranch would process coal from the Jacobs Ranch and Black Thunder mines. The proposed 5-MMTA North Rawhide plant would process coal from the North Rawhide and Buckskin mines, and the proposed 10-MMTA North Antelope plant would process coal from the North Antelope and Antelope mines.

A conveyor belt would deliver stockpiled coal to each preparation plant where it would be crushed to pipeline size requirements. The crushed coal would be mixed with water to form a slurry. The slurry, approximately half water and half coal by weight, would be pumped to agitated storage tanks. From there it would be pumped into gathering lines, which would empty into the main pipeline terminus at Jacobs Ranch.

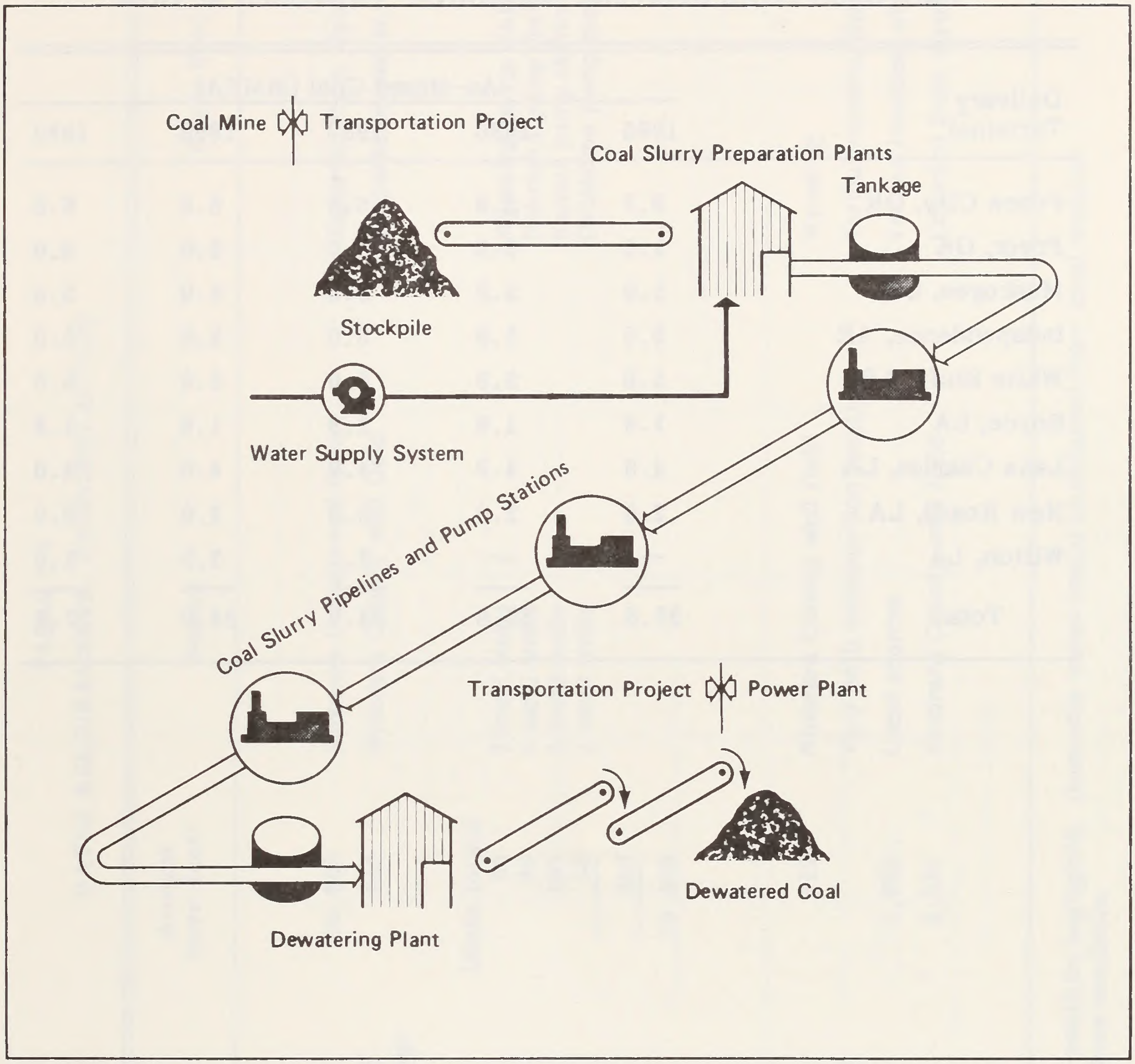


Figure 1-1. CONCEPTUAL DESCRIPTION OF COAL SLURRY TRANSPORTATION PROJECT

TABLE 1-2

PROPOSED COAL DELIVERY SCHEDULE: PROPOSED ACTION

Delivery Terminal	As-Mined Coal (MMTA)				
	1985	1986	1987	1988	1989
Ponca City, OK	3.3	5.0	6.6	6.6	6.6
Pryor, OK	1.5	3.0	3.0	3.0	3.0
Muskogee, OK	5.0	5.0	5.0	5.0	5.0
Independence, AR	5.0	5.0	5.0	5.0	5.0
White Bluff, AR	5.0	5.0	5.0	5.0	5.0
Boyce, LA	1.8	1.8	1.8	1.8	1.8
Lake Charles, LA	4.0	4.0	4.0	4.0	4.0
New Roads, LA	2.0	2.0	2.0	2.0	2.0
Wilton, LA	--	--	2.5	2.5	5.0
Total	27.6	30.8	34.9	34.9	37.4

TABLE 1-3

WATER REQUIREMENTS: PROPOSED ACTION

Use	Amount (acre-feet)	Source	Where Used
Annual Requirements			
Coal transport medium	20,000	Niobrara County well field	Exported from Wyoming
Preparation plant storage pond evaporation makeup, dust suppression, plant washdown	200	Niobrara County well field	Preparation plants (Wyoming)
Pump station storage pond evaporation makeup*	(state totals)		
	60	2 local wells	Wyoming pump stations
	85	2 local wells	Nebraska pump stations
	105	2 local wells	Kansas pump stations
	50	3 local wells	Oklahoma pump stations
Subtotal	300		
Total	20,500		
Construction Requirements (total for project)			
Water-well drilling operations	112	Niobrara County well field	Wyoming
Fugitive dust control, concrete		Vary with construction location	Various construction locations
Pipeline hydrotesting	1,650	Local sources	Various locations along pipeline
Initial packing of pipeline, filling of pump station storage ponds	2,535	Niobrara County well field	Exported from Wyoming

*Domestic water requirements would be negligible. Domestic water would be obtained from local wells or local water supply systems, where available.

FIGURE 1-2

ASSUMED PIPELINE AND PUMP STATION CONSTRUCTION SCHEDULE: PROPOSED ACTION

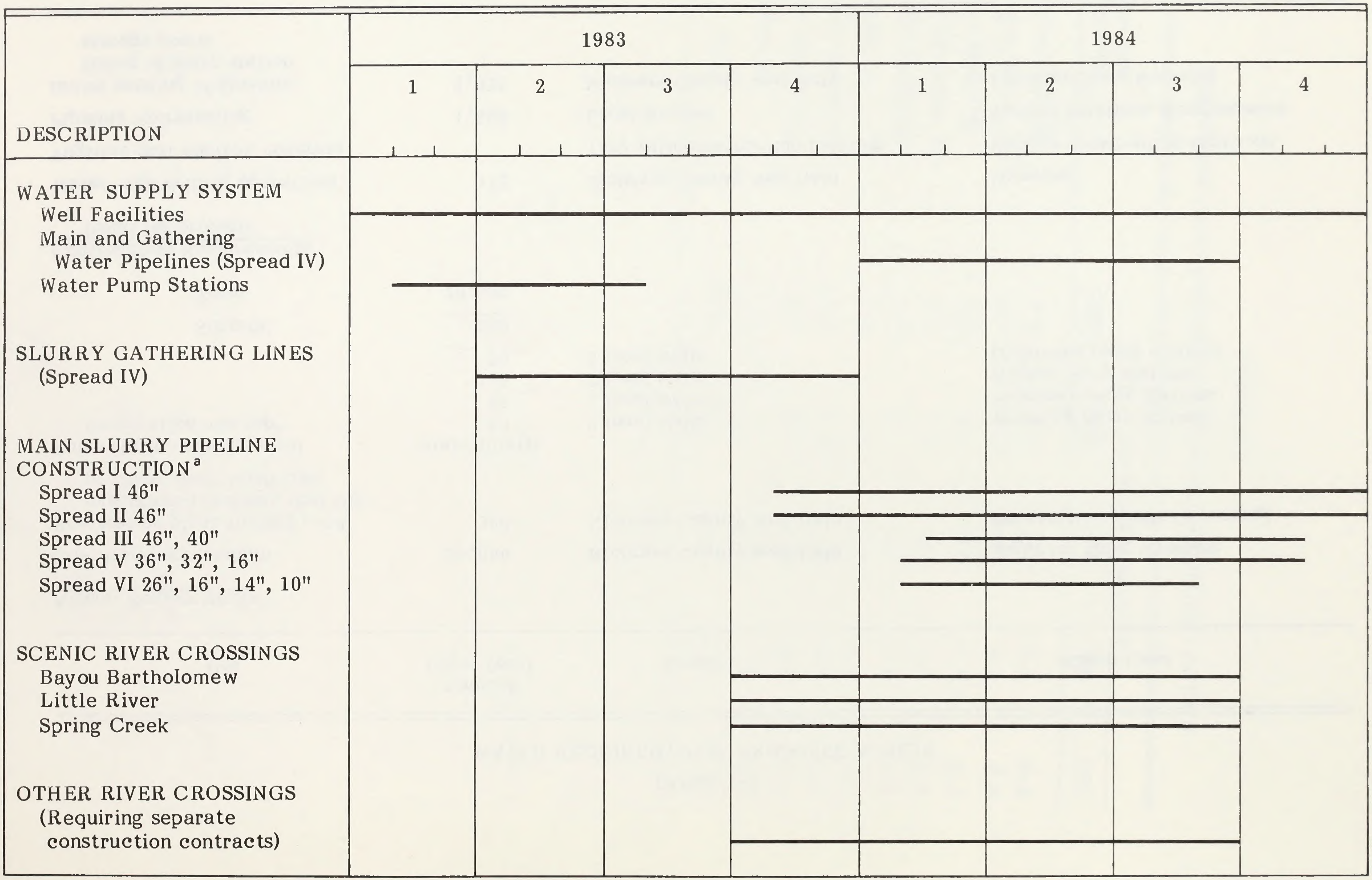
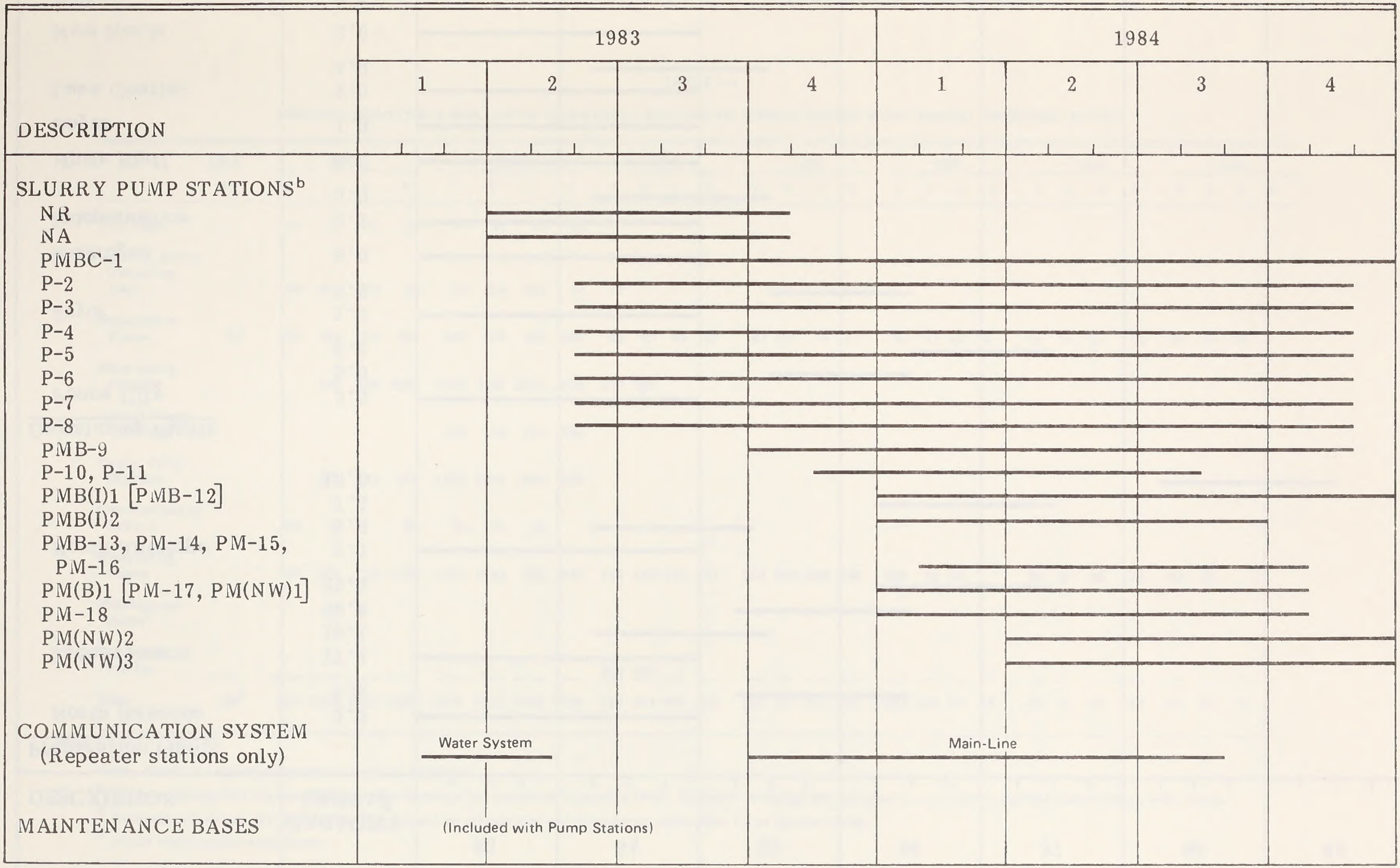


FIGURE 1-2 (concluded)



[a]See Table 1-6 for spread locations.

[b]See strip maps in Appendix A for description of symbols and locations of pump stations. There are only 23 different slurry pump station locations; pump stations shown in brackets are at same location as first pump station listed in the row.

FIGURE 1-3

ASSUMED PREPARATION AND DEWATERING PLANTS CONSTRUCTION SCHEDULE: PROPOSED ACTION

DESCRIPTION	CAPACITY (MMTA)*	83	84	85	86	87	88	89
Preparation Plants								
North Rawhide	3.5							
	5.0							
Jacobs Ranch	17.1							
	19.1							
	20.8							
	22.4							
North Antelope	2.5							
	5.0							
	7.5							
	10.0							
Dewatering Plants								
Ponca City	3.3							
	5.0							
	6.6							
Pryor	1.5							
	3.0							
Muskogee	5.0							
Independence	2.5							
	5.0							
White Bluff	5.0							
Boyce	1.8							
Lake Charles	2.0							
	4.0							
New Roads	2.0							
Wilton	2.5							
	5.0							
THROUGHPUT (MMTA)*		-	-	27.6	30.8	34.9	34.9	37.4

* Millions of (short) tons annually

TABLE 1-4

ASSUMED QUARTERLY BUILDUP OF QUARTERLY BUILDUP OF CONSTRUCTION WORK FORCE: PROPOSED ACTION

	1982	1983				1984				1985				1986				1987				1988				1989			
	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Well Field		41	41	41	41	41	41	41	41																				
Water & Slurry Gathering Lines		60	360	360	60	60	260	260	30	15																			
Preparation Plants	34[c]	129	189	259	342	402	440	338	202	66	83	95	57	81	107	91	92	93	61	58	33	20	26	21	49	56	25	18	5
Main Slurry Pipeline			100	500	2950	2950	2950	2950	2950	300	100																		
Special River Crossings[a]						150	150	150	150																				
Slurry Pump Stations			265	685	975	1870	1970	1680	945																				
Communication System		20	20		20	20	20	20																					
Dewatering Plants		58	378	726	1155	1332	1182	903	488	145	140	105	173	204	240	230	192	150	83	18		20	45	65	70	60	40		
Maintenance Bases[b]																													
Testing & Startup										260	260																		
Total	34[c]	308	1353	2571	5543	6825	7013	6342	4806	786	583	200	230	285	347	321	284	243	144	76	33	40	71	86	119	116	65	18	5

Note: Numbers represent number of workers required.

[a] River crossings that may require separate construction contracts (Appendix D-6). Standard crossings are included in main slurry pipeline construction work force.

[b] Numbers of workers are incorporated in respective preparation and dewatering plant work force requirements.

[c] Initial mobilization work force.

TABLE 1-5

SUMMARY OF OPERATING PERSONNEL: PROPOSED ACTION

Location	Total
Headquarters (Denver)	41
Western District (Jacobs Ranch)	
Administration	4
Water Supply	11
Preparation Plants	196
Pipelines	9
Maintenance Base	23
Subtotal	243
Central District (Pryor)	
Administration	3
Dewatering Plant	64
Pipeline	24
Maintenance Base	33
Subtotal	124
Eastern District (White Bluff)	
Administration	3
Dewatering Plants	110
Pipeline	18
Maintenance Base	47
Subtotal	178
Southern District (New Roads)	
Administration	3
Dewatering Plants	93
Pipeline	24
Maintenance Base	47
Subtotal	167
Total	753

The coal slurry preparation plants would include dust collection facilities at all transfer points that are likely to be sources of airborne dust. The amount of particulate dust for a typical 5-MMTA plant with dust collectors would be 230 tons per year; it would be 330 tons per year for a 10-MMTA plant. These emission quantities are for airborne dust from the starting point of the coal-loading conveyor to the preparation plant and include all emission points inside the plant boundary.

The preparation plants would be constructed in phases from 1983 to 1989 as the pipeline throughput increases (Figure 1-3). During project operation, the buildings, roads, and all other structures associated with coal slurry preparation plants would occupy about 235 acres.

A maximum work force of approximately 440 persons would be required to construct the three preparation plants to initial capacity. An estimated maximum of 107 construction workers would be needed to increase the total capacity of the three plants to 37.4 MMTA (Table 1-4). A total of 196 people would be required to operate the plants: 117 at Jacobs Ranch, 27 at North Rawhide, and 52 at North Antelope.

Water Supply System

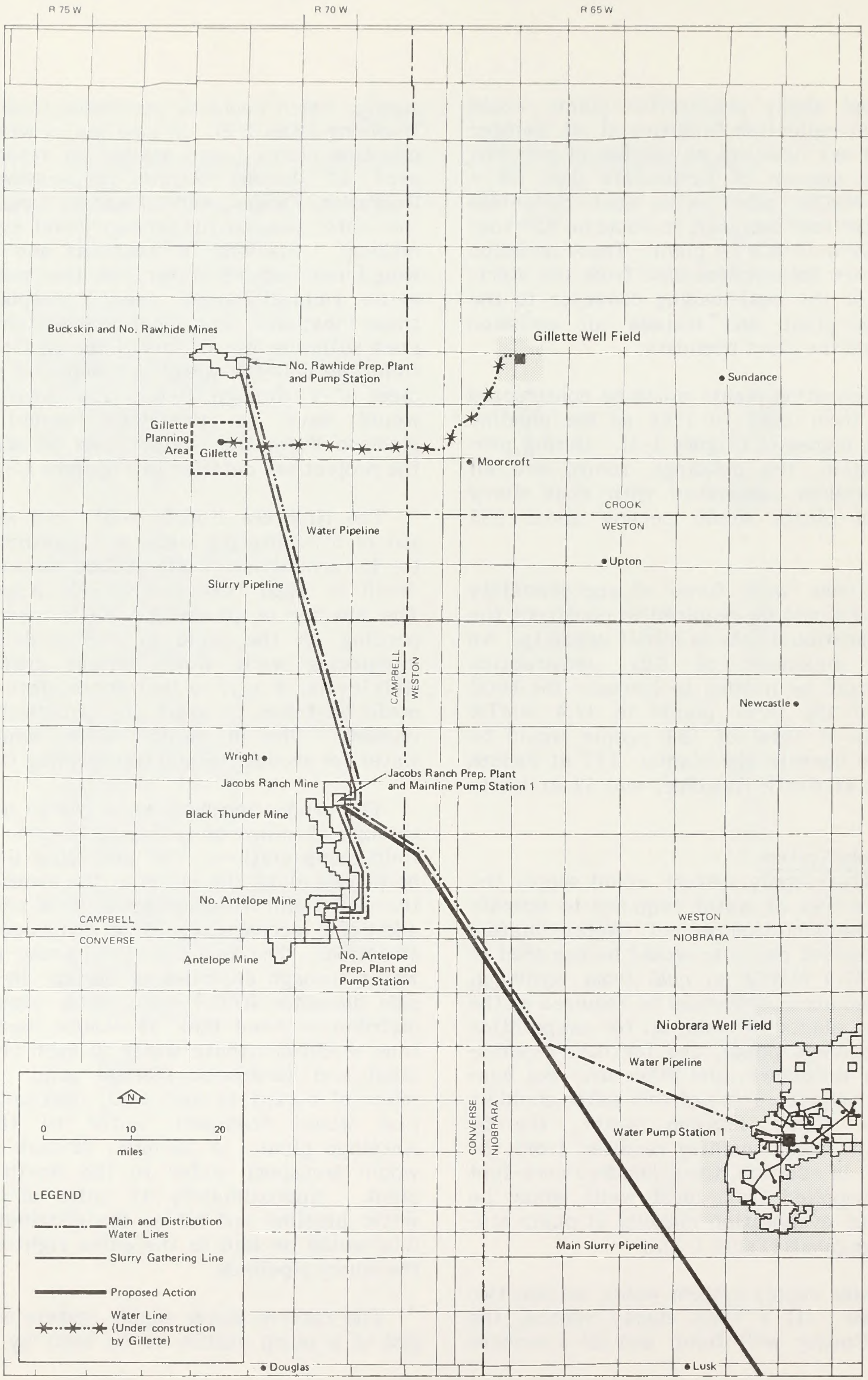
The water supply system would supply the 20,200 acre-feet of water required to operate the coal transportation project. Approximately 20,000 acre-feet per year would be required to transport 37.4 MMTA of coal from Wyoming. Two hundred acre-feet would be required at the preparation plants to make up for evaporation from the storage ponds, and for dust suppression, plant washdown, and other uses not connected with slurry. Some of this water could be reused as slurry makeup water, thereby reducing the total quantity required from the well field. In addition, three hundred acre-feet per year supplied from local wells would be required for evaporation makeup at pump station storage ponds (Table 1-3).

The water supply system would include two components: (1) a main supply source, the Niobrara County well field; and (2) a reserve supply, which could be purchased from Gillette, Wyoming (Map 1-2). In addition, a well at each mainline slurry pump station in Wyoming (except at Jacobs Ranch preparation plant), Nebraska, Kansas, and Oklahoma would provide the water needed for storage pond evaporation makeup. Stations in Arkansas and Louisiana would not require water for this purpose because rainfall would exceed evaporation at these locations. The legal requirements associated with the use of the Niobrara County well field and Gillette water are included in Appendices C-2 through C-6. The measures ETSI would have to undertake should existing Madison Formation water users be affected by the project are detailed in Appendix C-3.

The Niobrara County well field would consist of 5 monitoring wells and approximately 40 to 45 production wells drilled to an average depth of 4000 feet (Map A-53, Appendix A). The number of production wells may vary depending on the yield of the wells. The 5 monitoring wells would detect drawdown on well levels, if any, so that appropriate measures could be taken to avert any potential negative impact. The production wells would supply water for processing and transporting the coal.

The production-well water would be pumped through 62 miles of gathering lines to the well-field pump station. The gathering lines would be placed along the edges of the access roads in the well field, where possible, so a minimum of additional acreage would be disturbed for construction. The pump station would pump the water through 68 miles of buried, 26-inch outside diameter (O.D.) main water pipeline to a distribution head tank at Jacobs Ranch. This tank would distribute water to each preparation plant and associated storage pond. Some 16 miles of buried 16-inch O.D. distribution pipeline would transport water to the North Antelope plant. A 55-mile, 22-inch O.D. line would transport water to the North Rawhide plant. Approximately 37 miles of the main water pipeline and all of the distribution pipeline would be laid in the same right-of-way as the slurry pipelines.

The reserve water supply system would consist of a pump station to be built by ETSI. It



Map 1-2. PROPOSED ACTION WATER SUPPLY SYSTEM

would be located at the intersection of the well-field pipeline being constructed by Gillette and the Jacobs Ranch-North Rawhide water distribution pipeline that would be constructed by ETSI. The pipelines would intersect approximately 7 miles south of the proposed North Rawhide preparation plant. The pump station would direct surplus Gillette water in either direction, to North Rawhide or Jacobs Ranch. ETSI and the city of Gillette have signed a memorandum of understanding regarding the purchase of Gillette water (Appendix C-5).

Construction of the water supply system would begin in 1983 and would be completed in late 1984. Approximately 2.5 acres would be cleared and leveled at each well site. An area of 150 x 105 feet (0.5 acre) would be required for operation of each well. The remaining disturbed area would be revegetated following removal of the drill rigs. During operation, the well-field surface facilities would occupy about 28 acres, including the 3 acres required for the main water pump station.

A construction work force of approximately 41 would be required for the well field (Table 1-4). Approximately 11 people would be needed to operate the water supply system.

Slurry Pipelines and Pump Stations

Two buried slurry gathering lines, a buried main slurry pipeline, and 23 slurry pump stations would be required. Slurry from the North Rawhide and North Antelope preparation plants would be transported via 55-mile, 32-inch O.D. and 16-mile, 24-inch O.D. gathering pipelines, respectively, to the origin of the main slurry pipeline at the Jacobs Ranch plant. The main pipeline would extend 1664 miles from Jacobs Ranch to the delivery sites in Oklahoma, Arkansas, and Louisiana. The 46-inch diameter of the main pipeline would decrease gradually south of Pryor, Oklahoma. This would be necessary to maintain the correct rate of flow after each slurry delivery.

A pump station at the North Rawhide and North Antelope plant sites would pump slurry in the gathering lines to the main slurry pipeline. The remaining 21 pump stations would be located along the main slurry pipeline route. Their locations are shown on the maps included in Appendix A.

Each station would include a water storage pond, agitated slurry storage tank and reinjection system, slurry-pump house, water-pump house, cooling tower, electric substation, water well (Wyoming, Nebraska, Kansas, and Oklahoma only), and waste treatment facility. Approximately 20 to 25 acres would be required for each of the 20 slurry pump stations not located within a preparation plant boundary.

The slurry pipelines and pump stations would be constructed from 1983 through 1984. A work force of approximately 2950 organized as six construction teams, or "spreads", would work concurrently on various sections of the line (Tables 1-4 and 1-6). The principal communities likely to serve as pipeline spread headquarters are listed in Table 1-6.

Pipeline construction techniques for a coal slurry pipeline are the same as for conventional pipelines. Typically, pipelines are laid in a continuous operation by a spread, consisting of equipment and crews handling various types of construction activities for a given pipeline segment. Figures 1-4 and 1-5 illustrate these operations.

Construction activities would be confined to a 100-foot right-of-way and a storage and work area (200 x 200 feet) at periodic staging sites and at each side of river, highway, and railroad crossings. When possible, existing roads would be used to provide access to the right-of-way for materials, machinery, and construction workers. In remote areas where there are no access roads, the right-of-way would be the primary path of surface travel.

Vegetation would not necessarily be removed from the entire right-of-way but only in those areas where necessary to provide safe and efficient operation of construction equipment. Thus vegetation would be cleared from the trench line and from as much of the authorized right-of-way as necessary to provide adequate room for vehicle travel and work space. Only minimal clearing would be required in grasslands, since this vegetation type does not usu-

TABLE 1-6

PIPELINE SPREAD RESPONSIBILITIES: PROPOSED ACTION

Pipeline Spread	Likely Spread Headquarters	Pipeline Segment[a]	Miles	Workers Required: Typical Spread[b]	Workers Required: Add for Rough Terrain
I	Gillette, WY	Jacobs Ranch to PMB-367 (PMB-0 to PMB-367)	367	670	78
	Wright, WY				
	Lusk, WY				
	Scottsbluff, NB				
	Ogallala, NB				
	McCook, NB				
II	Hays, KS	PMB-367 to Ponca City (PMB-367 to P-700)	333	670	78
	Kingman, KS	Ponca City to Oologah (P-700 to P-778)	78		
	Ponca City, OK				
III	Pryor, OK	Oologah to Pryor (P-778 to P-808)	30	610	78
	Fort Smith, AR	Pryor to Muskogee (P-808 to P-840)	32		
	Russellville, AR	Muskogee to Atkins Junction (P-840 to PMB-997.4)	157		
IV	Gillette, WY	Jacobs Ranch to North Antelope (water)	16	260	-
		North Antelope to Jacobs Ranch (slurry)	16	390	-
		Jacobs Ranch to North Rawhide (water)	55	260	-
		North Rawhide to Jacobs Ranch (slurry)	55	390	-
		Jacobs Ranch to Well Field (water)	68	390	-
V	Russellville, AR	Atkins Junction to White Bluff (PMB-997.4 to PMB-1077.6)	80	550	65
	Batesville, AR	White Bluff to Alexandria Junction (PMB-1077.6 to PM 1315)	238	550	65
	Pine Bluff, AR	Atkins Junction to Independence (PMB(I)-0 to PMB(I)-93)	93	260	-
VI	Monroe, LA	Alexandria Junction to New Roads (PM(NW)-0 to PM(NW)-75.6)	76	390	-
	Alexandria, LA	New Roads to Wilton (PM(NW)-75.6 to PM(NW)-141.5)	66	260	-
	Lake Charles, LA	Alexandria Junction to Boyce (PM(B)-0 to PM(B)-24)	24	260	-
	Baton Rouge, LA	Alexandria Junction to Lake Charles (PM-1315 to PM-1404)	89	260	-

Notes: Spread I would proceed from south to north. Spread IV would proceed as shown above. All other spreads would proceed from north to south.

[a] Explanation of milepost (MP) designations is included in Appendix A.

[b] Numbers represent maximum number of workers per pipeline spread.

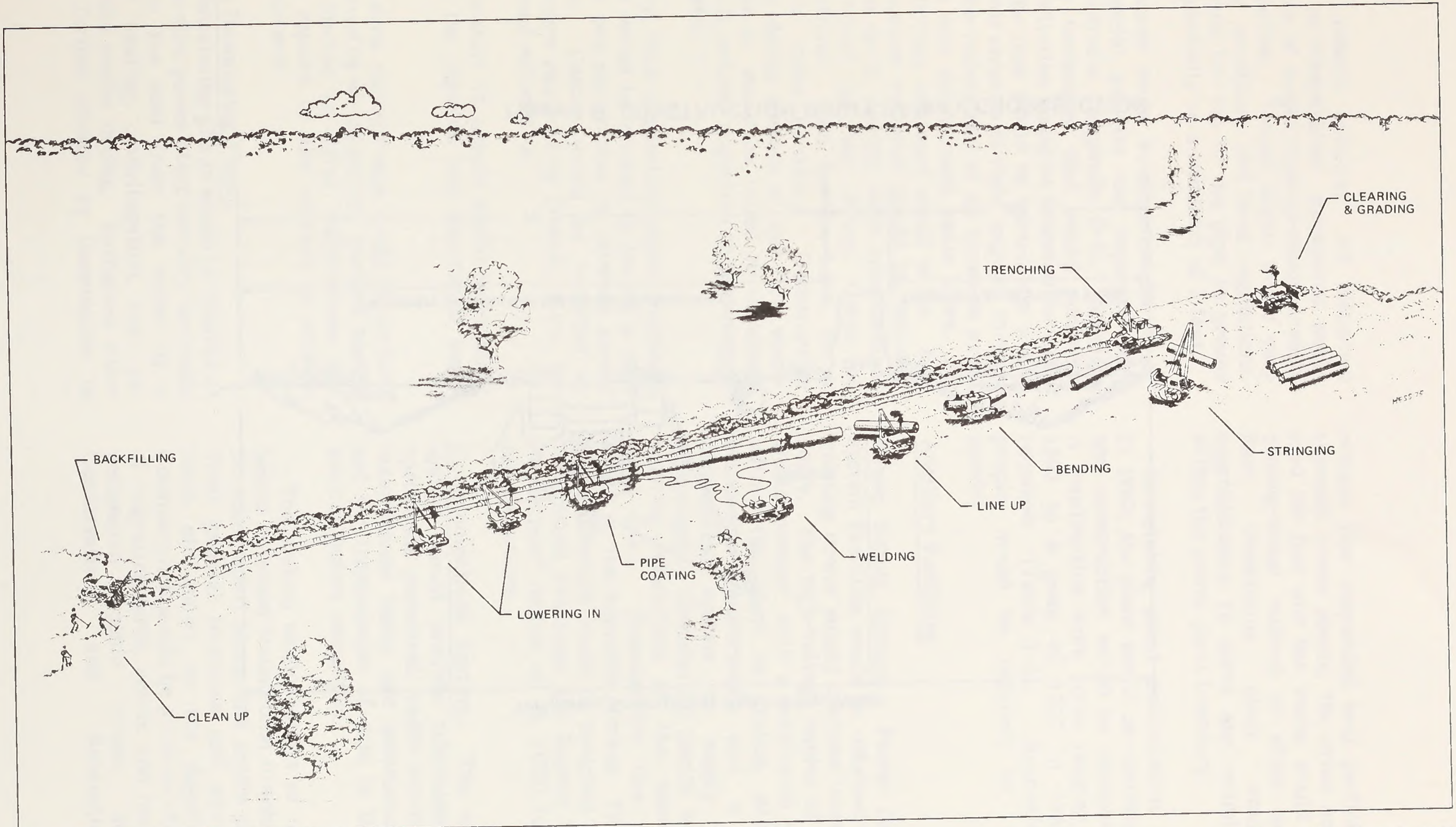


Figure 1-4. TYPICAL MAIN SLURRY PIPELINE CONSTRUCTION SPREAD

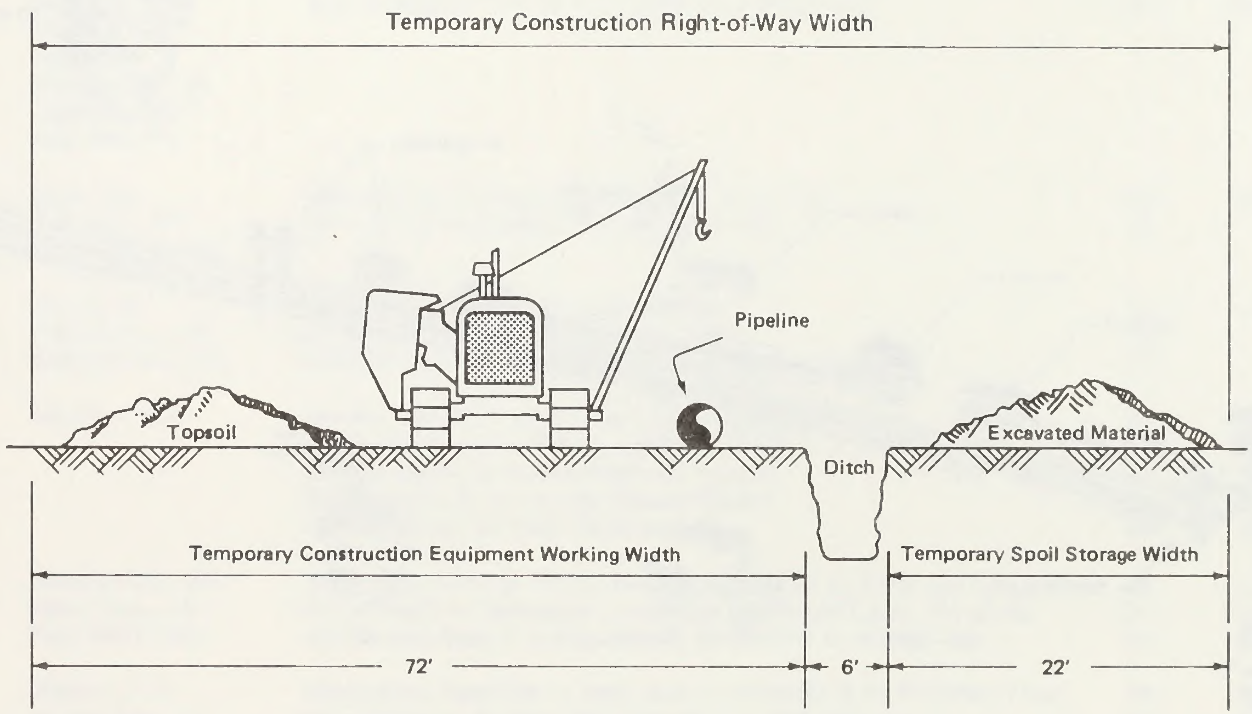


Figure 1-5. CONSTRUCTION RIGHT-OF-WAY CROSS SECTION

ally impede vehicle passage. All disturbed areas would be revegetated. Exceptions would be in the case of larger trees growing directly over the pipeline. Trench depth would vary with existing conditions and local regulations. The cover from the top of the pipe to ground level would generally be a minimum of 3 feet.

The proposed route would cross 58 rivers requiring special permits and separate construction contracts (Appendix D-6). Specific construction techniques that would minimize erosion and siltation would be selected for each crossing. The pipe would be buried and would generally cross streams at right angles. Stream flow would be maintained at all times to avoid interference with downstream water users. No changes in bottom contours would occur. Any excess excavation material would be disposed of upland so as to comply with conditions of U.S. Department of the Army, Corps of Engineer permits. (See Section 1.F.4. for a discussion of these permits.) Construction would occur during periods of low flow whenever possible or would be timed to eliminate conflicts with critical migration or spawning of aquatic species.

Generally, beds supporting paved roadways or railroads would be crossed by boring a hole beneath the bed rather than by ditching across the surface. Casing would be installed at crossings where required by federal, state, local, or railroad authorities.

Approximately 75 people would be required to operate the pipeline and associated pump stations.

The pipeline right-of-way would be periodically inspected by aerial patrol. Surface traffic would be limited to valve maintenance and emergency repairs to the pipeline or erosion control structures.

Coal Slurry Dewatering Plants

Slurry dewatering plants would be located at each of the nine power plant delivery terminals to separate the coal from the water by a process of heating, centrifugation, heat exchanging, and cooler drying. Extracted water would be further treated by flocculation to remove fine suspended coal particles. In the adjacent power plants, the dried coal would be used for fuel and the water would be used for cooling-water makeup or other in-plant uses. Each dewatering plant would require approximately 10 acres and would be located within the power plant boundary.

Dewatering plant construction would begin in 1983; the plant would be operational in 1985, and construction would be completed in 1989. A construction work force ranging from 58 in 1983 to a peak of 1332 in 1984 would be required (Table 1-4). Approximately 267 people would be required to operate the plants.

Ancillary Facilities

Power Supply System. Power for the slurry system facilities would be obtained by extending existing power supply systems located along the route. The high-voltage cables of an extension would connect with a substation yard (located within the plant or station site) containing stepdown transformers and a low-voltage distribution system to supply the facility equipment. Dewatering plants would tie into existing substations at the associated power plant sites. Transmission line locations are shown on the Appendix A maps. The power poles and conductors would be designed to conform to "Suggested Practices for Raptor Protection on Powerlines" (Miller et al. 1975) to avoid raptor electrocutions.

Communications System. The communication system would provide telephone service for operations personnel, radio communication for maintenance bases and associated field units, and for transmission of data to the supervisory control system computer.

The system would consist of microwave repeater antennas mounted on towers spaced about 30 miles apart along the entire pipeline route. Their general locations and associated access roads are shown on the Appendix A maps. Consideration would be given to the flight routes of migrating birds, scenic and recreation areas, designated scenic rivers, and Heritage Conservation and Recreation Service

(HCRS) draft inventory wild and scenic rivers in determining the exact location of each tower.

Each tower would be equipped with omnidirectional receiver antennas to pick up transmissions from mobile units traveling the route. The towers would range in height from 40 to 360 feet, depending on the topography. Communication sites that would lie off the primary system or between towers, such as mine sites, valve locations, and river crossings, would be serviced by narrowband radio installations transmitting to the nearest microwave tower. The main control center for the communication system would be located in Denver, Colorado.

Supervisory Control System. The supervisory control system would monitor the operation of all project facilities from a master control station located in the main control room in Denver. It would control all the water and slurry pipelines and would monitor selected data for the coal preparation and dewatering plants. The operation of the plants would be controlled from individual control rooms at each plant site.

In addition to the master control station, a backup control system would be provided at White Bluff, Arkansas. This system would permit continuous operation of the slurry pipeline in case of malfunction of the master control room or failure of the communication link with Denver.

1.F.3 SYSTEM ROUTINE AND NONROUTINE OPERATIONS

The pipeline operation procedures that would be used on the ETSI system have been used successfully on existing coal slurry and mineral pipelines in operation throughout the world, such as the Black Mesa pipeline (transporting coal across Arizona to Nevada) and the Samarco pipeline (transporting iron concentrate in Brazil). These procedures--including start-up, steady-state flow, shutdown, and restart after shutdown—are described in detail in the Project Description Technical Report (WCC 1980a).

Each pump station would have sufficient pumping capacity so that the system could continue to operate (at reduced flow and for a short duration) with a loss of up to 40 percent of pumping capacity at any pump station.

The general operating philosophy is that the system would operate at reduced flow as necessary due to nonoperational periods and would shut down completely only in the event that reduced flow could not be maintained. In the event of a system shutdown, the pump stations downstream of the shutdown point would continue to pump slurry or water to maintain the downstream flow as long as possible or to flush the downstream section of pipeline. The various nonroutine operating cases--such as one or more nonoperational pump stations, a nonoperational dewatering plant, or handling nonspecification slurry--are described in the Project Description Technical Report (WCC 1980a).

Many features of design, construction, and operation of the pipeline system would prevent or reduce the likelihood of a coal slurry spill. Others would minimize or contain coal that could possibly be released. A detailed spill contingency plan for the pipeline would be prepared prior to initiating pipeline operations. Design, construction, and operating features that would prevent or minimize spills are discussed in more detail in Appendix C-7.

1.F.4 AUTHORIZING ACTIONS

In order to implement ETSI's proposed action, certain federal, state, and local "authorizing actions" would have to be taken. Examples of authorizing actions are approvals of applications for right-of-way grants, stream crossing permits, and microwave communication licenses. The authorizing actions that would be necessary before ETSI could construct a coal slurry pipeline are discussed below. A summary list of the known required authorizing actions and the general conditions that would apply to the various grants and permits are included in Appendix D-1.

Federal

Bureau of Land Management (BLM). The BLM is responsible for issuing right-of-way and other land use authorizations for the pipeline and related facilities on Public Lands administered by the agency. In order to comply with Title V of the Federal Land Management Policy Act (FLMPA), ETSI filed a revised application with the BLM Wyoming State Office on April 28, 1978. If the application were approved, the BLM would:

1. Grant a 50-foot right-of-way for construction, maintenance, and operation of a water pipeline across approximately 2.0 miles of Public Lands and a coal slurry pipeline across approximately 3.5 miles of Public Lands. The estimated 5.5 miles of combined right-of-way located between Gillette and Lusk, Wyoming, would be issued under Title V of FLPMA, as defined in the Code of Federal Regulations (CFR), 43 CFR 2800. It would be issued from the BLM Wyoming State Office in Cheyenne for a 30-year period, after which time ETSI could file for renewal.

2. Grant a 50-foot temporary use permit across approximately 5.5 miles of Public Lands immediately adjacent to the 50-foot water pipeline and coal slurry pipeline right-of-way during the construction phase. This permit would be issued under Title V of FLPMA, as defined in 43 CFR 2920. It would be issued from the BLM Casper District Office in Casper, Wyoming, for a maximum period of two years.

Forest Service, U.S. Department of Agriculture (FS). The FS would:

1. Grant a 50-foot right-of-way for construction, operation, and maintenance of water and coal slurry pipelines across approximately 27.0 miles of federal lands administered by the FS in the Thunder Basin National Grassland in northeast Wyoming. The approximately 27.0-mile right-of-way easement would be issued under Title V of FLPMA, as defined in 36 CFR 251. (New proposed regulations were issued in the Federal Register, Vol. 44, No. 98, May 18, 1979.) It would be issued by the Secretary of Agriculture for a 30-year period with the option to renew upon satisfactory compliance with terms of the easement.

2. Grant a 50-foot special use permit for construction of water and coal slurry pipelines across approximately 27.0 miles of federal lands administered by the FS in the Thunder Basin National Grassland in northeast Wyoming. The permit would be issued under Title V of FLPMA, as defined in 36 CFR 251, from the Forest Supervisor's Office for the Medicine Bow National Forest, Laramie, Wyoming.

U.S. Army Corps of Engineers (COE). Section 10 permits under the Rivers and Harbors Act of 1899 (33 USC 401-413) are required for crossings of navigable waters in the United States. Under Section 404 of the Clean Water Act of 1977 (40 CFR 122-123), and implemented by Corps of Engineers regulations (33 CFR 323), the placement of dredged or fill material for bedding or backfilling pipeline crossings is permitted under the nationwide permit for utility lines (33 CFR 323.4 and 323.4-3), provided that the conditions outlined in Appendix D-7 are met. However, the Corps does have discretionary authority to require individual permits for all or portions of the pipeline crossings if the District Engineer determines that the concerns of the aquatic environment indicate a need for such action (33 CFR 323.4-4).

A list of ETSI pipeline river crossings that require Section 10 or Section 404 permits is presented in Appendix D-6.

COE Districts would require ETSI to file one permit application for all Department of the Army (Section 10 and Section 404) permits for river crossings within their jurisdiction. (With successful interagency coordination, it may be possible to process a single permit for all ETSI crossings.)

The COE has established the following procedures for processing applications for individual Department of the Army permits:

1. On the basis of project description information supplied by the applicant, the appropriate COE District Office or Offices determine

whether an individual Department of the Army permit is required.

2. The applicant must file the appropriate permit applications, which are then reviewed by COE officials.

3. COE District Office distributes a public notice requesting comment on the permit applications from federal and state agencies, as well as the general public. Comments are received for a 30-day period.

4. Following the comment period, all public input is evaluated. If requested, the COE District Engineer may require a formal public hearing on the proposed action. Upon receipt of comments, the District Engineer will offer the applicant an opportunity to resolve any adverse comments. The District Engineer will also make a public interest review and, should the review be positive, a Department of the Army permit will be issued.

5. If a formal public hearing is necessary, all public input and pertinent information will be reevaluated and the COE District Engineer will make a decision regarding the Department of the Army permit.

6. A decision on the Department of the Army permit will not be made until 30 days after the Final Environmental Impact Statement is filed with the Environmental Protection Agency.

In addition, the COE would require an easement for those portions of the pipeline crossing the federal government's fee ownership. A consent to easement would be required for those portions crossing lands over which the United States acquired only an easement interest. Processing would be concurrent with that of the permit application.

Federal Communication Commission (FCC). The FCC would issue a separate operating license for each of the approximate 66 repeater stations. ETSI would submit application Form 402 for license in the Operational Fixed Microwave Service. Authority for issuing the microwave licenses is contained in Volume V, Parts 90 and 94 of 47 CFR of the FCC Rules and Regulations, which govern private repeater stations.

The following steps must be taken in applying for the individual licenses:

1. A functional diagram of the entire communication system must be filed with the FCC. This must include a certified statement indicating that no harmful interference would be caused to other existing radio stations operating within 120 miles of each proposed transmitter site.

2. Notification to the Federal Aviation Administration (FAA) is required in the case of specified possible hazards to air navigation. Notification to the FAA and a "no-hazard determination" by that agency is required for antenna structures that will stand more than 200 feet above ground level or, in the case of those antenna towers within specified proximities of existing or proposed public and military airports, for structures that will be of a greater height than an imaginary surface existing outward and upward from such airports at specified slopes. Notification is not required in the case of towers of lesser height.

3. The applicant should select from the frequency table in the FCC regulations the appropriate frequency band where designated bandwidth most nearly fits the applicant's needs and FCC regulations.

Bureau of Indian Affairs (BIA). The BIA would:

1. Grant a 100-foot right-of-way for construction and operation across approximately 18.0 miles of allotted Indian lands in Oklahoma. The right-of-way would cross the Pawnee and Osage reservations within the Anadarko Area jurisdiction of BIA, and within the boundary of the Cherokee Nation in the Muskogee Area jurisdiction. Authority for issuance of the right-of-way would rest with the Commissioner of Indian Affairs or the Superintendent in charge of the reservation on which the lands involved are situated, in accordance with the Act of February 5, 1948, 62 Stat. 17 (25 USC 323-328), 25 CFR 161.

2. Grant right-of-way easements for construction and operation across two river beds of the Arkansas River in Oklahoma which are owned by the Cherokee Nation. The BIA would appraise the river beds prior to finalization of any right-of-way easement agreements.

Using the Muskogee Area Office as an example, the following procedures would generally be followed for acquiring right-of-way grants:

1. A BIA official would explain the proposed project to the Cherokee tribal officials and seek their approval. When ETSI furnishes specific segment plat locations for the Indian tracts involved, appraisals would be requested.

2. ETSI would complete a Consent Form that details the purpose of the easement and pertinent engineering and construction information. This would be supplied to the landowner to ensure he or she is thoroughly advised of all factors of the project. The right-of-way grants would be approved in the Muskogee Area Office, provided the owners have consented in writing and documentation is in order.

State

Wyoming. The Wyoming Department of Environmental Quality, Division of Air Quality, has the responsibility for approving construction and granting permits for the operation of the slurry preparation plants. Pursuant to Sections 21 and 24 of the Wyoming Air Quality Standards, the following state actions would be required:

1. Approval to construct slurry preparation plants adjacent to the North Rawhide, Jacobs Ranch, and North Antelope mines in Campbell County. Approval to construct the North Rawhide, Jacobs Ranch, and North Antelope slurry preparation plants was granted on January 15, 1980 (see state permit Nos. CT-274, CT-275, and CT-176 included in Appendix D-9). These permits would have to be revised to handle the increase from 25 to 37.4 MMTA.

2. Permits to operate the coal cleaning and preparation plants would be required after a 120-day start up period. Performance tests would be necessary within 90 days of the initial start up.

Kansas. The Kansas Department of Agriculture, Division of Water Resources, would require the following permits:

1. Permits for each stream crossing where the stream flow is greater than 5 cubic feet per second

2. Permits for each of the two water-well sites associated with the three proposed pump stations

Arkansas. The state of Arkansas would require:

1. A Prevention of Significant Deterioration permit from the Environmental Protection Agency

2. A water quality permit for water runoff from stored coal from the Arkansas Department of Pollution Control and Ecology

Louisiana. The Louisiana Wildlife and Fisheries Commission (LWFC) administers the Natural and Scenic Rivers System program under the authority of the Scenic Rivers System Act of 1970, Number 398. The ETSI coal slurry pipeline would cross three natural and scenic rivers in Louisiana. Therefore the Louisiana Wildlife and Fisheries Commission would grant separate "Class B Use" permits for each crossing of the following natural and scenic rivers: Little River, Spring Creek, and the Bayou Bartholomew.

LWFC would conduct a thorough evaluation of the impacts of the proposed use. The parameters that would be evaluated include wilderness qualities, scenic values, ecological effects, recreation, fishing, wildlife, archeological, botanical, water quality, and other natural and physical features and resources. In addition, the Louisiana Geological Survey would evaluate geological parameters.

Other major permitting applications required include:

1. Permits for water and solid wastes effluents, from the Louisiana Office of Environmental Affairs, Department of Natural Resources

2. A pipeline authorization from the Office of Conservation, Department of Natural Resources

3. Rights-of-way authorization from the Office of State Lands, Department of Natural Resources

1.F.5. INTERRELATIONSHIP OF PROPOSED ACTION WITH OTHER PLANNED PROJECTS

Projects that are in the planning stages in Converse and Campbell counties, Wyoming, were examined to determine which ones are likely to occur by 1990. Table 1-7 lists the projects that are most likely to occur.

Table 1-8 lists planned construction activities adjacent to the proposed dewatering plant sites. The schedules and manpower demands for these projects have been considered in the assessment of socioeconomic impacts.

Other planned projects in the vicinity of the proposed project include the Chicago and North Western (C&NW) coal line project in Wyoming, Interstate-49 (I-49) (Louisiana North-South Expressway) and I-630 in Arkansas.

1.G MARKET ALTERNATIVE

1.G.1 GENERAL DESCRIPTION

The market alternative is an ETSI system-design option rather than a decision maker's alternative. It is included in this environmental impact statement (EIS) at ETSI's request because ETSI is considering several market configurations. The market alternative would be very similar to the proposed action but would serve two different markets. Oologah, Oklahoma, and Baton Rouge, Louisiana, would be served rather than Ponca City and Muskogee, Oklahoma (Table 1-9). These changes in markets require minor changes to the main slurry pipeline route, the two dewatering plant locations, and individual preparation plant throughputs (although the total project throughput of 37.4 MMTA remains the same). The main slurry pipeline route in all states but Kansas and Oklahoma is essentially the same as the proposed action route. The differences in Kansas and Oklahoma are due to the differences in the Oklahoma markets served (Map 1-1). Maps showing the locations of all system components are provided in Appendix A.

During construction of this alternative, approximately 22,199 acres would be disturbed. Approximately 1 percent of this land is federally controlled. All of the approximately 21,256 right-of-way acres would be reclaimed as outlined in Appendix C-1. These acres would be returned to their preconstruction use wherever possible. Exceptions would be in the case of large trees growing directly over the pipeline. Construction of the surface facilities would require approximately 943 acres, but only 843 acres would be utilized during the operational phase. The land use of the 843 acres required for the surface facilities during the operational phase would be changed for the life of the project.

The total construction and annual water requirements for the market alternative would be the same as those for the proposed action (Table 1-2). However, because of the differences in pump station locations, the pump station water requirements would be slightly different, as shown in Table 1-10.

The construction schedules for the water supply system, slurry supply lines, main slurry pipeline construction spreads, communication system, and maintenance bases would be the same as those for the proposed action (Figures 1-2 and 1-3). Figures 1-6 and 1-7 present the construction schedules for the other project components.

Tables 1-11 and 1-12 show the construction work force required for the project. Table 1-13 lists the operating personnel that would be required.

The interrelationships of the market alternative with other proposed projects would be

TABLE 1-7

PLANNED PROJECTS IN CONVERSE AND CAMPBELL COUNTIES THAT ARE MOST LIKELY TO OCCUR DURING CONSTRUCTION PERIOD FOR PROPOSED ACTION

Project	Company	Construction Period
Coal Mines		
Antelope	Nerco	1982-1983
South Rawhide	Carter Mining	1980-1984
Uranium Operations		
Reno Creek	Rocky Mountain Energy	1981-1985
Pintec (expansion)	Thunderbird Joint Venture	1981-1984
American Nuclear Mine & Mill	American Nuclear	1982-1984
Kerr-McGee Mine & Mill	Kerr-McGee	*
Power Plant		
Wyodak II (new unit)	Pacific Power & Light; Black Hills Power & Light	1983-1985

* Construction period undetermined due to uncertainties in uranium market.

TABLE 1-8

PROJECTS PLANNED OR UNDER CONSTRUCTION
AT DEWATERING PLANT SITES DURING PROPOSED CONSTRUCTION PERIOD

Dewatering Plant Site	Project	Company	Construction Period
Ponca City, OK[a]	Sooner Power Plant Units 3 and 4	Oklahoma Gas & Electric	1984-1987
Pryor, OK[b,c]	Grand River Dam Authority Unit 2	Grand River Dam Authority	1984-1986
Muskogee, OK[a]	Muskogee Power Plant Unit 6	Oklahoma Gas & Electric	1982-1984
Independence, AR[a,b,c]	Independence Steam Electric Station	Arkansas Power & Light	1980-1984
New Roads, LA[a,b]	Big Cajun Unit 3	Cajun Electric	Construction ongoing 1980, on-line 1983
Wilton, LA[a,b]	Wilton Power Plant Units 1 and 2	Louisiana Power & Light	1985-1988
Baton Rouge, LA[b]	Exxon Cogeneration Plant	Exxon	1983-1986

[a] Proposed action markets.

[b] Market alternative markets.

[c] Cypress Bend pipeline-barge markets.

TABLE 1-9

PROPOSED COAL DELIVERY SCHEDULE: MARKET ALTERNATIVE

Delivery Terminal	As-Mined Coal (MMTA)				
	1985	1986	1987	1988	1989
Oologah, OK	3.5	3.5	3.5	3.5	3.5
Pryor, OK	2.7	5.3	5.3	5.3	5.3
Independence, AR	5.0	5.0	5.0	5.0	5.0
White Bluff, AR	5.0	5.0	5.0	5.0	5.0
Boyce, LA	1.8	1.8	1.8	1.8	1.8
Lake Charles, LA	4.0	4.0	4.0	4.0	4.0
New Roads, LA	2.0	2.0	2.0	2.0	2.0
Baton Rouge, LA	--	5.8	5.8	5.8	5.8
Wilton, LA	--	--	2.5	2.5	5.0
Total	24.0	32.4	34.9	34.9	37.4

TABLE 1-10

PUMP STATION WATER REQUIREMENTS:
MARKET ALTERNATIVE

State	Local Wells Required	Total Water Requirements (acre-feet/year)
Wyoming	2	60
Nebraska	1	40
Kansas	3	120
Oklahoma	2	50

FIGURE 1-6

ASSUMED PIPELINE AND PUMP STATION CONSTRUCTION SCHEDULE: MARKET ALTERNATIVE

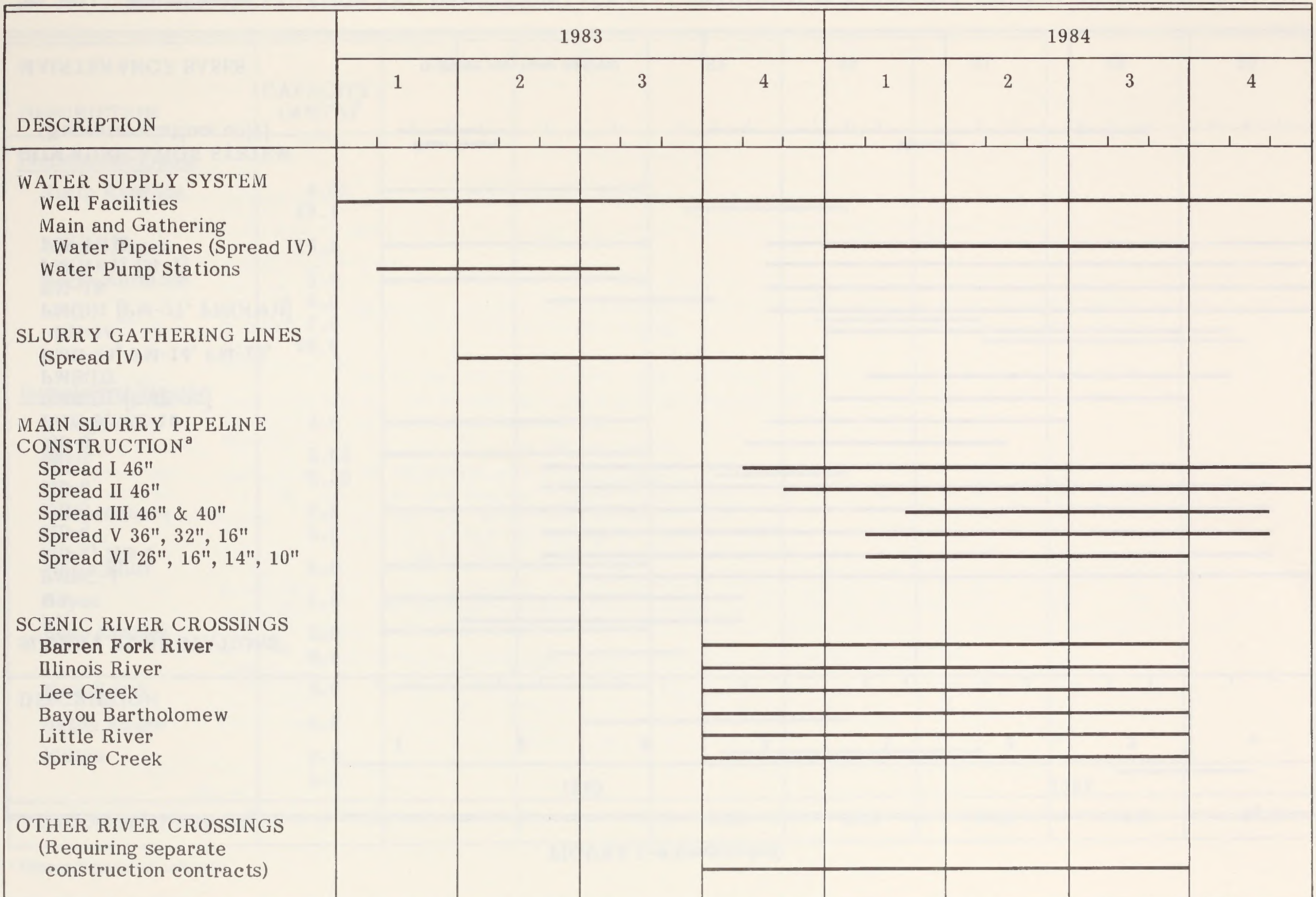
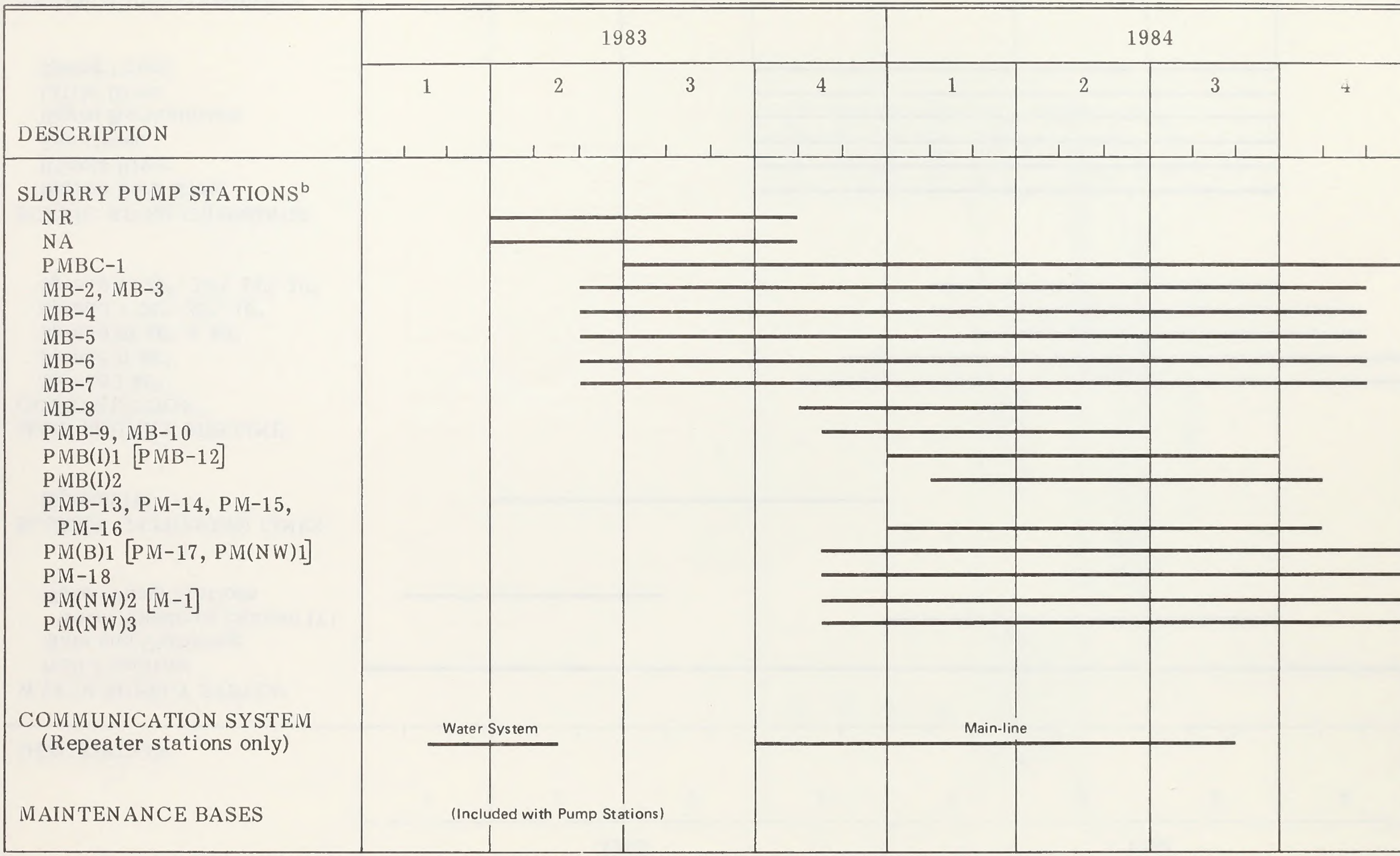


FIGURE 1-6 (concluded)

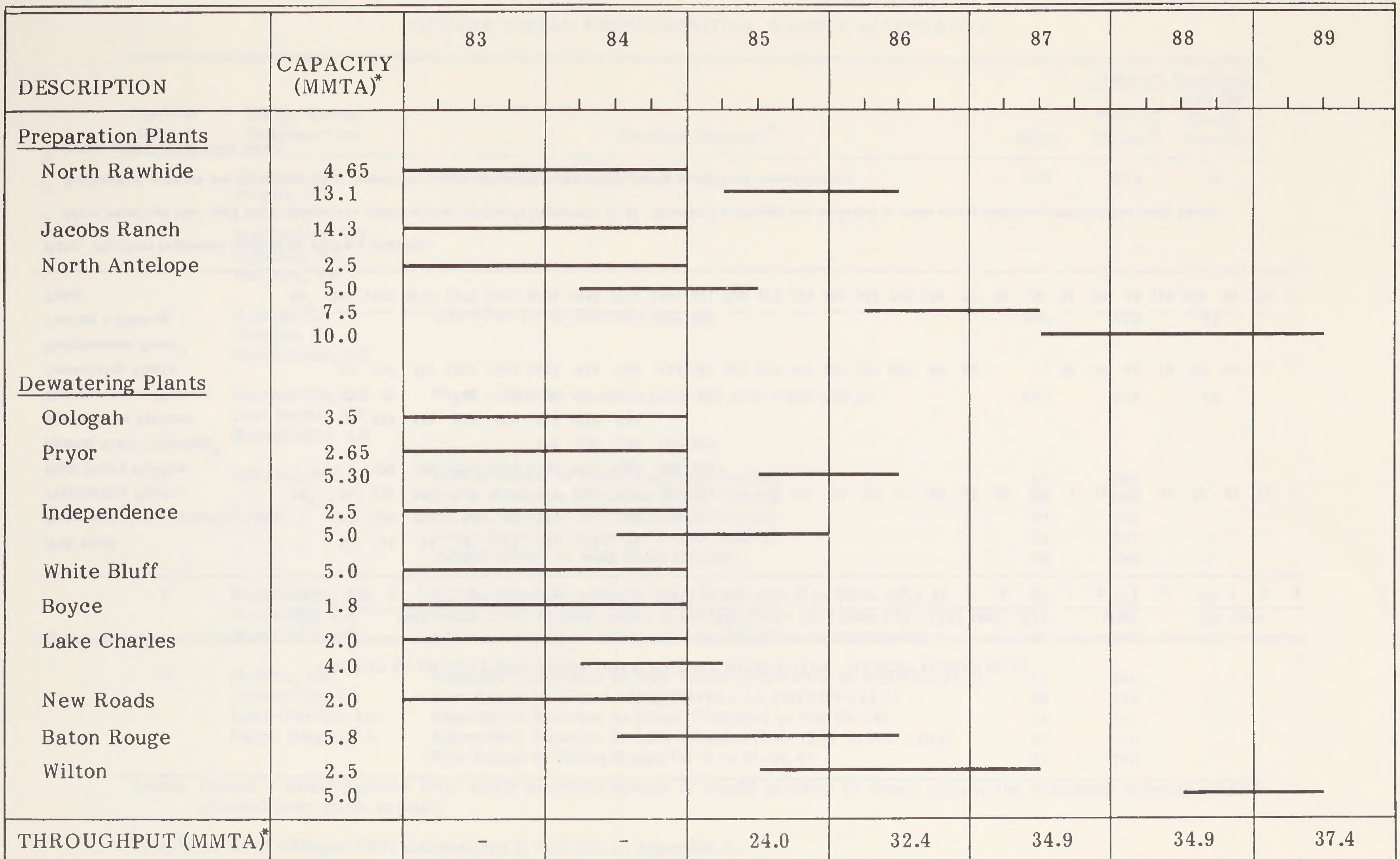


[a]See Table 1-12 for spread locations.

[b]See strip maps in Appendix A for description of symbols and locations of pump stations. There are only 22 different slurry pump station locations; pump station shown in brackets is at same location as first pump station listed in the row.

FIGURE 1-7

ASSUMED PREPARATION AND DEWATERING PLANTS CONSTRUCTION SCHEDULE: MARKET ALTERNATIVE



* Millions of (short) tons annually

TABLE 1-11

ASSUMED QUARTERLY BUILDUP OF CONSTRUCTION WORK FORCE: MARKET ALTERNATIVE

	1982	1983				1984				1985				1986				1987				1988				1989			
	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Well Field		41	41	41	41	41	41	41	41																				
Water and Slurry Gathering Lines		60	360	360	60	90	260	260	30	15																			
Preparation Plants	29[c]	96	145	206	300	380	414	387	325	165	154	72	126	105	53	56	67	62	34	40	19	5	11	21	49	56	25	18	5
Main Slurry Pipeline			100	500	2950	2950	2950	2950	2950	300	100																		
Special River Crossings[a]							150	150	150	150	150																		
Slurry Pump Stations			265	685	975	1870	1970	1680	945																				
Communication System		20	20		20	20	20																						
Dewatering Plants		52	295	587	1031	1202	1063	815	435	154	207	224	353	413	402	310	203	93	43			20	45	65	70	60	40		
Maintenance Bases[b]																													
Testing & Startup										260	260																		
Total	29[c]	269	1226	2379	5377	6553	6868	6283	4876	1044	871	296	479	518	455	366	270	155	77	40	19	25	56	86	119	116	65	18	5

Note: Numbers represent number of workers required.

[a] River crossings that may require separate construction contracts (Appendix D-6). Standard crossings are included in main slurry pipeline construction work force.

[b] Numbers of workers are incorporated in respective preparation and dewatering plants work force requirements.

[c] Initial mobilization work force.

TABLE 1-12

PIPELINE SPREAD RESPONSIBILITIES: MARKET ALTERNATIVE

Pipeline Spread	Likely Spread Headquarters	Pipeline Segment[a]	Miles	Workers Required: Typical Spread[b]	Workers Required: Add for Rough Terrain
I	Gillette, WY Wright, WY Lusk, WY Scottsbluff, NB Ogallala, NB McCook, NB	Jacobs Ranch (PMB-0) to MB-12	390	670	78
II	Russell, KS Wichita, KS Bartlesville, OK	MB-12 to Pryor (MB-407.5)	396	670	78
III	Bartlesville, OK Fort Smith, AR Russellville, AR	Pryor to Atkins Junction (MB-407.5 to PMB-997.4)	162	610	78
IV	Gillette, WY	Jacobs Ranch to North Antelope (water)	16	260	-
		North Antelope to Jacobs Ranch (slurry)	16	390	-
		Jacobs Ranch to North Rawhide (water)	54	260	-
		North Rawhide to Jacobs Ranch (slurry)	54	390	-
		Jacobs Ranch to Well Field (water)	68	390	-
V	Russellville, AR	Atkins Junction to White Bluff (PMB-997.4 to PMB-1077.6)	80	550	65
	Batesville, AR	White Bluff to Alexandria Junction (PMB-1077.6 to PM 1315)	238	550	65
	Pine Bluff, AR	Atkins Junction to Independence (PMB(I)-0 to PMB(I)-93)	93	260	-
VI	Monroe, LA	Alexandria Junction to New Roads (PM(NW)-0 to PM(NW)-75.6)	76	390	-
	Alexandria, LA	New Roads to Wilton (PM(NW)-75.6 to PM(NW)-141.5)	66	260	-
	Lake Charles, LA	Alexandria Junction to Boyce (PM(B)-0 to PM(B)-24)	24	260	-
	Baton Rouge, LA	Alexandria Junction to Lake Charles (PM-1315 to PM-1404)	89	260	-
		New Roads to Baton Rouge (M-0 to M-24.4)	24	260	-

Notes: Spread I would proceed from south to north; spread IV would proceed as shown above; the remaining spreads would proceed from north to south.

[a] Explanation of milepost (MP) designations is included in Appendix A.

[b] Numbers represent maximum number of workers per pipeline segment.

TABLE 1-13

SUMMARY OF OPERATING PERSONNEL: MARKET ALTERNATIVE

Location	Total
Headquarters	41
Western District (Jacobs Ranch)	
Administration	4
Water Supply	11
Preparation plant	196
Pipeline	9
Maintenance Base	23
Subtotal	243
Central District (Pryor)	
Administration	3
Dewatering Plant	57
Pipeline	24
Maintenance Base	33
Subtotal	117
Eastern District (White Bluff)	
Administration	3
Dewatering Plants	73
Pipeline	18
Maintenance Base	47
Subtotal	141
Southern District (New Roads)	
Administration	3
Dewatering Plants	137
Pipeline	24
Maintenance Base	47
Subtotal	211
Total	753

the same as those discussed for the proposed action (Section 1.F.5.).

1.G.2 PROJECT COMPONENTS

The project components would be generally the same as those discussed for the proposed action in Section 1.F.2. Only the differences in siting, dimensions, construction techniques, and construction and operating work force are described below. Because construction, operation, and maintenance of the water supply system, dewatering plants, and ancillary facilities would be the same as those described for the proposed action, they are not discussed here.

Coal Slurry Preparation Plants

The capacities of the coal slurry preparation plants would be different from those described for the proposed action. The North Rawhide plant would have a capacity of 13.1 MMTA, the Jacobs Ranch plant would have a capacity of 14.3 MMTA, and the North Antelope plant would have a capacity of 10.0 MMTA. The schedules for capacity buildup and the expansion of delivery capability at the plants are shown in Figure 1-7.

Slurry Pipelines and Pump Stations

Construction of the 1621 miles of main slurry pipeline between Jacobs Ranch and Wilton would disturb approximately 19,647 acres. The pipeline would cross 30 rivers requiring special permits as listed in Appendix D-6. The principal communities likely to serve as pipeline spread construction headquarters are listed in Table 1-12.

Upon completion of construction, the pipeline right-of-way would be reclaimed as described in Appendix C-1. The affected right-of-way acreage would be returned to its preconstruction use wherever possible, except in the case of larger trees growing directly over the pipeline.

The slurry pipeline system would require 22 pump stations, of which 3 are included in the preparation plant acreage. Approximately 20 to 25 acres would be required for each of the remaining 19 slurry pump stations. The land use of this acreage would be changed for the life of the project.

1.H CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

1.H.1 GENERAL DESCRIPTION

The Cypress Bend pipeline-barge alternative is an ETSI system-design option rather than a decision-maker's alternative. It is analyzed in this EIS at ETSI's request. Under this alternative, coal slurry would be transported by pipe line along the market alternative route from Jacobs Ranch, Wyoming, to the White Bluff, Arkansas, delivery terminal (PMB-0 to PMB-1077.6, as shown on Appendix A maps). Coal deliveries would be made at the same terminals served by the market alternative along this part of the route (Oologah and Pryor, Oklahoma; Independence and White Bluff, Arkansas). From White Bluff a lateral pipeline, with one pump station, would be constructed eastward 81 miles to a barge loading facility on the Mississippi River at Cypress Bend, Arkansas. Coal would be transported by barge down the Mississippi River to the New Roads, Baton Rouge, and Wilton, Louisiana, delivery terminals. This route is shown on Map 1-1. Table 1-14 shows the coal delivery schedule for the terminals.

This alternative would include a barge loading facility in addition to coal slurry preparation plants, water supply system, coal slurry pipelines and pump stations, and dewatering plants. Maps showing the locations of all system components are provided in Appendix A.

During construction of this alternative, approximately 17,097 acres would be disturbed. Approximately 1 percent of this land is federally controlled. All of the approximately 16,179 right-of-way acres would be reclaimed as outlined in Appendix C-1. They would be returned to their preconstruction use wherever possible except in the case of large trees growing directly over the pipeline. Construction of the surface facilities would require approximately 918 acres, but only 818 acres would be utilized during the operational phase. The land

TABLE 1-14

PROPOSED COAL DELIVERY SCHEDULE:
CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

Delivery Terminal	As-Mined Coal (MMTA)				
	1985	1986	1987	1988	1989
Oologah, OK[a]	3.5	3.5	3.5	3.5	3.5
Pryor, OK[a]	2.65	5.3	5.3	5.3	5.3
Independence, AR[a]	5.0	5.0	5.0	5.0	5.0
White Bluff, AR[a]	5.0	5.0	5.0	5.0	5.0
New Roads, LA[b]	2.0	2.0	2.0	2.0	2.0
Baton Rouge, LA[b]	--	5.8	5.8	11.3	11.3
Wilton, LA[b]	--	--	2.5	2.5	5.0
Cypress Bend, AR[c]	0.3	0.3	0.3	0.3	0.3
Total	18.45	26.9	29.4	34.9	37.4

[a] Delivery by pipeline.

[b] Transportation by pipeline to Cypress Bend, then delivery by barge.

[c] To be used at dewatering plant.

use of the 818 acres required for the surface facilities during the operational phase would be changed for the life of the project.

The total construction and annual water requirements would be the same as those for the proposed action (Table 1-2). However, because of the differences in the pump station locations, the pump station water requirements would be slightly different, as shown in Table 1-15.

The construction schedule for this alternative is shown on Figures 1-8 and 1-9. Table 1-16 shows the construction work force required for the project. Table 1-17 lists the operating personnel requirements.

The interrelationships of the Cypress Bend pipeline-barge alternative with other planned projects would be the same as those for the proposed action (Section 1.F.5).

1.H.2 PROJECT COMPONENTS

The Cypress Bend pipeline-barge alternative would have the same components as the proposed action, with the addition of barge loading facilities, including a dewatering plant, at Cypress Bend. Planned or existing barge unloading facilities would be used, so they are not considered part of this alternative. The water supply system and ancillary facilities would be the same as those described for the proposed action in Section 1.F.2, so they are not discussed here. In general, the design, construction, operation, and maintenance of the preparation plants, slurry pipelines, and pump stations would also be the same as those described for the proposed action. However, specific capacities, dimensions, and similar details would be different. These are described below.

Coal Slurry Preparation Plants

For this alternative, the North Rawhide plant would process 18.9 MMTA, the Jacobs Ranch plant would process 8.5 MMTA, and the North Antelope plant would process 10.0 MMTA. The schedules for capacity buildup and the expansion of delivery capabilities of the plants are shown in Figure 1-9. Acreage requirements would be 110 for North Rawhide, 70 for Jacobs Ranch, and 65 for North Antelope.

Slurry Pipelines and Pump Stations

Construction of the 1202 miles of slurry pipeline between Jacobs Ranch and Cypress Bend would disturb approximately 14,568 acres. The pipeline would cross 35 rivers requiring special permits as listed in Appendix D-6. The principal communities likely to serve as pipeline spread construction headquarters are listed in Table 1-18.

Upon completion of construction, the pipeline right-of-way would be reclaimed as described in Appendix C-1. The affected right-of-way acreage would be returned to its preconstruction use wherever possible, except in the case of larger trees growing directly over the pipeline.

Approximately 20 to 25 acres would be required for each of the 12 slurry pump stations not located within a preparation plant boundary. The main water pump station (Niobrara well field) would require approximately 3 acres. The land use of this acreage would be changed for the life of the project.

Dewatering Plants

The dewatering plants for this alternative would be similar to those described for the proposed action, except for the plant at the Cypress Bend barge loading site. Since no power plant would be at this location, a coal-fired boiler would burn coal supplied by the pipeline at a rate of 300,000 tons per year (Table 1-14). A pit would be provided for disposal of the coal ash (Map 1-3). The residual water would be treated as necessary and discharged into the Mississippi River as described in Section 1.M.

Barge Loading Facility

The Cypress Bend loading facility would be sized to load 18.3 MMTA of coal for delivery to downstream customers. This facility, including the associated 18.3-MMTA dewatering plant described above, would occupy a 205-acre fenced plot.

TABLE 1-15

PUMP STATION WATER REQUIREMENTS:
CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

State	Local Wells Required	Total Water Requirements (acre-feet/year)
Wyoming	2	60
Nebraska	1	40
Kansas	3	120
Oklahoma	2	50

FIGURE 1-8

ASSUMED PIPELINE AND PUMP STATION CONSTRUCTION SCHEDULE:
CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

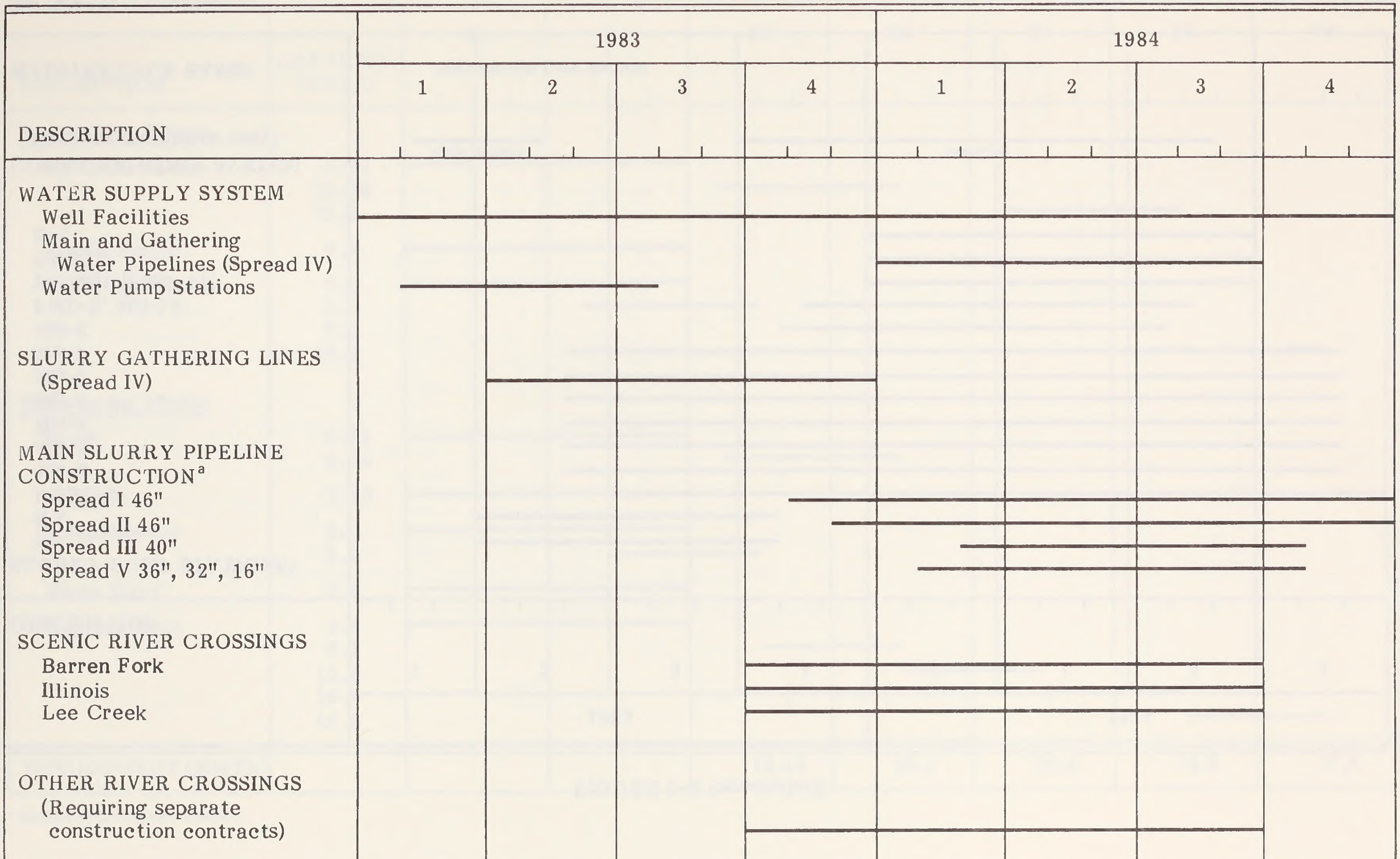
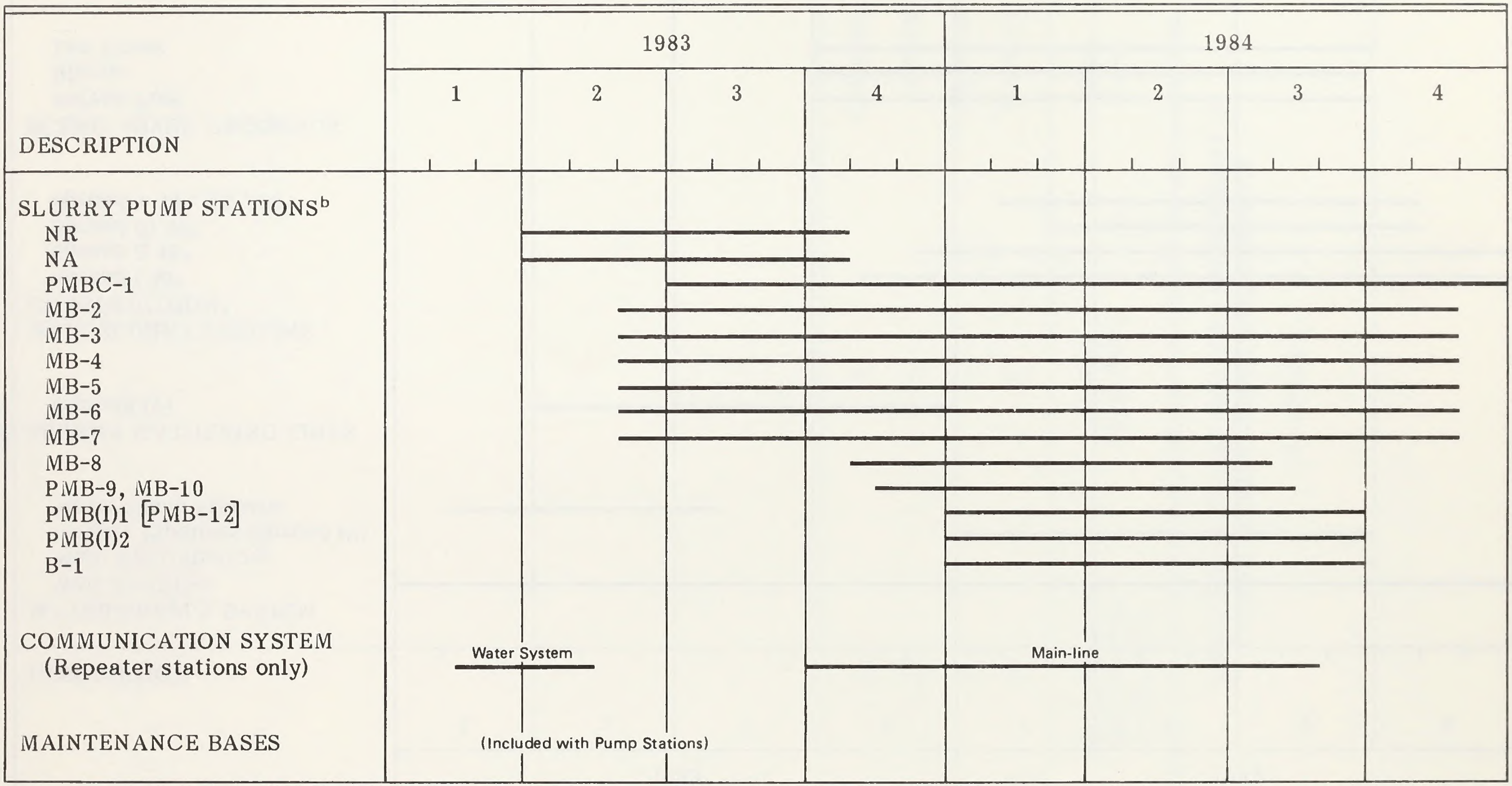


FIGURE 1-8 (concluded)

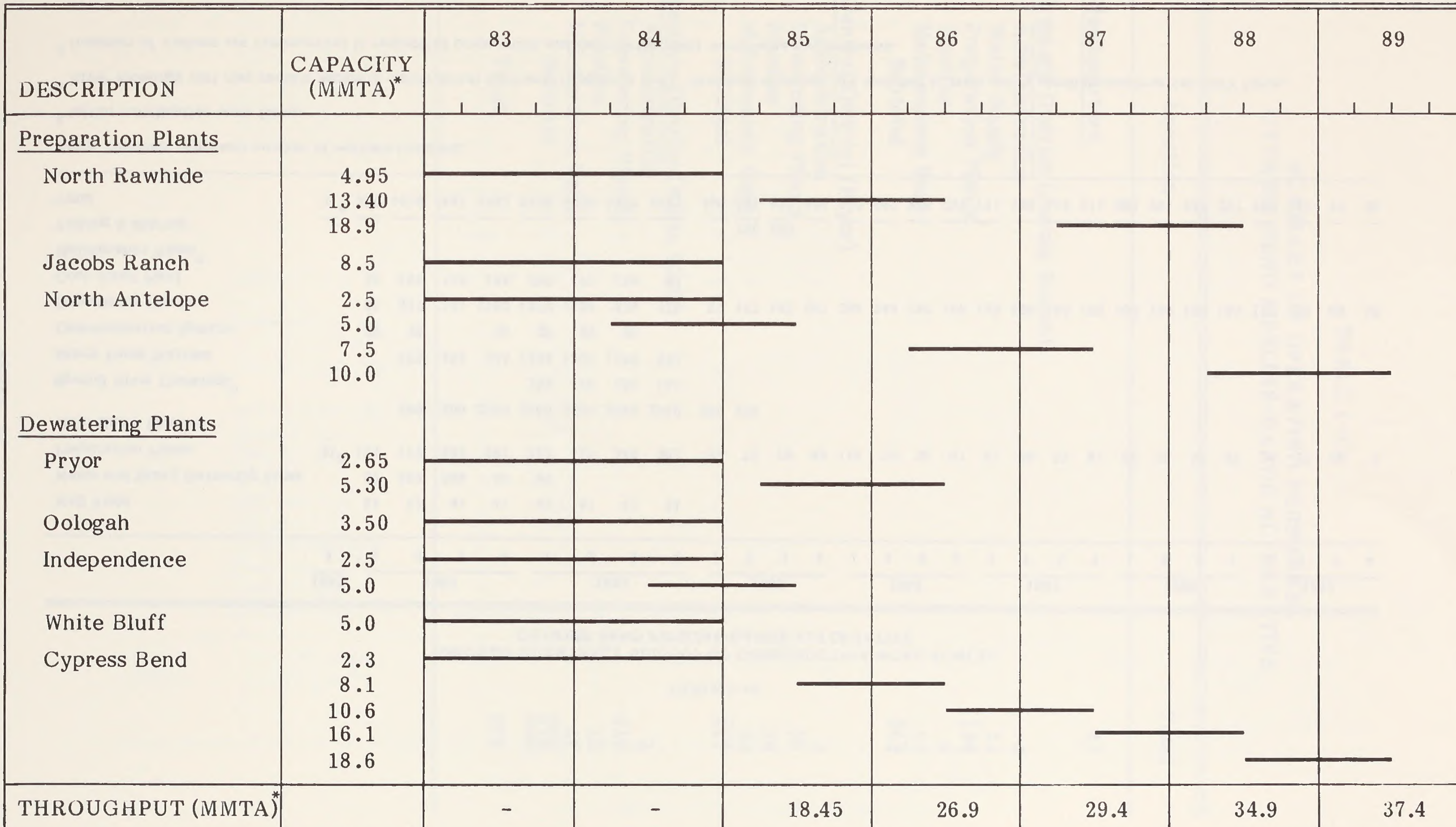


[a]See Table 1-18 for spread locations.

[b]See strip maps in Appendix A for description of symbols and locations of pump stations. There are only 15 different slurry pump station locations; pump station shown in brackets is at same location as first pump station listed in the row.

FIGURE 1-9

ASSUMED PREPARATION AND DEWATERING PLANTS CONSTRUCTION SCHEDULE: CYPRESS BEND PIPELINE-BARGE ALTERNATIVE



* Millions of (short) tons annually

TABLE 1-16

ASSUMED QUARTERLY BUILDUP OF CONSTRUCTION WORK FORCE:
CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

	1982	1983				1984				1985				1986				1987				1988				1989			
	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Well Field		41	41	41	41	41	41	41	41																				
Water and Slurry Gathering Lines		60	360	360	60	90																							
Preparation Plants	31[a]	124	172	209	291	343	419	348	304	94	70	76	68	116	58	59	67	61	36	52	81	91	65	59	67	56	25	18	5
Main Slurry Pipeline			100	500	2560	2560	2560	2560	2560	300	100																		
Special River Crossings[b]						150	150	150	150																				
Slurry Pump Stations			175	452	644	1234	1300	1109	624																				
Communication System		20	20		20	20	20	20																					
Dewatering Plants		95	417	731	1102	1272	1108	839	376	92	157	197	267	266	244	190	160	110	150	190	190	190	190	190	160	110	90	60	30
Coal-Fired Plant		50	125	150	175	200	170	150	25																				
Maintenance Bases[c]																													
Testing & Startup											260	260																	
Total	31[a]	390	1410	2443	4893	5910	6028	5477	4085	486	587	533	335	382	302	249	227	171	186	242	271	281	255	249	227	166	115	78	35

Note: Numbers represent number of workers required.

[a] Initial mobilization work force.

[b] River crossings that may require separate construction contracts (Appendix D-6). Standard crossings are included in main slurry pipeline construction work force.

[c] Numbers of workers are incorporated in respective preparation and dewatering plant work force requirements.

TABLE 1-17

SUMMARY OF OPERATING PERSONNEL
CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

Location	Total
Headquarters	41
Western District (Jacobs Ranch)	
Administration	4
Water Supply	11
Preparation Plants	196
Pipeline	9
Maintenance Base	23
Subtotal	243
Central District (Pryor)	
Administration	3
Dewatering Plants	57
Pipeline	24
Maintenance Base	33
Subtotal	117
Eastern District (White Bluff)	
Administration	3
Dewatering Plants	210
Pipeline	18
Maintenance Base	47
Subtotal	278
Total	679

TABLE 1-18

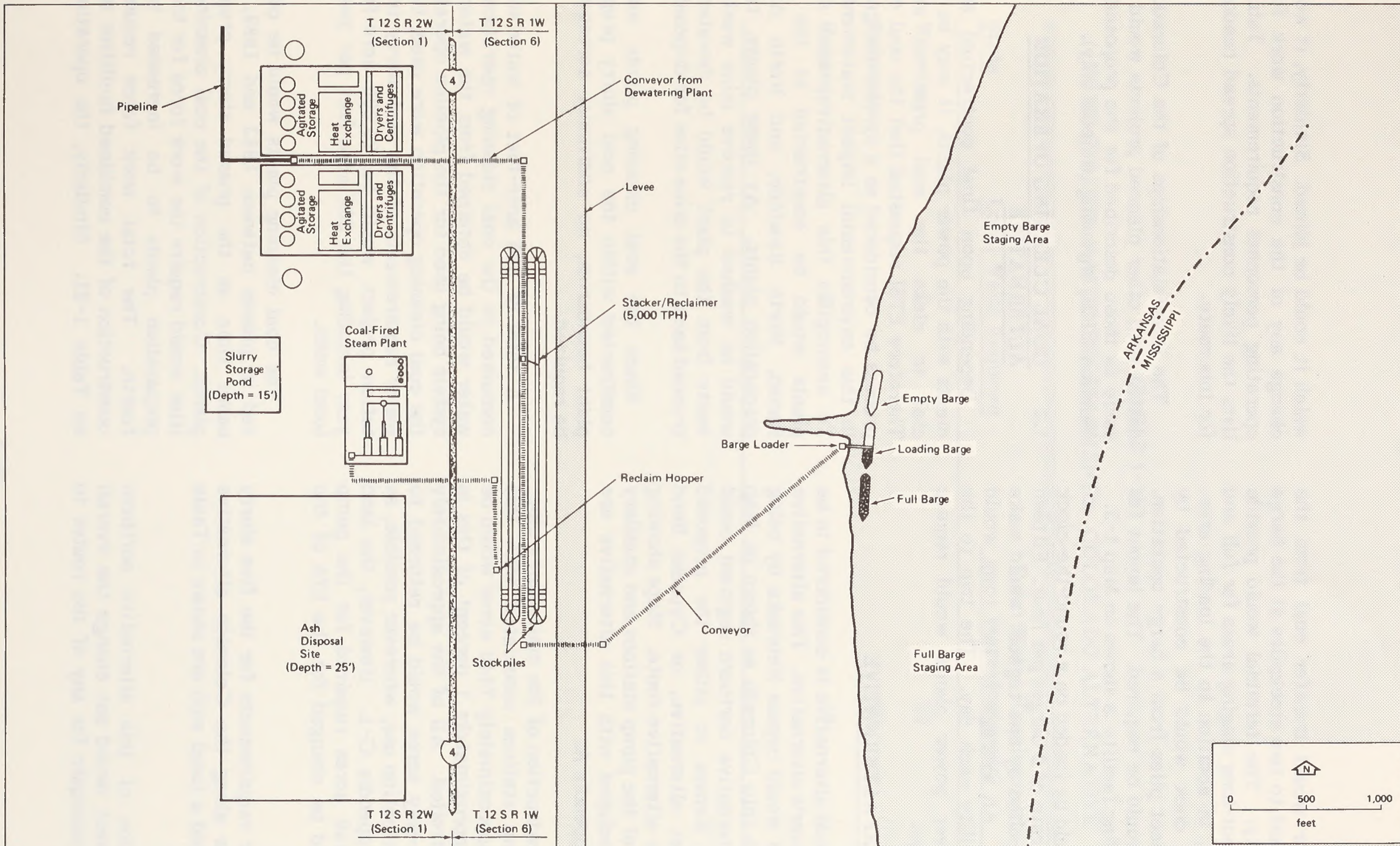
PIPELINE SPREAD RESPONSIBILITIES:
CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

Pipeline Spread	Likely Spread Headquarters	Pipeline Segment[a]	Miles	Workers Required: Typical Spread[b]	Workers Required: Add for Rough Terrain
I	Gillette, WY Wright, WY Lusk, WY Scottsbluff, NB Ogallala, NB McCook, NB	Jacobs Ranch (PMB-0) to MB-12	390	670	78
II	Russell, KS Wichita, KS Bartlesville, OK	MB-12 to Pryor (MB-407.5)	396	670	78
III	Bartlesville, OK Fort Smith, AR Russellville, AR	Pryor to Atkins Junction (MB-407.5 to PMB-997.4)	162	610	78
IV	Gillette, WY	Jacobs Ranch to North Antelope (water)	16	260	-
		North Antelope to Jacobs Ranch (slurry)	16	390	-
		Jacobs Ranch to North Rawhide (water)	55	260	-
		North Rawhide to Jacobs Ranch (slurry)	55	390	-
		Jacobs Ranch to Well Field (water)	68	390	-
V	Russellville, AR Batesville, AR Pine Bluff, AR Dumas, AR	Atkins Junction to White Bluff (PMB-997.4 to PMB-1077.6)	80	550	65
		White Bluff to Cypress Bend (PMB-1077.6 to B-80.6)	81	550	65
		Atkins Junction to Independence (PMB(I)-0 to PMB(I)-93)	93	260	-

Notes: Spread I would proceed from south to north; spread IV would proceed as shown above; all remaining spreads would proceed from north to south.

[a] Explanation of milepost (MP) designations is included in Appendix A.

[b] Numbers represent maximum number of workers per pipeline segment.



Map 1-3. BARGE FACILITY

A conveyor would transfer coal from the dewatering plant to two stockpiles at the barge loading facility. The terminal would provide for two 100-foot-long staging areas for full and empty barges, in addition to the loading area. The terminal dock would be constructed by driving the sheet piles from a barge operation. No dredging would be required. The layout for the barge loading facility is shown on Map 1-3.

Barges would be loaded on a round-the-clock schedule at a rate of 2 barges per hour. Fifteen to 20 barges pulled by one tugboat would make up each tow. An average of two tows would leave the facility each day. The trip to the three downriver power plants would require about four days.

1.I COLORADO ALTERNATIVE

The Colorado alternative is considered to be a decision-maker's alternative. This alternative pipeline route would bypass Nebraska by being directed south into Colorado as shown on Map 1-1. This alternative northern segment could be joined in Kansas to either the proposed action, market alternative, or Cypress Bend pipeline-barge alternative route. Maps showing the locations of the pump stations and ancillary facilities associated with this alternative are provided in Appendix A.

During construction of the main slurry pipeline and pump stations associated with this alternative, approximately 7446 acres would be disturbed. Approximately 1 percent of this is federally controlled. All of the approximately 7296 right-of-way acres would be returned to their preconstruction use, wherever possible, as outlined in Appendix C-1. However, the land use of the 150 acres required for the pump stations would be changed for the life of the project.

The water requirements for the five slurry pump stations along the Colorado alternative route that need a local well are shown in Table 1-19.

Construction of this alternative northern pipeline segment would not change the overall construction schedule for any of the routes to which it could be joined. Similarly, it would not change any of the construction work force or operating personnel requirements. Table 1-20 lists the likely construction spread headquarters for this route.

The interrelationships of the Colorado alternative with other planned projects would be the same as those described for the proposed action (Section 1.F.5, Wyoming projects only).

1.J COAL CLEANING OPERATION ALTERNATIVE

Depending upon final contractual arrangements with the power plants, it may be beneficial to clean the coal prior to shipping. Therefore ETSI requested that the coal cleaning process be considered as a system-design option in this environmental impact statement (EIS). To accomplish this alternative, coal cleaning plants would be constructed at the Jacobs Ranch, North Rawhide, and North Antelope preparation plants. At these plants, the coal would be washed to remove mine waste. All waste from the plant would be dewatered and trucked back to the mine sites for disposal.

Since the coal cleaning plants would be constructed within the coal slurry preparation plant boundaries, no additional acreage would be required.

A total of 300 acre-feet of water would be consumed in the coal cleaning operation. This water would be obtained from the water supply system being used for the pipeline operation. If the coal cleaning operation were used, the total water requirements of the coal slurry transportation project would be 20,800 acre-feet per year including the 300 acre-feet per year from local wells.

The coal cleaning plants would be constructed in phases between 1983 and 1989, at the same time as the phased slurry preparation plants. Construction of the coal cleaning facilities would require the work force for the slurry preparation plants to be increased by one-fourth. The total work force required for construction of the combined facilities is shown on Table 1-21. Similarly, the operating staff

TABLE 1-19

PUMP STATION WATER REQUIREMENTS: COLORADO ALTERNATIVE

State	Local Wells Required	Total Water Requirements (acre-feet/year)
Wyoming	2	60
Colorado	2	90
Kansas	1	70

TABLE 1-20

LIKELY PIPELINE CONSTRUCTION SPREAD HEADQUARTERS: COLORADO ALTERNATIVE

Community	County	State
Gillette	Campbell	Wyoming
Wright	Campbell	Wyoming
Lusk	Niobrara	Wyoming
Cheyenne	Laramie	Wyoming
Sterling	Logan	Colorado
Colby	Thomas	Kansas
Hays	Ellis	Kansas
Wichita	Sedgwick	Kansas

TABLE 1-21

QUARTERLY BUILDUP OF CONSTRUCTION WORK FORCE: COAL CLEANING OPERATION ALTERNATIVE

Year and Quarter	Workers	Year and Quarter	Workers
1982		1986	
4	43	1	101
		2	134
		3	114
		4	115
1983		1987	
1	161	1	116
2	236	2	76
3	324	3	73
4	428	4	41
1984		1988	
1	503	1	25
2	550	2	33
3	298	3	26
4	253	4	61
1985		1989	
1	83	1	70
2	104	2	31
3	119	3	23
4	71	4	6

for the combined facilities would be one-fourth more than for the preparation plants alone. Thus the total number of personnel required would be 245.

The interrelationships of the coal cleaning alternative with other planned projects would be the same as those described for the proposed action (Section 1.F.5, Wyoming projects only).

1.K CROOK COUNTY ALTERNATIVE WATER SUPPLY SYSTEM

The Crook County alternative water supply system is considered to be a decision-maker's option. It is an alternative to the Niobrara County well field, the primary water source for the proposed action. Implementation of this alternative would require ETSI to obtain new well permits from the Wyoming State Engineer. Under this alternative, the main water source for the coal slurry transportation project would be a well field drilled into the Madison Formation northeast of Gillette in Crook County, Wyoming, as shown on Map 1-4. This water supply system would require a total of approximately 770 acres during construction and 15 acres during operation.

Most aspects of the Crook County water supply system would be the same as those described for the Niobrara County well field in Section 1.F.2 under Water Supply System. The construction schedule and construction and operating procedures would be the same as outlined in that section. Due to increased flow volumes in wells at this site, only about 24 wells would be required; hence, only about half as many construction and operation personnel would be required compared with the proposed action well field.

Because of the more northerly location of the well field, the distribution system for the well-field water would be different from that described for the Niobrara County well field. The well-field pump station would pump water through 47 miles of buried, 26-inch O.D. main water pipeline to a distribution head tank at the North Rawhide preparation plant. The tank would supply the preparation plant at North Rawhide and the water pipeline to the Jacobs Ranch distribution head tank. This tank similarly would supply the Jacobs Ranch preparation plant and the water pipeline to North Antelope. Should this alternative water system be constructed, the Gillette reserve water supply would be used, if needed, as described for the proposed action in Section 1.F.2, Water Supply System.

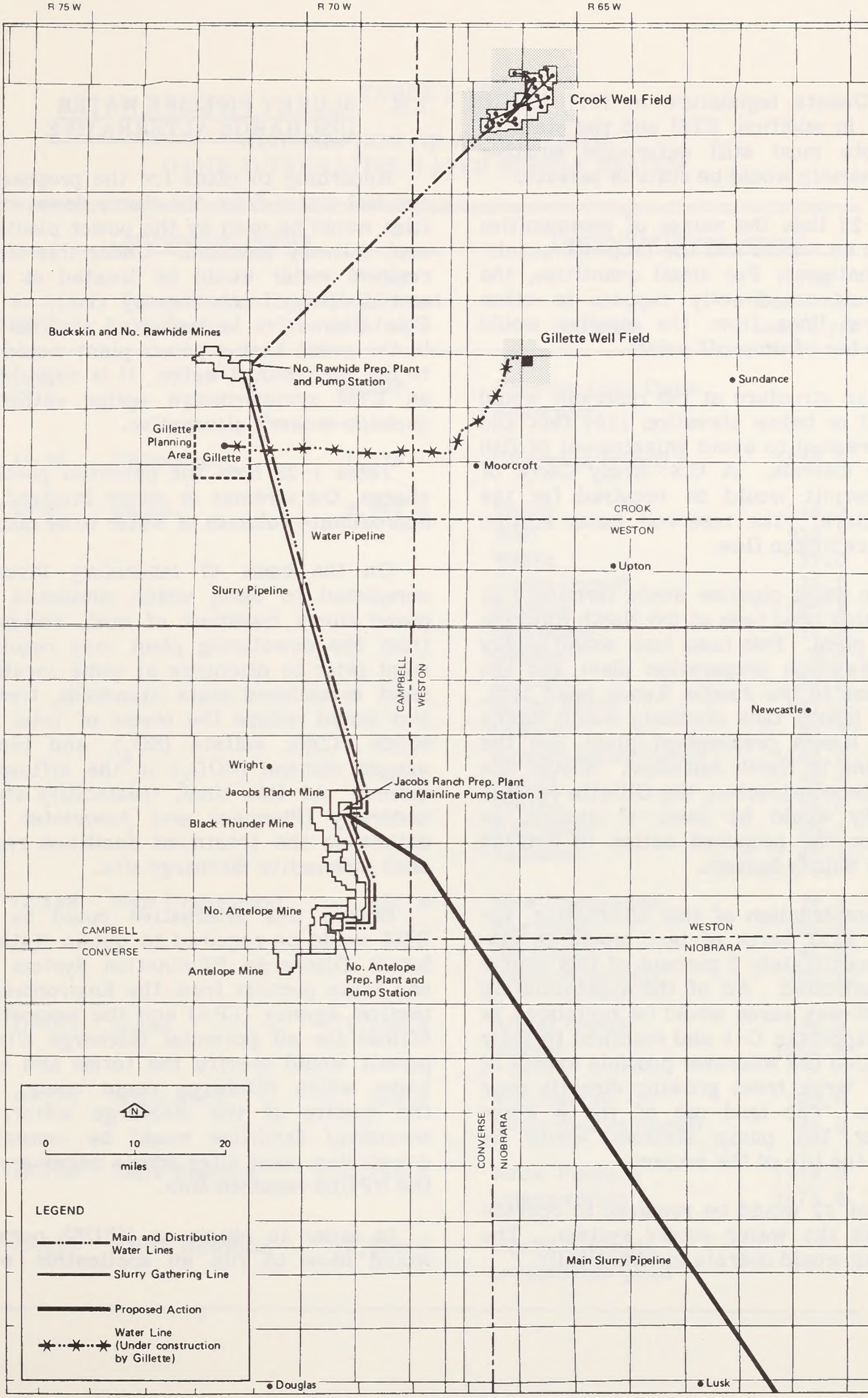
The interrelationships of the Crook County alternative water supply system would be the same as those described for the proposed action (Section 1.F.5, Wyoming projects only).

1.L OAHE ALTERNATIVE WATER SUPPLY SYSTEM

The Oahe alternative water supply system is considered to be a decision--maker's option. It is an alternative to the Niobrara County well field, the primary water source of the proposed action. Under this alternative, the Oahe Reservoir on the Missouri River near Pierre, South Dakota, would be the major water source for the coal slurry transportation project. Implementation of this alternative would require ETSI to obtain a water right from the State of South Dakota.

To develop this alternative it would be necessary to construct a 276-mile pipeline, with eight pump stations, across western South Dakota into Wyoming (Appendix A, Maps A-55 through A-59). The system would be designed for a throughput of 30,200 acre-feet per year, of which 10,000 acre-feet per year would be for designated urban and rural areas in South Dakota, generally along the pipeline route, and 20,200 acre-feet per year would be for ETSI's use.

It is a requirement of the South Dakota Department of Water and Natural Resources that before it recommends a water right for ETSI for 20,200 acre-feet per year, approximately 10,000 acre-feet must be designated to the communities in western South Dakota. The water right must be granted by the state's Board of Water Management; and because the amount exceeds 10,000 acre-feet per year, it would be necessary to secure legislative approval for export as a result of an act passed by



Map 1-4. CROOK COUNTY ALTERNATIVE WATER SUPPLY SYSTEM

the South Dakota legislature in 1977 (SDCL 46-5-20.1). In addition, ETSI and the state of South Dakota must still determine whether pipeline ownership would be state or private.

Table 1-22 lists the names of communities and areas to be served and the drop-off quantities and locations. For small quantities, the pipeline would be directly tapped; in other cases, lateral lines from the pipeline would supply a number of drop-off points.

The intake structure at the reservoir would be placed at or below elevation 1540 feet and would be screened to avoid entrainment of fish and aquatic animals. A U.S. Army Corps of Engineers permit would be required for the intake structure. The reservoir pump station would monitor intake flow.

The main water pipeline would terminate at the distribution head tank at the North Rawhide preparation plant. This head tank would supply the North Rawhide preparation plant and the water pipeline to the Jacobs Ranch head tank. The Jacobs Ranch tank similarly would supply the Jacobs Ranch preparation plant and the water pipeline to North Antelope. Should this alternative be constructed, the Gillette reserve water supply would be used, if needed, as described for the proposed action in Section 1.F.2, Water Supply System.

During construction of this alternative, approximately 3353 acres of land would be disturbed. Approximately 2 percent of this land is federally controlled. All of the approximately 3345 right-of-way acres would be reclaimed as outlined in Appendix C-1 and returned to their preconstruction use wherever possible except in the case of large trees growing directly over the pipeline. The land use of the 8 acres required for the pump stations would be changed for the life of the project.

A staff of 12 would be required to operate and maintain the water supply system. The pump stations would operate automatically.

1.M SLURRY PIPELINE WATER DISCHARGE ALTERNATIVE

According to plans for the proposed action, residual water from the slurry dewatering facilities would be used by the power plants at each coal delivery terminal. Under this alternative, residual water would be treated as necessary and discharged into nearby rivers or streams. This alternative is evaluated at ETSI's request in the event that a power plant would not wish to use the residual water. It is considered to be an ETSI system-design option rather than a decision-maker's alternative.

Table 1-23 lists the potential points of discharge, the streams or rivers involved, and the approximate volumes of water to be discharged.

On the basis of laboratory investigations completed to date, which simulated the proposed slurry transport of coal, residual water from the dewatering plant may require treatment prior to discharge at some locations. To meet established state standards, these facilities would reduce the levels of total dissolved solids (TDS), sulfate (SO_4), and biochemical oxygen demand (BOD_5) in the effluent as required. At this time, treatability studies are underway (Plummer and Associates 1980) to determine the treatment facilities required at each alternative discharge site.

Before this alternative could be adopted, ETSI would be required to obtain National Pollutant Discharge Elimination System (NPDES) and State permits from the Environmental Protection Agency (EPA) and the respective state offices for all potential discharge sites. This permit would specify the terms and conditions under which discharge could occur, including the quality of the discharge water. Water treatment facilities would be constructed at dewatering plant sites where necessary to meet the NPDES requirements.

In order to obtain an NPDES permit, ETSI would have to file an application with EPA

TABLE 1-22

DISTRIBUTION OF WATER FROM
OAHE ALTERNATIVE WATER SUPPLY SYSTEM

Distribution Points			Towns/Facilities Served	
Milepost	Pump Station Location	Water Distributed (ac-ft/yr)	Location	Water Delivered (ac-ft/yr)
O-0		30,200	Receive from Oahe Reservoir	
O-20	Cheyenne	1,378	Cheyenne (rural)	1378.0
O-96	Philip	2,247.2	Philip	134.0
			Wall	239.9
			Wasta	22.0
			Cedar (rural)	35.0
			Kadoka	135.8
			Belvedere	11.0
			Okaton	6.0
			Murdo	66.3
			White River	157.0
			Draper	20.3
			Lyman-Jones (rural)	1153.0
			Vivian	29.2
			Presho	116.0
			Kennebec	80.5
			Reliance	41.2
O-138	New Underwood	452.8	New Underwood	21.8
			Box Elder	280.0
			Hermosa	45.0
			Hermosa (rural)	106.0
O-163	Alkali	1,226.0	Alkali (rural)	22.0
			Sturgis	1204.0
O-174	Whitewood	303.0	Whitewood	269.0
			Butte-Meade (rural)	34.0
O-196	Belle Fourche	4,393.0	Belle Fourche	1518.0
			Unaccounted	2875.0
O-287	North Rawhide	20,200.0	North Rawhide preparation plant	

TABLE 1-23

ALTERNATIVE DISCHARGE OF DEWATERING PLANT EFFLUENT INTO LOCAL RECEIVING WATERS

Site	Receiving Water	Discharge Quantity[a] Maximum gpm	Acre-Feet per Year
Ponca City, OK[b]	Arkansas River, 29 miles downstream of Ponca City	2190	3540
Oologah, OK[c,d]	Verdigris River, 1 mile downstream of Oologah Dam	1125	1820
Pryor, OK[b,c,d]	Neosho River (Grand River), 40 miles upstream of confluence with Arkansas River	1760	2845
Muskogee, OK[b]	Arkansas River, 4 miles downstream of confluence with Neosho River (Grand River)	1645	2660
Independence, AR[b,c,d]	White River, between mouth and Lock & Dam 3, 20 miles downstream from Lock 4, Dam 1 at Batesville	1660	2685
White Bluff, AR[b,c,d]	Arkansas River, 25 miles downstream of Little Rock, between Lock & Dam 5 & 6	1660	2685
New Roads, LA[b,c]	Mississippi River, 35 miles upstream of Baton Rouge	660	1065
Baton Rouge, LA[c]	Mississippi River, Baton Rouge	1660	2685
Wilton, LA[b,c]	Mississippi River, 13 miles downstream of Donaldsonville	1660	2685
Boyce, LA[b,c]	Red River, 3 miles upstream of Boyce	580	940
Lake Charles, LA[b,c]	Calcasieu River, Lake Charles	1330	2150
Cypress Bend, AR[d]	Mississippi River, upstream from Arkansas City	6175	10,000

Note: Revised discharge volumes received too late for inclusion in the DEIS are provided in the Project Description Technical Report (WCC 1980a). These changes do not substantially change any of the conclusions presented here.

[a] Depending on the final market configuration, the total discharge from all sites would not exceed 12,450 gallons per minute (gpm), or about 20,000 acre-feet per year, representing a 37.4-MMTA system.

[b] Potential proposed action site.

[c] Potential market alternative site.

[d] Potential Cypress Bend pipeline-barge alternative site.

Region 6, Dallas, Texas. EPA staff would review the application and make a tentative decision to issue or deny the permit. Should the decision be to issue, a draft permit would be prepared by EPA, with the assistance of the appropriate state water division office for public review and comment. Following a well-publicized public review period, usually 30 days, EPA would make a final decision to issue or deny the permit on the basis of public comments received. EPA has the option to hold public hearings on the permit application during the public review period.

1.N NO-ACTION ALTERNATIVE

The proposed coal slurry transportation project represents a new method of transporting Wyoming coal to power plants in Oklahoma, Arkansas, and Louisiana. No-action alternatives are options available if neither the proposed action nor any of its alternatives are approved. In this case, the 37.4 million tons annually (MMTA) of coal would be transported by either an all-railroad transportation system or a railroad-barge transportation system. The information presented here is summarized from the more detailed No-Action Technical Report (WCC 1980i).

1.N.1 ALL-RAIL ALTERNATIVE

The all-rail alternative would involve transportation of 37.4 MMTA of coal to the proposed action markets shown on Map 1-1. Coal would leave the Wyoming mines and be carried south over track owned jointly by Burlington Northern (BN) and Chicago and North Western (C&NW) to Shawnee Junction, Wyoming. From there the traffic would move over the BN system to Kansas City, Missouri, where it would be transferred to a connecting railroad: Missouri-Pacific; Kansas City Southern; Atchison, Topeka, and Santa Fe; or Missouri-Kansas-Texas.

The coal would be transported in unit trains. The typical coal unit train would be made up of 100 to 110 cars, each carrying 100 tons of coal, plus three to five locomotives, depending on the grades and curves of the track. The unit train would operate continuously between the mine and the generating plant, with intermediate stops only for servicing or crew changes but not for delivery or receipt of other freight. Table 1-24 shows the all-railroad system buildup for the proposed action markets.

Acreage Requirements and Land Status

At present, there is rail access to each coal mine and also to each of the power plants. All track between these points, except for the interchange in Kansas City, has been designated as mainline track (category A or B) by the Federal Railroad Administration (U.S. Department of Transportation 1977). No additional acreage would be required for new rail routes, and the railroads have all the rights-of-way necessary for any upgrading of track capacity.

General Construction and Operation Procedures

Operation of unit trains depends upon equipment specifications and operating parameters. Equipment specifications include the number of trains and the number, size, and type of cars and locomotives in each train. The operating parameters are cycle time, crew changes, fueling needs, and maintenance needs. All of these are established from the fuel-use analysis, which considers total amount of coal to be hauled; amount per day; contract period; mine location; mine loading facilities; power plant location; and power plant unloading, material handling, and storage facilities.

On the basis of the above considerations, the railroads involved have provided their equipment specifications and operating assumptions. These are summarized in Table 1-25, which shows for each mine-market combination the originating railroad, delivering railroad, distance, cycle time, and number of trains. The tonnages that would be carried over various portions of the route and the associated number of trains per day are shown in Table 1-26.

Time Frame

According to railroad construction plans, all new track, additions of siding, and new control systems necessary to carry the additional 37.4 MMTA will be in place prior to the proposed start of pipeline delivery in 1985 (Boyce 1979). The most critical link in the route is the segment of new track in Wyoming that connects

TABLE 1-24

PROPOSED SYSTEM BUILDUP SCHEDULE,
RAILROAD ROUTES FOR PROPOSED ACTION MARKETS

Delivery Terminal	As-Mined Coal (MMTA)												
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Ponca City, OK	—	—	1.6	3.3	3.3	3.3	3.3	3.3	3.3	4.9	6.6	6.6	6.6
Pryor, OK	—	—	—	—	1.5	1.5	1.5	1.5	1.5	3.0	3.0	3.0	3.0
Muskogee, OK	1.6	3.3	3.3	3.3	3.3	3.3	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Independence, AR	—	—	—	—	—	—	2.5	2.5	5.0	5.0	5.0	5.0	5.0
White Bluff, AR	—	—	—	2.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Boyce, LA	—	—	—	—	—	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Lake Charles, LA	—	—	—	—	—	2.0	2.0	2.0	4.0	4.0	4.0	4.0	4.0
New Roads, LA	—	—	—	—	—	—	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Wilton, LA	—	—	—	—	—	—	—	—	—	—	2.5	2.5	5.0
Total	1.6	3.3	4.9	9.1	13.1	16.9	23.1	23.1	27.6	30.7	34.9	34.9	37.4

TABLE 1-25

OPERATING PARAMETERS FOR RAILROAD DELIVERY TO MARKETS OF PROPOSED ACTION

Market	Receiving Railroad	Delivering Railroad	Round Trip Distance (miles)	Cycle Time (hours)	Number of Trains[a]
Pryor, OK	BN	MKT	2076	122.25	4
Ponca City, OK	BN	AT&SF	2200	124.45	5
Muskogee, OK	BN	MP	2242	133.25	4
Redfield, AR	BN	MP	2742	158.25	3
Newport, AR	BN	MP	2433	151.45	4
Boyce, LA	BN	MP	3303	187.45	3
Lake Charles, LA	BN	KCS	3148	200.75	9
New Roads, LA	BN	MP	3448	237.75	2
Wilton, LA	BN	KCS	3273	217.95	11
				Total	45

Sources: Burlington Northern 1980; Kansas City Southern 1980; Missouri-Kansas-Texas Railroad Co. 1980; Missouri-Pacific Railroad Co. 1980.

BN = Burlington Northern
MKT = Missouri-Kansas-Texas
AT&SF = Atchison, Topeka, and Santa Fe
MP = Missouri-Pacific
KCS = Kansas City Southern

[a] Estimate includes loaded and empty trains.

TABLE 1-26

TONNAGE AND NUMBER OF TRAINS, BY ROUTE SEGMENT, FOR THE NO-ACTION ALL-RAILROAD ALTERNATIVE (37.4 MMTA)

Route Segment	Annual Tonnage	Approximate Number of Trains Daily[a]
Wyoming Mines to Kansas City	37.4	20
Kansas City to Ponca City	6.6	4
Kansas City to Independence	5.0	3
Kansas City to Pryor	3.0	2
Kansas City to Muskogee	13.8	8
Muskogee to Redfield	8.8	5
Redfield to Alexandria	3.8	2
Alexandria to Boyce	1.8	1
Alexandria to New Roads	2.0	1
Kansas City to Shreveport	9.0	5
Shreveport to Lake Charles	4.0	2
Shreveport to Wilton	5.0	3

[a] Approximate number of daily trains needed to carry 37.4 MMTA of coal is estimated using a factor of 1.848 tons per year per train per day. Estimate includes loaded and empty trains.

Donkey Creek and Orin, which was completed in 1979. The track runs through Campbell and Converse counties in the southern Powder River Basin and provides the only rail access to the six mines.

Work Force

Estimates of the work force required to operate the no-action railroad system of delivery to the proposed action markets are presented in Table 1-27.

Project Components

Project components include the unit train, track, and signal systems, as well as in-place facilities such as maintenance yards and offices for centralized traffic control. Figure 1-10 is an overview of a unit coal train transportation system.

Unit trains of 100 to 110 hopper cars, each carrying 100 tons of coal, would transport the coal from the mines to the power plants. The trains would be moved by special high-horsepower locomotives. Depending on capacity requirements, portions of the track will be 136-lb/yd continuous welded rail, the heaviest in use on railroads today. In addition, portions of the route will be double-tracked, which permits operation of trains in both directions at the same time. Major maintenance facilities already exist in Alliance, Nebraska, and Kansas City, Missouri.

Interrelationship of All-Rail Alternative with Other Planned Projects

The most important planned project affecting the all-rail no-action alternative is the C&NW Coal Line Project. This project is presently before the Interstate Commerce Commission for various approvals, and an application for guaranteed loans is pending before the Federal Railroad Administration. Completion of this project would provide an alternative means of moving coal by rail out of the Powder River Basin to Kansas City and other interchange points for delivery to connecting railroads (Nesbitt 1980).

The project, shown on Map 1-5, has four components: construction of a line jointly owned by BN and C&NW; rehabilitation of an existing line; construction of a new connecting line; and construction of various maintenance and operating facilities. Under this routing, coal would be moved from the mines to Shawnee, Wyoming, over the joint line. From there it would move east over the 45-mile rehabilitated line to Crandall, Wyoming, and then south via the proposed 56-mile connector line to Joyce Station, Nebraska, for interchange with Union Pacific (UP) at South Morrill, Nebraska. Union Pacific would then carry the coal to Kansas City, Missouri; Council Bluffs, Iowa; or other interchange points for delivery to the connecting railroads that would carry the coal to the power plant sites. The operation of the coal unit trains would be as described earlier, except for the differences between the BN and C&NW-UP routes (Nesbitt 1980).

Depending on the timing of government approvals and financial arrangements, construction could begin in the spring of 1981, and the C&NW-UP line could be operational by the fall of 1982. If the project is implemented, C&NW estimates that by 1991 it would be transporting 40.3 MMTA over this line for delivery to utilities located in the north-central states, the south-central states, Texas, and possibly Florida. Completion of this project would provide an alternative and competitive means of moving coal by rail out of the Powder River Basin to Kansas City and other interchange points for delivery to connecting railroads (Nesbitt 1980). Because the project's future is still uncertain and subject to funding approval, it is not included in the analysis of impacts.

1.N.2 RAIL-BARGE ALTERNATIVE

General Description and Location

Delivery of coal to the markets of the barge alternative would be accomplished by a combination of rail and barge transport. The route for this movement of coal appears on Map 1-1. Coal would leave the Wyoming mines and be carried south over the jointly owned BN-C&NW track to Shawnee Junction, Wyoming. From there the full 37.4 MMTA would be moved to Lincoln, Nebraska. At that point coal destined for rail delivery would be handled as described for the all-rail alternative above. Coal that was destined for barge delivery would travel

TABLE 1-27

OPERATIONS PERSONNEL ESTIMATES:
NO-ACTION ALL-RAILROAD ALTERNATIVE

Destination	Railroad	Number of Crews[a]	Inspections: 500-mi Brake[a]	Inspections: Pull-by[a]	Number of Trains[a]	Tons	Total Personnel: Crew[b]	Total Personnel: Brake Inspec.[c]	Total Personnel: Pull-by Inspec.[d]	Total Personnel: Operations[e]
Kansas City	BN	12	3	2	8	37.4	48	12	2	398
Boyce	MP	14	3	16	3	1.8	56	12	16	188
Newport	MP	6	1	11	4	5.0	24	4	11	100
New Roads	MP	15	4	16	2	2.0	60	16	16	169
Muskogee	MP	5	0	4	1	5.0	20	0	4	24
Redfield	MP	16	2	8	3	5.0	64	8	8	233
Lake Charles	KCS	14	3	4	9	4.0	56	12	4	492
Wilton	KCS	15	4	4	11	5.0	60	16	4	699
Ponca City	ATSF	5	2		5	6.6	20	8		98
Pryor	MKT	4	1	1	4	3.0	16	4	1	69
										2470

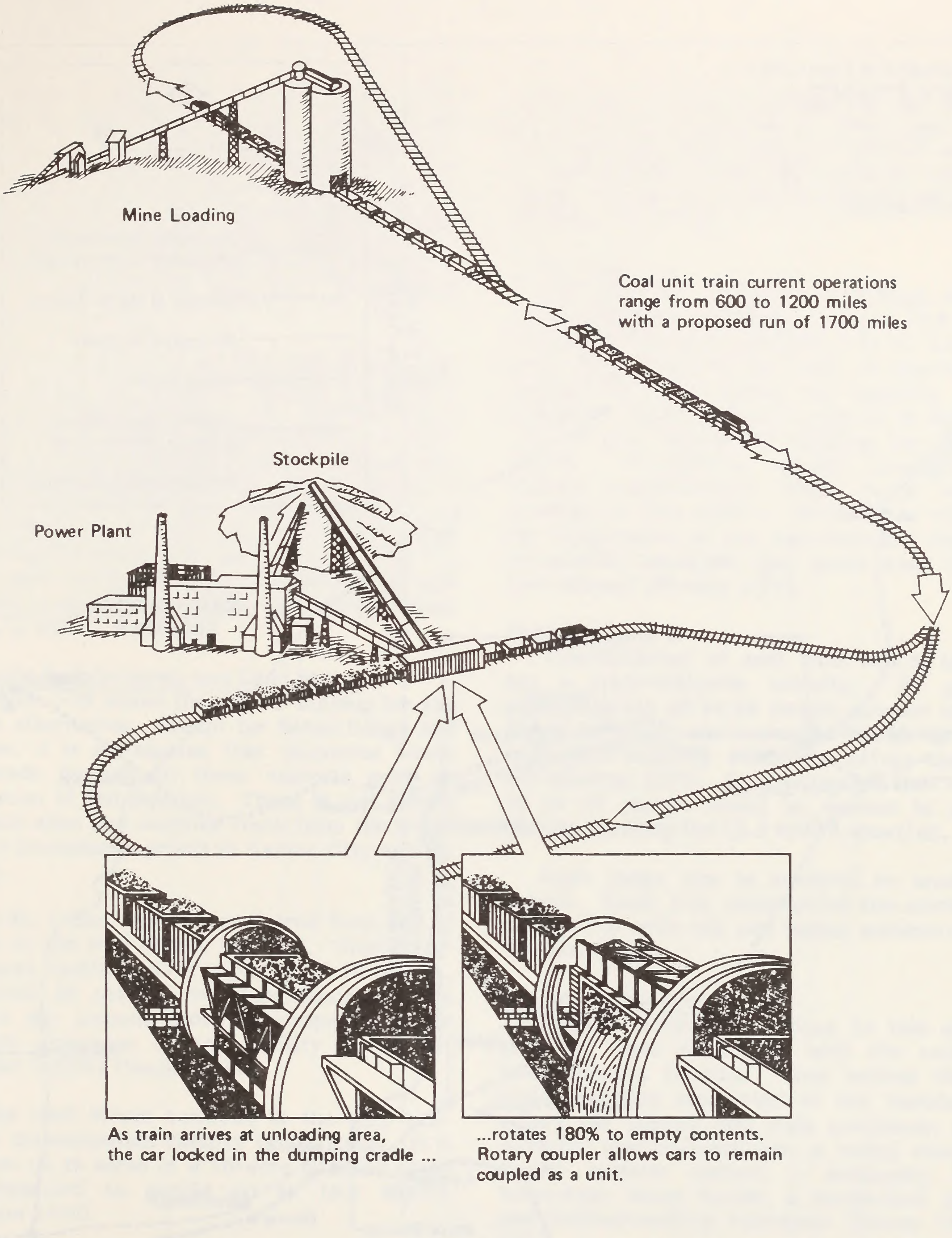
[a] Information supplied by involved railroads. Estimate includes loaded and empty trains.

[b] Each crew has 4 people.

[c] Each brake inspection averages 4 people.

[d] Each pull-by inspection averages 1 person.

[e] Total operations personnel = total crew x (number of trains) + brake inspection personnel + pull-by inspection personnel.



Source: U.S. House of Representatives, 1977.

Figure 1-10. COAL UNIT TRAIN TRANSPORTATION SYSTEM

Map 1-5. CHICAGO & NORTH WESTERN COAL LINE PROJECT

east over BN track to St. Louis, Missouri, for delivery to the Hall Street barge terminal. This terminal is on a 45-acre site outside the city of St. Louis and next to rail yards owned by BN. The facility has a capacity of handling 10 MMTA and was designed specifically for the transfer of low-sulfur coal, shipped by unit train from the Powder River Basin to barges for shipment south on the Mississippi River (Smock 1978, p. 29).

Coal would arrive at the terminal in unit trains and would be either transferred directly to a unit tow or stored. The terminal has a 500,000-ton storage yard with space for additional emergency storage (Smock 1978, p. 29). The terminal equipment can unload coal at a rate of 4000 tons per hour (tph). Barges can be loaded at a rate of 6000 tph. The operations of receiving incoming coal and stacking it in the main yard and reclaiming coal from storage and loading it on barges are fully automated (Smock 1978, p. 29).

Acreage Requirements and Land Status

Table 1-28 shows the system buildup for the barge alternative. Except for Baton Rouge and Wilton, it is anticipated that deliveries would be made by rail to these markets prior to operation of the pipeline. There is rail access to each mine and mainline track from the mines to the interchange points in Kansas City and St. Louis.

In St. Louis, coal is transferred from rail to barge at the Hall Street terminal. This transshipment facility has a capacity of 10 MMTA, of which 60 percent is under contract. To handle any amount above this capacity would require expansion of the facility or use of another facility (Mankus 1980).

The Hall Street terminal is the only rail-barge transshipment facility in St. Louis. It is located on 45 acres of a 70-acre site and could be expanded to handle up to 18.3 MMTA (Mankus 1980).

General Operation

Table 1-29 summarizes the operation of the rail-barge alternative, showing for each mine-market combination the originating railroad, delivering railroad, or barge and the distance, cycle time, and number of trains and barges. The tonnages that would be carried over the various portions of the route and the associated number of trains per day and barges per day are shown in Table 1-30.

Time Frame

All new track, additions to sidings, and new control systems necessary to move 18.8 MMTA to Kansas City and 18.3 MMTA to St. Louis will be in place prior to the start of pipeline coal delivery in 1985. While rail capacity will be adequate, transshipment facilities in St. Louis are not now capable of handling the full 18.3 MMTA. Considering current capacities and current commitments, there is a capacity shortage of 12.3 MMTA. Studies are underway for construction of new terminals and expansion of existing terminals that could meet this future demand (Mankus 1980).

Work Force

Transshipment of coal from rail to barge is not a labor-intensive activity. At present, approximately 30 to 40 people operate the Hall Street terminal, and increased traffic up to the terminal's capacity would not affect the number (Mankus 1980). It is estimated that another 30 to 40 people would be needed to staff a facility meeting the 12.3 MMTA shortfall.

Each barge tow is assumed to involve 15 people. Table 1-31 summarizes the numbers of people, for both rail and barge, associated with this alternative.

Project Components

Project components unique to this alternative are those associated with the rail-barge transshipment facility. They include the material handling equipment at the terminal: a rotary car dumper and train positioner, a rail-mounted stacker/reclaimer, a radial stacker, a tunnel reclaim system, a stationary luffing boom-type barge loader, a barge-haul system, and interconnecting conveyors (Smock 1978, p. 29).

Barges 195 feet long and 35 feet wide, with a 9-foot draft and 1500-ton capacity would be used (Rieber and Soo 1977a, p. 4-9) Each tow

TABLE 1-28

SYSTEM BUILDUP SCHEDULE FOR RAIL-BARGE ALTERNATIVE

Delivery Terminal	As-Mined Coal (MMTA)										
	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1988
Oologah, OK[a]	1.75	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Pryor, OK[a]	—	—	2.65	2.65	2.65	2.65	2.65	5.3	5.3	5.3	5.3
Independence, AR[a]	—	—	—	—	2.5	2.5	5.0	5.0	5.0	5.0	5.0
White Bluff, AR[a]	—	2.5	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Baton Rouge, LA[b]	—	—	—	—	—	—	—	5.8	5.8	11.3	11.3
New Roads, LA[b]	—	—	—	—	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Wilton, LA[b]	—	—	—	—	—	—	—	—	2.5	2.5	5.0
Total	1.75	6.0	11.15	11.15	15.65	15.65	18.15[c]	26.6[c]	29.1[c]	34.6[c]	37.1[c]

[a] Delivery by unit train.

[b] Transportation by unit train to St. Louis, then delivery by barge.

[c] These tonnages correspond to those that would be delivered to power plants by the Cypress Bend pipeline-barge alternative.

TABLE 1-29

OPERATING PARAMETERS FOR RAILROAD-BARGE ALTERNATIVE

Mine	Market	Receiving Railroad	Delivering RR or Barge	Round-Trip Distance	Round-Trip Time (hours)	Number of Trains[a]	Number of Barge Tows
North Rawhide	Pryor, OK	BN	MKT	2076	122[b]	1	
Jacobs Ranch	Oologah, OK	BN	MP	2112	129[b]	1	
Jacobs Ranch	Redfield, AR	BN	MP	2742	158[b]	3	
North Antelope	Newport, AR	BN	MP	2433	152[b]	4	
Buckskin	New Roads, LA	BN	Barge	3812	371	4	2
North Rawhide	Baton Rouge, LA	BN	Barge	3872	380	4	8
Antelope	Wilton, LA	BN	Barge	4012	401	4	4

[a] Estimate includes loaded and empty trains.

[b] Boyce 1980; BN.

TABLE 1-30

TONNAGE AND NUMBER OF
TRAINS AND BARGES, BY ROUTE SEGMENT

Route Segment	Tonnage (MMTA)	Number of Trains[a]	Number of Barges
Wyoming mines to Lincoln, NB	37.1	20	0
Lincoln to Kansas City, KS	18.8	10	0
Kansas City to Newport, AR	5.0	3	0
Kansas City to Pryor, OK	5.3	3	0
Kansas City to Oologah, OK	8.5	5	0
Kansas City to Redfield, AR	5.0	3	0
Lincoln to St. Louis, MO	18.3	10	0
St. Louis to New Roads, LA	18.3	0	3
St. Louis to Baton Rouge, LA	16.3	0	2
St. Louis to Wilton, LA	5.0	0	1

[a] Calculation of daily trains (round trips) assumes 1.848 million net tons per year per train per day (Peat, Marwick, Mitchell & Co. 1979, p. II-4). Estimate includes loaded and empty trains. Daily barge calculation assumes 25 barges per tow and 37,500 tons per tow.

TABLE 1-31

OPERATIONS PERSONNEL ESTIMATES: NO-ACTION RAILROAD-BARGE ALTERNATIVE

Destination	Railroad/ Barge	Number Personnel	500-mi Brake Inspection	Pull-by	Number of Trains[a]	Tons
Kansas City, MO	BN	48	3	2	4	18.8
Pryor, OK	MKT	16	1	1	7	5.3
Oologah, OK	MP	16	0	4	1	3.5
Redfield, AR	MP	64	2	8	3	5.0
Newport, AR	MP	24	1	11	4	5.0
St. Louis, MO	BN	48	3	2	4	18.3
New Roads, LA	Barge	45	-	-	2	2.0
Baton Rouge, LA	Barge	240	-	-	8	11.3
Wilton, LA	Barge	120	-	-	4	5.0

BN = Burlington Northern.

MKT = Missouri-Kansas-Texas.

MP = Missouri Pacific.

[a] Estimate includes loaded and empty trains.

would use 15 barges, for a total of 37,500 tons per tow. Travel downstream would average approximately 10 miles per hour; movement upstream would be at a rate of 5 miles per hour (Eickhorst 1980).

Interrelationship of Rail-Barge Alternative with Other Planned Projects

In addition to the C&NW Coal Line Project discussed in Section 1.N.1, this alternative would also be affected by Corps of Engineers' plans to rebuild the Alton Lock and Dam facility north of St. Louis, on the Mississippi River. Delays as long as 72 hours are affecting traffic using the existing facility (Mankus 1980). Construction of a new 1200-foot lock would decrease this delay and increase daily tow traffic from 39 to 66 units by the year 2035 (Dutt 1980). Without this improved facility, St. Louis would be the major transshipment point for tows entering the river southbound. This would increase shoreside activity in the city, and land use pressure, particularly to build more transshipment facilities, would be likely to increase (Department of the Army 1976, p. 36).

1.O ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

1.O.1 OTHER PIPELINE OR PIPELINE-BARGE ROUTES

An alternative pipeline route through Arkansas and Louisiana was studied. This route was to the east of the proposed action route but was eliminated from further consideration in order to avoid potential impacts to the federally listed endangered red-cockaded woodpecker, whose habitat has been identified as mature pine forests. Several miles of mature pine forests were located during aerial surveys along the eastern route in Arkansas. The proposed action route was selected to avoid mature pine forests, and the eastern route was eliminated from further consideration.

Another pipeline-barge alternative was initially studied. This alternative would have delivered coal to a proposed market near Penton, Mississippi, and would have included a barge loading facility on the east side of the Mississippi River. This alternative was eliminated because siting of the proposed power plant at Penton has been postponed indefinitely (Eiserman 1980). The elimination of this market also eliminated the need for further consideration of a barge loading facility at this location.

Barges

The Arkansas River provides a potential barge route for transporting ETSI coal but was excluded from further consideration for the following reasons: (1) This alternative would require a barge loading facility at the port of Catoosa east of Tulsa, Oklahoma, and barge unloading facilities for the Muskogee and White Bluff terminals, the only terminals that could be served by barges on the Arkansas River. (2) This alternative could not be used to provide coal shipments to the Ponca City, Oologah, and Pryor terminals, which are all served prior to reaching the port of Catoosa, nor to the Independence terminal, which is not on the Arkansas River. In addition, the Muskogee terminal is only 30 miles from the port of Catoosa, which is too short a distance to make barge shipment feasible.

The Arkansas River channel has inadequate capacity to handle the large volume of coal ETSI is proposing to transport because locks on the river would be unable to handle the congestion generated by approximately 3000 trips of the large barge units (Walker 1980).

1.O.2 OTHER SLURRY TRANSPORT MEDIA

Hydrocarbons

Replacement of water as a transporting fluid with other candidate liquids such as methanol, crude oil, fuel oil, or liquefied petroleum gas was studied as an alternative. These liquids were eliminated from consideration because of their unavailability in sufficient volumes at the coal preparation sites. Although hydrocarbons can be produced from coal, this process also requires large volumes of water. Processing plants are not presently operating or scheduled to be operating in the preparation plant vicinity by 1985 when the coal slurry transporation project is scheduled to begin operation.

Carbon Dioxide

Carbon dioxide (CO_2) is becoming increasingly in demand for use in tertiary oil recovery processes; and according to the National Petroleum Council (1976), there exists a potential need for CO_2 in Louisiana. Thus its use as a transporting fluid was evaluated.

The estimated slurry loading would be 47 percent as-mined coal; therefore 42.3 MMTA of CO_2 would be required to transport 37.4 MMTA of as-mined coal. This is equivalent to about 112 billion standard cubic feet of CO_2 annually. Carbon dioxide is not available from other sources in sufficient quantities in the area and there are no known plans to produce any CO_2 in the area within the time frame of the proposed project.

The alternative was eliminated because of the undeveloped technology of such a slurry mixture. In addition, any research being done is considered to be proprietary information and therefore is unavailable.

Treated Wastewater

This concept was evaluated and eliminated because of the unavailability of significant quantities (20,200 acre-feet per year) of unappropriated wastewater. Based upon an estimated water usage of 100 gallons per capita per day, and a flow into the treatment plants of 80 percent of water used and 10 percent loss to sludge, an estimated 72 gallons per day (0.081 acre-foot per year) of treated wastewater would be available. Supply of 20,200 acre-feet per year of wastewater would require collection of all the water from population centers totaling 250,000 people. Such a quantity of water is not available in Wyoming. Detailed analyses of cost and energy would be required to evaluate any sources outside Wyoming.

1.O.3 OTHER METHODS OF TRANSPORT

Trucks

Truck transport was evaluated but was eliminated as being impractical for the large quantities considered here. Such a scheme would require 40,000 twenty-ton trucks to be on the road at all times, with a truck loading operation required every 45 seconds at each of the coal preparation plants.

1.O.4 OTHER WATER SUPPLY SOURCES

Return Water Line

Water from the Mississippi River could be transported to the coal preparation sites for use in the slurry pipeline system. A water pipeline would have to be constructed adjacent to the slurry line, and centrifugal water pumps would have to be installed at the slurry pump station sites. The return water line was eliminated from detailed analysis because it would consume energy at the rate of 217,000 Btu/ton of coal as well as an additional commitment of approximately 1090 acres to construct the return water line. This would result in additional disturbance and environmental damage.

1.P COMPARISON OF PROPOSED ACTION AND ALTERNATIVES

The key facts pertaining to the descriptions of the proposed action and alternatives are summarized on Table 1-32.

TABLE 1-32

COMPARISON OF PROPOSED ACTION AND ALTERNATIVES

	Proposed Action	Market Alternative	Cypress Bend Pipeline-Barge Alternative	No-Action Alternative[a]
Water Requirements				
Construction (total)	4,297 ac-ft	4,297 ac-ft	4,297 ac-ft	0 ac-ft
Operation				
Well Field	20,200 ac-ft/yr	20,200 ac-ft/yr	20,200 ac-ft/yr	NA
Pump Stations				
Wyoming	60 ac-ft/yr	60 ac-ft/yr	60 ac-ft/yr	NA
Colorado	NA	NA	NA	NA
Nebraska	85 ac-ft/yr	40 ac-ft/yr	40 ac-ft/yr	NA
Kansas	105 ac-ft/yr	120 ac-ft/yr	120 ac-ft/yr	NA
Oklahoma	50 ac-ft/yr	50 ac-ft/yr	50 ac-ft/yr	NA
Total Operation	20,500 ac-ft/yr	20,470 ac-ft/yr	20,470 ac-ft/yr	NA
Land Requirements				
Construction	22,730 ac	22,199 ac	17,097 ac	0 ac
Operation of Surface Facilities	853 ac	843 ac	818 ac	no new acres required
New Right-of-Way Required	1,828 mi	1,785 mi	1,366 mi	no new miles required
Land Ownership/Management of Right-of-Way				
Bureau of Land Management	6 mi	6 mi	6 mi	0 mi
Forest Service	27 mi	27 mi	27 mi	0 mi
Indian	18 mi	18 mi	18 mi	0 mi
State	68 mi	68 mi	58 mi	0 mi
Private	1,709 mi	1,666 mi	1,257 mi	all miles
Work Force Requirements				
Construction (total)	38,847 worker-quarters[b]	38,940 worker-quarters[b]	36,054 worker-quarters[b]	0 worker-quarters[b]
Operation				
Headquarters	41 workers	41 workers	41 workers	NA
Western District	243 workers	243 workers	243 workers	NA
Central District	124 workers	117 workers	117 workers	NA
Eastern District	178 workers	141 workers	278 workers	NA
Southern District	164 workers	211 workers	NA	NA
Total	753 workers	753 workers	679 workers	2,470 workers (1,290 workers)
Water Distribution[c] and Slurry Gathering Pipelines[d]	71 mi	71 mi	71 mi	NA
Main Water Pipeline[c]	68 mi	68 mi	68 mi	NA
Main Slurry Pipeline	1,664 mi	1,621 mi	1,202 mi	NA
River Crossings Requiring Federal Permits	58	54	35	NA
Preparation Plants	3	3	3	NA
Slurry Pump Stations	23	22	15	NA
Dewatering Plants	9	9	5	NA
Length of Time to Deliver Coal[e]	17 days	17 days	17.5 days	5 days (8.5 days)

TABLE 1-32 Continued

	Colorado Alternative[f] / Proposed Action[f]	Colorado Alternative[f] / Market and/or Pipeline-Barge Alternative[f]	Coal Cleaning Operation Alternative
Water Requirements			
Construction (total)	*	*	+ 0 ac-ft
Operation			
Well Field	NA	NA	+ 300 ac-ft/yr
Pump Stations			
Wyoming	60 ac-ft/yr / 60 ac-ft/yr	60 ac-ft/yr / 60 ac-ft/yr	NA
Colorado	90 ac-ft/yr / NA	90 ac-ft/yr / NA	NA
Nebraska	NA / 85 ac-ft/yr	NA / 40 ac-ft/yr	NA
Kansas	70 ac-ft/yr / 55 ac-ft/yr	70 ac-ft/yr / 80 ac-ft/yr	NA
Oklahoma	NA / NA	NA / NA	NA
Total Operation	220 ac-ft/yr / 200 ac-ft/yr	220 ac-ft/yr / 180 ac-ft/yr	+ 300 ac-ft/yr
Land Requirements			
Construction	6,440 ac / 6,028 ac	7,446 ac / 6,931 ac	+ 0 ac
Operation of Surface Facilities	*	*	+ 0 ac
New Right-of-Way Required	519 mi / 485 mi	602 mi / 560 mi	NA
Land Ownership/Management of Right-of-Way			
Bureau of Land Management	3 mi / 2 mi	3 mi / 2 mi	NA
Forest Service	30 mi / 14 mi	30 mi / 14 mi	NA
Indian	0 mi / 0 mi	0 mi / 0 mi	NA
State	21 mi / 33 mi	21 mi / 33 mi	NA
Private	465 mi / 436 mi	548 mi / 511 mi	NA
Work Force Requirements			
Construction (total)	*	*	+ 4,218 worker-quarters[b]
Operation			
Headquarters	NA	NA	NA
Western District	*	*	+ 49 workers
Central District	NA	NA	NA
Eastern District	NA	NA	NA
Southern District	NA	NA	NA
Total	NA	NA	+ 49 workers
Water Distribution[c] and Slurry Gathering Pipelines[d]	NA	NA	NA
Main Water Pipeline[c]	NA	NA	NA
Main Slurry Pipeline	519 mi / 485 mi	602 mi / 560 mi	NA
River Crossings Requiring Federal Permits	2 / 3	2 / 4	NA
Preparation Plants	NA	NA	NA
Slurry Pump Stations	*	*	NA
Dewatering Plants	NA	NA	NA
Length of Time to Deliver Coal[e]	NA	NA	NA

TABLE 1-32 Concluded

	Crook County Alternative Water Supply System[g]	Oahe Alternative Water Supply System[g]	Slurry Pipeline Water Discharge Alternative[g]
Water Requirements			
Construction (total)	+ 0 ac-ft	+ 0 ac-ft	+ 0 ac-ft
Operation			
Well Field	+ 0 ac-ft/yr	+ 0 ac-ft/yr	+ 0 ac-ft
Pump Stations			
Wyoming	NA	+ 0 ac-ft/yr	+ 0 ac-ft/yr
Colorado	NA	+ 0 ac-ft/yr	+ 0 ac-ft/yr
Nebraska	NA	+ 0 ac-ft/yr	+ 0 ac-ft/yr
Kansas	NA	+ 0 ac-ft/yr	+ 0 ac-ft/yr
Oklahoma	NA	+ 0 ac-ft/yr	+ 0 ac-ft/yr
Total Operation	+ 0 ac-ft/yr	+0 ac-ft/yr	+ 0 ac-ft/yr
Land Requirements			
Construction	- 558 ac	+ 2,025 ac	variable
Operation of Surface Facilities	- 15 ac	- 20 ac	+ 0 ac
New Right-of-Way Required	- 25 mi	+ 208 mi	variable
Land Ownership/Management of Right-of-Way			
Bureau of Land Management	+ 0 mi	+ 0 mi	+ 0 mi
Forest Service	+ 0 mi	+ 0 mi	+ 0 mi
Indian	+ 0 mi	+ 0 mi	+ 0 mi
State	+ 0 mi	+ 0 mi	+ 0 mi
Private	-21 mi	+ 208 mi	variable
Work Force Requirements			
Construction (total)	- 164 worker-quarters[b]	+ 932 worker-quarters[b]	unknown
Operation			
Headquarters	NA	+ 0 workers	+ 0 workers
Western District	+ 0 workers	+ 1 worker	+ 0 workers
Central District	NA	+ 0 workers	unknown
Eastern District	NA	+ 0 workers	unknown
Southern District	NA	+ 0 workers	unknown
Total	+ 0 workers	+ 1 worker	unknown
Water Distribution[c] and Slurry Gathering Pipelines[d]	NA	NA	NA
Main Water Pipeline[c]	- 25 mi	+ 208 mi	NA
Main Slurry Pipeline	NA	NA	NA
River Crossings Requiring Federal Permits	+ 0	+ 0	+ 1 per site
Preparation Plants	NA	NA	NA
Slurry Pump Stations	NA	NA	NA
Dewatering Plants	NA	NA	NA
Length of Time to Deliver Coal[e]	NA	NA	NA

[a] Figures given apply to both all-rail and railroad-barge alternatives; exceptions for railroad-barge are included in parentheses.
[b] Worker-quarter is a measure of the amount of work done by 1 worker in a quarter of a year.
[c] Main water and water distribution pipelines would be adjacent to slurry pipelines except for about 31 miles.
[d] Both pipelines would lie within the same right-of-way.
[e] Represents length of time to transport coal to most distant terminal.
[f] Comparison pertains only to main slurry pipeline route(s) between Jacobs Ranch and intersection point(s) in Kansas.
[g] Numbers represent change from proposed action.
* Amount is approximately the same.
NA = Not applicable.

CHAPTER 2

COMPARATIVE ANALYSIS OF THE PROPOSED ACTION AND ALTERNATIVES

The energy efficiencies and environmental impacts of the proposed action and alternatives, including the no-action alternative, are compared in this chapter.

2.A ENERGY EFFICIENCY

Transportation of coal requires energy. The different scenarios being considered would consume different amounts of energy in transporting a certain amount of coal to the specified destinations. These comparative amounts of energy have been calculated for the more viable scenarios and are presented in an energy consumption table (matrix) for comparison purposes (Table 2-1).

The transportation efficiencies of these major scenarios are also presented in a table similar to the energy consumption matrix, but showing comparative percentages (Table 2-2). These percentages show the comparative amount of energy that would be delivered after allowing for the energy consumed in transportation.

2.A.1 ENERGY CONSUMPTION AND EFFICIENCY MATRICES

The common measure of transportation energy consumption is the ratio of energy consumed in transportation per unit of commodity transported. When the commodity transported is coal, this energy consumption is expressed as British thermal units (Btu) per ton of as-mined specification coal. (A Btu is defined as the amount of heat (energy) required to raise the temperature of 1 pound of water 1 degree Fahrenheit.)

The energy consumptions shown in Table 2-1 are expressed in terms of this common measure. These figures were calculated at the raw energy level. For electric power, it is the amount of energy from coal required to enter a power plant to generate the necessary electricity. This takes into account the energy losses encountered in the power plant boilers and turbines. Calculating the energy consumptions in this way gives a truer picture of the amount of raw resources consumed in generating the required power. For diesel fuel, the figures are based on the amount of raw energy from crude oil to produce the required diesel fuel energy. This dual basis (i.e., coal for electrical power and crude oil for diesel fuel) was chosen because no concrete evidence stating that diesel fuel would be primarily made from coal over the lifetime of the ETSI project could be found, although the technology does exist. Diesel fuel made from coal requires more energy than making it from crude oil (about 1.92 times more energy). However, coal is an indigenous source of energy, which is an advantage, whereas at least part of the crude oil would be from foreign sources.

This dual basis does not allow a direct raw energy consumption comparison, though. Hence, for the alternatives involving the use of diesel fuel (scenarios 5, 7, and 8), the energy consumption required if diesel fuel were to be produced from coal is shown in parentheses and footnoted by (d). This gives a direct comparison with the other scenarios' figures assuming an alternative energy source (i.e., diesel fuel made from coal).

Taking the case of the no-action (all rail) alternative, the energy consumed due to diesel fuel usage is divided by the coal-to-crude oil thermal efficiency factor to obtain the energy consumed if the diesel fuel were produced from coal. This is added to the rest of the energy consumption components to obtain the revised total figure (See Table E-1 in Appendix E for energy consumption components):

<u>Diesel fuel portion:</u>

$$\frac{534,434}{0.52} = 1,027,758 \text{ Btu/ton}$$

(see Table E-3 in Appendix E for conversion factor)

<u>Electrical and losses portion:</u>
35,754 Btu/ton

TABLE 2-1

TRANSPORTATION ENERGY CONSUMPTION MATRIX

Scenario	Annual Delivered Throughput[a] (MMTA)	Energy Consumed in Transport (10^3 Btu/ton)[a,b]	Water Supply System[c]: Niobrara County	Crook County	Oahe Reservoir	Recycle
1. Proposed action	37.4	---	664	659	679	849
2. Proposed action - Colorado route	37.4	---	669	663	683	853
3. Market alternative	37.4	---	679	669	689	864
4. Market alternative - Colorado route	37.4	---	687	677	697	871
5. Pipeline-barge alternative	37.1[f]	---	792 (857)[d]	776 (841)[d]	796 (862)[d]	978 (1043)[d]
6. Proposed action with coal cleaning alternative	37.4	---	1099[e]	1094[e]	1114[e]	1284[e]
7. No-action alternative (all-rail)	37.4	570 (1064)[d]	---	---	---	---
8. No-action alternative (railroad-barge)	37.1[f]	697 (1303)[d]	---	---	---	---

Note: All slurry pipeline scenarios (scenarios 1-6) include energy consumption for water treatment at the dewatering plants because it is insignificant and would have little effect if treated as a separate alternative.

[a]This is on an as-mined coal basis (29.49% moisture and 11,814 Btu/lb of dry coal) or equivalent.

[b]Not based on total consumption figures (consumptions do not include all energy debits; e.g., grinding energy). Use for comparison only.

[c]City of Gillette surplus water supply is not included because it is designed as a reserve water source only.

[d]Proposed action and slurry pipeline scenarios (except barges) use energy primarily derived from coal. No-action alternatives (and barges) use energy primarily derived from crude oil. Diesel fuel produced from coal would require 1.92 times more energy than from crude oil. First figures are based on diesel fuel made from crude oil (i.e., 570 for no-action [all rail] alternative), and figures in parentheses are based on diesel fuel made from coal (i.e., 1064 for no-action [all-rail] alternative).

[e]These large values are due to irretrievable coal Btu's lost in coal cleaning refuse.

[f]Because 0.3 MMTA of coal are consumed at Cypress Bend (within the system) in the pipeline-barge alternative, only 37.1 MMTA are delivered to market. In order to get a direct comparison between the pipeline-barge alternative and the railroad-barge alternative, 37.1 MMTA was also used for the railroad-barge alternative.

TABLE 2-2

TRANSPORTATION ENERGY EFFICIENCY MATRIX

Scenario	Annual Delivered Throughput[a] (MMTA)	Percentage of Energy Effectively Delivered[b]				
			Water Supply System[c]			
			Niobrara County	Crook County	Oahe Reservoir	Recycle
1. Proposed action	37.4	---	96.02	96.05	95.93	94.92
2. Proposed action - Colorado route	37.4	---	95.99	96.03	95.91	94.89
3. Market alternative	37.4	---	95.93	95.99	95.87	94.83
4. Market alternative - Colorado route	37.4	---	95.89	95.95	95.83	94.78
5. Pipeline-barge alternative	37.1[f]	---	95.26 (94.87)[d]	95.35 (94.96)[d]	95.23 (94.84)[d]	94.14 (93.75)[d]
6. Proposed action with coal cleaning alternative	37.4	---	93.42[e]	93.45[e]	93.33[e]	92.31[e]
7. No-action alternative (all-rail)	37.4	96.59 (93.63)[d]	---	---	---	---
8. No-action alternative (railroad-barge)	37.1[f]	95.83 (92.20)[d]	---	---	---	---

Note: All slurry pipeline scenarios (scenarios 1-6) include energy consumption for water treatment at the dewatering plants because it is insignificant and would have little effect if treated as a separate alternative.

[a]This is on an as-mined coal basis (29.49% moisture and 11,814 Btu/lb of dry coal) or equivalent.

[b]Not based on total consumption figures (consumptions do not include all energy debits; e.g., grinding energy). Use for comparison only.

[c]City of Gillette surplus water supply is not included because it is designed as a reserve water source only.

[d]Proposed action and slurry pipeline scenarios (except barges) use energy primarily derived from coal. No-action alternatives (and barges) use energy primarily derived from crude oil. Diesel fuel produced from coal would require 1.92 times more energy than from crude oil. First figures are based on diesel fuel made from crude oil (i.e., 96.59 for no-action [all-rail] alternative) and figures in parentheses are based on diesel fuel made from coal (i.e., 93.63 for no-action [all-rail] alternative).

[e]These low values are due to irretrievable coal Btu's lost in coal cleaning refuse.

[f]Because 0.3 MMTA of coal are consumed at Cypress Bend (within the system) in the pipeline-barge alternative, only 37.1 MMTA are delivered to market. In order to get a direct comparison between the pipeline-barge alternative and the railroad-barge alternative, 37.1 MMTA was also used for the railroad-barge alternative.

<u>Total</u>
$1{,}027{,}758 + 35{,}754 = 1{,}063{,}512$ Btu/ton
$= 1{,}064 \times 10^3$ Btu/ton

Similar numbers were obtained for the no-action (railroad-barge) alternative and pipeline-barge alternative, taking into account railroad and barge diesel fuel consumption.

Another way of stating transportation energy efficiencies is to express them in terms of percentages as shown in Table 2-2. In this case, the percentages express the ratio of the amount of energy contained in the coal minus the energy consumed in transporting the coal to the amount of energy contained in the coal, or in other words, the effective amount of energy to be delivered after subtracting the energy required to transport it. These percentages are derived by:

[(energy contained in coal - energy consumed transporting coal)÷(energy contained in coal)] x 100

Each ton of coal contains approximately 16.7×10^6 Btu. Hence for the proposed action using the Niobrara water supply system, the percentage is:

$[(16.7 \times 10^6 \text{ Btu/ton} - 664 \times 10^3 \text{ Btu/ton}) \div (16.7 \times 10^6 \text{ Btu/ton})] \times 100 = 96.02\%$

Likewise one could state that 100 - 96.02 = 3.98% is consumed in transporting the coal.

It must be noted here that the numbers in Tables 2-1 and 2-2 are not true total figures stating that so much energy is consumed in transporting the coal, because all of the energy debits have not been included such as grinding energy. Hence, the numbers are <u>comparative</u> energy consumption and percentage figures.

The methodology and sources of data for developing the information in Table 2-1 are shown in Appendix E. The components that comprise each of the proposed action and alternative scenarios in Table 2-1 are listed below:

1. <u>Proposed Action</u>
   Three preparation plants with no coal cleaning.
   Slurry pipelines and pump stations.
   Nine dewatering facilities.
   Boiler feed moisture correction.
   Water treatment at dewatering facilities.
   Water supply and pipelines.

2. <u>Proposed Action - Colorado route</u>
   (Includes the same components as proposed action, but slurry pipeline follows the Colorado route.)

3. <u>Market Alternative</u>
   (Includes the same components as proposed action, but coal is delivered to different markets.)

4. <u>Market Alternative-Colorado Route</u>
   (Includes the same components as market alternative, but pipeline follows the Colorado route.)

5. <u>Pipeline-Barge Alternative</u>
   Three preparation plants with no coal cleaning.
   Slurry pipelines and pump stations.
   Five dewatering facilities.
   Boiler feed moisture correction.
   Barge loading.
   Barge transportation to three markets.
   Water treatment at dewatering facilities.
   Water supply and pipelines.
   Coal consumption at Cypress Bend.

6. <u>Proposed Action with Coal Cleaning Alternative</u>
   (Same components as proposed action.)
   Add: Coal cleaning facilities.
   Cleaning weight loss - Btu's lost
   Cleaning weight loss adjustment.

   The rationale for including the energy lost in the coal cleaning refuse as an energy consumption component is that this coal is assumed to be irretrievable with both present and future commercial technology.

7. <u>No-Action Alternative (All Rail)</u>
   Railroad loading facilities.
   Railroad unit trains to nine markets.

Railroad unloading facilities.
Railroad windage losses.

8. No-Action Alternative (Railroad-Barge)
Railroad loading facilities.
Railroad unit trains to four markets.
Railroad unloading.
Railroad windage losses.
Barge loading.
Barge transportation to three markets.

One component worth mentioning is the steam supplied to the dewatering plants. It poses a penalty to the power plants under normal load conditions; however, it is an incremental steam requirement and does not require a proportional increase in coal burned by the power plants because part of this steam energy is waste heat. Therefore, the Btu's in the additional coal consumed to provide steam for slurry dewatering have been debited to the slurry pipeline scenarios.

The following are components that have been excluded from the energy consumption analysis and thus are not included in Table 2-1:

1. Human labor.

2. Energy consumed in manufacturing or fabricating pipeline physical plant and railroad track and cars.

3. Energy used in transporting fuels to railroad fuel depots or electricity to pipeline power sources.

4. Energy benefits associated with burning coal that has lower sulfur and ash content at the power plant (pipeline cleaned coal).

5. Energy required to mine the coal.

6. Energy consumed by small vehicles used in pipeline or railroad general transportation or maintenance.

7. Coal grinding energy (necessary in all cases).

All of the 98 possible permutations have not been listed in these matrices because they would become too large for making a practical comparison, and upon inspection of these results, it can be seen that many of the alternative scenarios need not be listed for decision-making or comparison purposes. In particular, water treatment at the dewatering plants has been included in all of the slurry pipeline scenarios and not treated separately, which would have generated many more combinations. It only consumes 1000 Btu/ton of energy, which is an insignificant amount compared with the totals shown in Table 2-1, and thus would be of little, if any, importance in decision making.

Also, all the possible coal cleaning scenarios have not been included because it can be seen that they will yield very high energy consumptions. Upon comparison of scenarios one through five, it can be seen that other combinations employing coal cleaning will yield even higher consumption figures than scenario six (with the pipeline-barge-Colorado route with coal cleaning alternative yielding the highest energy consumption of all).

In addition, the figures for some of the scenarios not mentioned can be derived by arithmetic inspection, such as the energy consumption of the pipeline-barge-Colorado route alternative, which would be higher than the pipeline-barge alternative by an amount equivalent to the difference between the market alternative and the market alternative-Colorado route scenarios.

Based on the assumptions and calculations described above, the following conclusions can be drawn:

1. The most energy efficient scenario is the no-action (all rail) alternative, with a comparative energy consumption of 570×10^3 Btu/ton of delivered as-mined coal. (Some 3.41% [comparative] of the total energy transported would be consumed, with a resulting comparative efficiency of 96.59%.)

2. The most energy efficient slurry transportation scenario is the proposed action using the Crook County water supply system, with a comparative energy consumption of 659×10^3 Btu/ton of delivered as-mined coal. (Some 3.95% [comparative] of the total energy trans-

ported would be consumed, with a resulting comparative efficiency of 96.05%.)

In order to put these figures in further perspective, it must be noted that the no-action (all rail) alternative primarily uses crude oil as an energy source, while the proposed action can utilize either coal or crude oil as a source. If the no-action (all rail) alternative were to derive its diesel fuel from coal as shown above, the consumption would be 1064 x 10^3 Btu/ton, or 6.37% of the energy transported, with a resulting efficiency of 93.63%.

3. The most efficient slurry pipeline scenario is the proposed action; the least efficient is the pipeline-barge-Colorado route with coal cleaning alternative (determined by inspection).

4. The most efficient water supply system is the Crook County system; the least efficient is the water recycle system.

2.B ENVIRONMENTAL IMPACTS

The environmental impacts for the proposed action and the major alternatives are compared in this section. The alternatives considered are market, Cypress Bend pipeline-barge, Colorado, Crook County water supply system, Oahe water supply system, no-action, coal cleaning operation, and slurry pipeline water discharge. For comparison purposes it is useful to group the alternatives into four categories: processing alternatives, water supply system alternatives, slurry pipeline system alternatives, and no-action alternatives. Alternatives within each of these categories will be compared and then the categories will be compared. Such comparisons are difficult, especially between the slurry pipeline system alternatives and the no-action alternatives. The significant impacts that can be quantified are shown in Tables 2-3 and 2-4.

2.B.1 PROCESSING ALTERNATIVES

The coal cleaning operation and slurry pipeline water discharge alternatives are processing alternatives considered at the request of the applicant (ETSI). The facilities required for the coal cleaning operation would be located within the boundaries of the coal slurry preparation plants, so this alternative would not require additional land. The cleaning operation would require an additional 300 acre-feet of water per year, which would be obtained from the Madison aquifer. The withdrawal of this additional water would not measurably increase the drawdowns resulting from withdrawal of the 20,200 acre-feet required annually by the proposed action. This alternative would require approximately one-fourth more construction workers at the preparation plant sites. No additional personnel would be required for operation. The additional construction workers would not significantly increase the preparation plant construction impacts (see Section 4.E.1).

Facilities for the slurry pipeline water discharge alternative would be located at the dewatering plant sites, so this alternative would not require additional land. No additional workers would be required for construction or operation of these facilities. Because the discharged water would have to meet the applicable state water quality standards and National Pollutant Discharge Elimination System (NPDES) permit standards set by the Environmental Protection Agency (EPA), this alternative would have no significant effects on the environment (see Section 4.H.1).

These two processing alternatives are not considered further in the comparison of alternatives because they would not cause any significant impacts.

2.B.2 PROPOSED ACTION AND WATER SUPPLY SYSTEM ALTERNATIVES

The major issue raised during the scoping process (Appendix B-1) concerned potential ground-water impacts that would be caused by the proposed action (Niobrara County well field). Thus two alternative water supply systems were studied: an alternative well-field site in Crook County, Wyoming, and the Oahe Reservoir in South Dakota. Impacts of the Niobrara County well field and the alternative water supply systems are shown in Table 2-4.

IMPACTS OF PROPOSED ACTION AND ALTERNATIVES

Impacts	Proposed Action	Market Alternative	Cypress Bend Pipeline-Barge Alternative	Colorado Alternative	Other Comparable Segments Proposed Act.	Other Comparable Segments Market Alt.	No-Action Alternatives[a]
Surface Water[b]							
River/Stream Crossings Requiring Federal Permits	58	54	35	3	5	4	0
Socioeconomnics							
Wyoming Region							
1984 Peak Construction Employment[c]	1,624	X	X	X	X	0	
1984 Peak Construction Population Increase[c]	2,609	X	X	X	X	X	0
1984 Peak Housing Unit Requirements[c]	1,396	X	X	X	X	0	
Operation Employment[c]	243	X	X	X	X	X	5,700
Operation Population Increase[c]	728	X	X	X	X	X	NA
Annual Property Tax Revenues ($1000)	$3,298	X	X	X	X	X	NA
Pipeline and Pump Station Areas							
Peak Construction Employment (Direct)	4,992	4,992	3,932	797	NA	NA	NA
Peak Construction Population Increase	2,232	2,232	2,833	1948	NA	NA	NA
Dewatering Plant Areas							
Peak Construction Employment	1,182	1,063	1,1278	NA	NA	NA	0
Peak Construction Population Increase	1,555	1,555	1,217	NA	NA	NA	0
Operation Employment[c]	1,054	959	893		NA	NA	c
Operation Population Increase[c]	2,353	2,155	1,995	NA	NA	NA	c
Vegetation							
Land Temporarily Disturbed by Construction	21,877 ac	21,356 ac	16,279 ac	7,296 ac	5,878 ac	6,281 ac	0
Land Permanently Removed from Production	853 ac	843 ac	818 ac	150 ac	150 ac	150 ac	0
Agriculture							
Prime Farmland Permanently Removed From Production	375 ac	305 ac	385 ac	25 ac	75 ac	75 ac	0
Wildlife							
Federal Threatened & Endangered Species That Could Be Affected	4	4	4	3	2	2	0
Recreation Resources							
Scenic River Crossings	3	6	3	0	0	0	0
Rivers Identified in HCRS Phase I Inventory	8	7	4	1	0	0	0
Visual Resources							
Visual Resource Impact Areas	36	33	23	0	7	10	0

a Figures for an all-railroad system are given. Impacts for a railroad-barge system would be roughly equivalent.
b See Table 2-1 for ground water impacts resulting from well field pumping.
c Includes construction and service sectors.
NA Not applicable.
X Same as for the proposed action.

TABLE 2-4

SUMMARY OF WATER SUPPLY SYSTEM IMPACTS

Impact	Niobrara County Water Supply System (Proposed Action)[a,b]	Crook County Alternative Water Supply System[a,c]	Oahe Alternative Water Supply System
Hydrology			
Decline in Potentiometric Surface			
> 25 ft	5300 sq mi	16,700 sq mi	0 sq mi
> 100 ft	3800 sq mi	3000 sq mi	0 sq mi
> 200 ft	2000 sq mi	470 sq mi	0 sq mi
> 400 ft	500 sq mi	0 sq mi	0 sq mi
Counties Affected by Potentiometric Surface Decline > 25 ft	7	11	0
Industrial & Public Water Supplies Affected by a Potentiometric Surface Decline > 25 ft	2	7	0
Areas with Madison Wells Affected by Potentiometric Surface Decline			
Edgemont, SD	-303 ft	- 8 ft	0
Provo, SD	-343 ft	- 8 ft	0
Bell Creek, MT	- 11 ft	-162 ft	0
Devils Tower, WY	- 10 ft	-144 ft	0
Spearfish, SD	- 4 ft	- 42 ft	0
Sundance, WY	- 8 ft	- 55 ft	0
Upton, WY	- 13 ft	- 51 ft	0
Osage, WY	- 14 ft	- 31 ft	0
Newcastle, WY	- 21 ft	- 23 ft	0
Water Quality Change in Madison Water at the Well Field (TDS)	+ 60 mg/l	+ 10 mg/l	0
Maximum Stream Flow Reduction for Any One Stream	- 4 cfs	- 4 cfs	0 cfs
Streams/Springs Affected by Flow Reductions > 1 cfs	3 cfs	5 cfs	0
Vegetation			
Acres Temporarily Disturbed by Construction	852	751	3345
Acres Permanently Removed by Surface Facilities	28	15	8
Agriculture			
Prime Farmland Permanently Removed From Production	0	0	2
Wildlife			
Federal Threatened and Endangered Species That Could Be Affected	1	1	2
Recreation Resources			
Scenic River Crossings	0	0	0
Rivers Identified in HCRS Phase I Inventory[d]	0	0	1
Visual Resources			
Visual Resource Impact Areas	1	3	0

[a]Based on pumping for 50 years at a rate of 20,500 ac-ft/yr, which represents a worst-case analysis (see Section 4.A.1). ETSI only proposes to withdraw 20,200 ac-ft/yr.

[b]The hydrology impacts shown are for pumping from the Niobrara County well field only (Plan 1) and also include drawdowns due to existing users.

[c]The hydrology impacts shown are for pumping from the Crook County well field only (Plan 3) and also include drawdowns due to existing users.

[d]Rivers to be studied to determine eligibility for the National and Scenic River System (see Section 3.A.9.).

The water supply system impacts can be compared in terms of land disturbed during construction, land required for operation of surface facilities, areas potentially affected by ground-water drawdowns, changes in water quality, spring and stream flow reductions, construction impacts, and energy efficiency.

Construction of the Niobrara main water pipeline would temporarily disturb land within a 68-mile right-of-way, the Crook County pipeline would disturb 47 miles of right-of-way, and the Oahe pipeline would disturb 276 miles.

Construction of the Niobrara County well field would temporarily disturb 852 acres; 28 acres would be permanently removed from production by the system's surface facilities. The Crook County well field would temporarily disturb 757 acres; 15 acres would be permanently removed. The Oahe alternative would not require a well field, but 3345 acres would be temporarily disturbed by the main water pipeline; 8 acres would be permanently removed. None of the land that would be permanently removed from production by the Niobrara or Crook County well field is prime farmland. About 2 acres of prime farmland would be removed by Oahe alternative facilities.

The Niobrara County water supply system may affect one federally listed threatened or endangered species. The Crook County system may affect one species, and the Oahe system may affect two.

Construction of the Oahe pipeline could make it feasible to supply 24 South Dakota communities with additional domestic water. The Niobrara and Crook County water supply systems could not provide similar opportunities for any communities.

There would be no ground-water impacts with the Oahe alternative because it does not involve withdrawal of any ground water. After 50 years of pumping 20,200 acre-feet of water annually from the Niobrara County well field, parts of 7 counties would be affected by Madison aquifer drawdowns greater than 25 feet. After similar pumping from the Crook County well field, parts of 11 counties would be affected by drawdowns greater than 25 feet.

A comparison of the Table 2-4 acreage figures presented for different potentiometric surface declines shows that pumping from the Crook County well field would affect a larger area than pumping from the Niobrara well field.

Potentiometric surface declines of more than 25 feet would occur in the Madison aquifer over a 16,700-square-mile area if pumping were to occur from the Crook County well field; only 5300 square miles would be affected by more than 25 feet of Madison potentiometric surface declines if pumping occurred from the Niobrara well field. Although pumping from the Crook County well field would affect a larger surface area than would pumping from the Niobrara well field, drawdowns within the vicinity of the Crook well field would be less than those near the Niobrara well field. Water levels in the Madison aquifer would decline by more than 400 feet within a 15-mile radius (500 square miles) of the Niobrara well field, whereas a maximum of only about 200 feet would occur within a 10-mile radius (470 square miles) in the vicinity of the Crook well field.

The number of industries or communities served by public water supplies that would be affected by a water-level decline of more than 25 feet would also differ, depending upon which ETSI well field was pumped. Only two supplies would be affected by water-level declines exceeding 25 feet if the Niobrara site were pumped, whereas seven supplies would be affected if the Crook well field were pumped. The maximum amount of water-level decline that would be felt by an industrial or municipal water supply user, however, would be less with the Crook well field than it would be with the Niobrara well field. At Provo, South Dakota, water levels could decline as much as 343 feet, whereas the maximum decline if the Crook well field were pumped would occur at the Madison water well used for water flooding at the Bell Creek oil field, where only 162 feet of decline would be expected to occur. The predicted drawdown at Edgemont with use of the Niobrara well field would be 303 feet and only 8 feet with pumping from the Crook well field.

Spring flow and stream flow reduction would be expected to be small if either the Niobrara or Crook well field were pumped. Over all, fewer of these surface-water resources would be affected if the Niobrara well field were pumped than if the Crook well field were pumped.

Little or no change would occur in water quality at water wells, other than at the ETSI well fields. The Gillette well field is the only location outside the ETSI well fields where a water quality change would be expected to occur. At the Gillette site, the total dissolved solids concentration would be expected to increase by 20 mg/1 with pumping from either the Crook or Niobrara well field.

The main construction impacts for all three water supply systems would result from the influx of construction workers. The impacts for both well fields would be similar. Although more workers would be required to construct the Oahe alternative, these workers would be spread over the entire length of the pipeline right-of-way and would not have any significant impacts on any local community (Section 4.G.2). The Crook County water supply system would require half the number of workers required by the Niobrara system. This would result in slightly less overall impact.

There would be little difference between the water supply systems in terms of energy efficiency. The efficiencies would be 96.02 percent for the Niobrara well field, 96.05 for the Crook well field, and 95.93 percent for the Oahe alternative. Although the well-field energy efficiencies would be the same, the Niobrara well field would consume slightly more energy, 664 x 10^3 British thermal units (Btu) per ton as opposed to 659 x 10^3 Btu for the Crook County well field (see Section 2.A.1). Oahe would consume 679 x 10^3 Btu.

2.B.3 PROPOSED ACTION AND SLURRY PIPELINE SYSTEM ALTERNATIVES

As shown in Table 2-3, there are very few differences in the impacts of the various slurry pipeline systems (proposed action, market alternative, Cypress Bend pipeline-barge alternative, and Colorado alternative). The major impacts of these alternatives would be related to ground-water withdrawal and construction; few impacts would result from operation. This contrasts with the no-action alternatives (all-railroad and railroad-barge transportation), which would have no water or construction impacts and many operation impacts.

In the Wyoming region, construction impacts (including construction and service-sector employees) would be essentially the same for the proposed action and the various slurry pipeline alternatives. This is because the impacts are primarily due to construction of the preparation plants and well field. In all cases, Wyoming construction would provide for a peak construction employment of 1624 for a period of 1 to 2 years. Population would increase in the area for this same period by 2609 workers and family members. Operation figures would be less: 534 permanent jobs (construction and service), with an associated population increase of 1064. Property tax revenues from the Wyoming facilities would generate about $3,298,000 annually (see Section 4.A.2).

The employment and population increases for the remainder of the pipeline, including pump station and dewatering plant areas, would be different for the proposed action and each of the slurry pipeline alternatives. This is because of differences in the length of the main slurry pipeline. However, differences between the employment and population increases for the different systems have little meaning, because the increases would be scattered over such a long right-of-way. The impact analyses for the proposed action, market alternative, and Colorado alternative did not indicate any significant impacts on any one locality. For the Cypress Bend pipeline-barge alternative, however, construction of the dewatering plant and barge loading facility at Cypress Bend, Arkansas, would create a significant localized impact during the construction phase. The impact would be due to a peak population increase of 1593 for less than 2 years, which would affect housing and some public services in the towns of Arkansas City, McGehee, Dermott, and Dumas, Arkansas (see Section 4.C.2).

There would be some differences between the biological impacts of the proposed action and the pipeline system alternatives. The proposed action would temporarily disturb 21,877 acres; the market alternative, 21,356 acres; and the Cypress Bend pipeline-barge alternative, 16,279 acres. The amounts of vegetation permanently removed from production by surface facilities would not vary significantly, however. The proposed action would remove 853 acres; the market alternative, 843 acres; and the Cypress Bend pipeline-barge alternative, 818 acres. The acreage removed would be widely scattered and does not include a large area in one place. The proposed action facilities would remove 375 acres of prime farmland; the market alternative, 305 acres; and the Cypress Bend pipeline-barge alternative, 365 acres. The Colorado alternative would remove 25 acres, which would be less than equivalent sections of the proposed action, market, or pipeline-barge alternative. There would be no differences in the number of federally listed threatened or endangered animal species that may be affected by the proposed action, market, or Cypress Bend pipeline-barge alternative. The Colorado alternative would affect one more species than equivalent sections of the proposed action or other alternatives. In addition, one plant species that will be included on the federal list by December 1980 may be affected by the Colorado alternative (see Section 4.D.4).

There are differences in the number of areas that would have significant visual impacts: 36 for the proposed action, 33 for the market alternative, and 23 for the Cypress Bend pipeline-barge alternative.

Of some concern, but of relatively minor impact, are the numbers and types of river crossings. The proposed action would cross 58 rivers requiring Department of Army (Corps of Engineers) permits; the market alternative, 54; and the Cypress Bend pipeline-barge alternative, 35. Some of these rivers have special classifications because of their scenic or recreation qualities. The proposed action would cross 3 rivers included in state scenic river systems; the market alternative would cross 6; and the Cypress Bend pipeline-barge alternative would cross 3. The Heritage Conservation and Recreation Service has recently identified Phase I Inventory Rivers. The proposed action would cross 8; the market alternative, 7; and the Cypress Bend pipeline-barge alternative , 4.

2.B.4 NO-ACTION ALTERNATIVES

Two no-action alternatives were considered: all-rail transportation of coal, and railroad-barge transportation. Unlike the proposed action and pipeline system alternatives, the major impacts of the no-action alternatives would result from operation instead of construction. There would be no construction required for the all-rail alternative. Although barge loading facilities would have to be expanded for the railroad-barge alternative, no significant impacts would result (Section 4.I.1).

In general the two no-action alternatives would have the same operation impacts, because no significant impacts would be caused by the barge segment of the railroad-barge alternative. To facilitate the impact discussion, only figures for the all-rail no-action alternative will be given below.

The number of people required for rail operation alone is estimated to be 2500, with an additional 3200 required for related functions such as rail maintenance and supporting services. Whether this results in the same number of new jobs is a function of overemployment at some of the railroads as well as expected future gains in productivity.

The all-rail no-action alternative would add an estimated 20 daily trains to the existing traffic between Wyoming and Kansas City. This represents a 39 percent increase in traffic on the Burlington Northern segment from Table Rock, Nebraska, to Napier, Missouri. Because coal would be delivered via many different routes south of Kansas City, the maximum increase in daily trains would be much less in this part of the system. The largest daily increase, 28 percent over existing traffic, or 8 trains, would occur on the Kansas City to Muskogee route. The smallest increase would be 14.4 percent, on the segment from Grand Island to Aurora, Nebraska.

To illustrate the possible operation impacts of a no-action alternative, two extreme cases are used as examples. There would be a 29 percent increase in rail traffic through Torrington, Wyoming. The town is divided by the tracks. About 85 percent of the population and all services, including schools, police, and fire, lie north of the tracks. Thus the traffic increase would aggravate existing problems for the 15 percent of the population lying south of the tracks. These problems include delays for police, fire, and emergency equipment; traffic congestion; and potential accidents. The other extreme would be Grand Island, Nebraska, which would have an estimated 15.6 percent increase in traffic. Most of the city is south of the tracks, but the older part is to the north. Only a few facilities north of the tracks--two schools, a veterans' home, a hospital, a church, and a recreation park--would be affected by the increase.

These two cases typify the range of impacts that would occur in the 500 communities along the railroad route. This is contrasted with the proposed action and slurry pipeline system alternatives, which would not result in these types of socioeconomic impacts after construction is completed.

The all-rail no-action alternative would be the most energy-efficient transportation system analyzed in this environmental impact statement. The efficiency rating for this alternative would be 96.59 percent. The most efficient pipeline system, the proposed action using the Crook County well field, would have a rating of 96.05 percent (see Section 2.A.1).

It is important to consider the source of the power required for the no-action alternatives and the slurry pipeline systems, because of the national energy policy. A goal of this policy is to decrease our dependence on foreign sources of energy by promoting the use of coal over oil. Railroads would be powered by diesel fuel, an oil derivative. Approximately 2.8 million barrels of diesel fuel would be required annually. The pipeline systems would use electricity produced by coal-fired power plants.

2.B.5 SLURRY PIPELINE AND NO-ACTION (RAILROAD) SYSTEMS

The major environmental differences between the slurry pipeline system impacts and the railroad system impacts are summarized below in a highly simplified form.

<u>Pipelines</u>

Many ground-water impacts
Many construction impacts
Few operation impacts
High construction employment
Low operation employment
Less energy-efficient
Power requirements provided by
  coal-fired power plants

<u>Railroads</u>

No ground-water impacts
No construction impacts
Many operation impacts
No construction employment
High operation employment
More energy-efficient
Power requirements provided by
  diesel fuel, an oil derivative

CHAPTER 3

AFFECTED ENVIRONMENT

The affected environment is that portion of the existing environment that would be affected by the proposed action or alternatives. The affected environment and impacts for the proposed action and alternatives were analyzed for all of the following resources:

- Geology (including geologic hazards)
- Mineral resources
- Soils
- Water resources (including 100-year floodplains)
- Socioeconomic considerations
- Vegetation
- Wildlife
- Aquatic biology
- Cultural resources and paleontology
- Agriculture (including prime and unique farmlands and livestock grazing lands)
- Climate, air quality, and noise
- Recreation resources (including designated "scenic rivers")
- Transportation networks
- Wilderness
- Visual resources

Existing land use plans, controls, and constraints were also reviewed for potential conflicts with the proposed action and alternatives. This chapter provides information about only the environment that would be affected as discussed in Chapter 4. The analyses indicated that several resources would not be affected. These resources and explanatory notes are included below:

- Geology. The proposed action and the various alternatives would result in little or no subsurface disturbance; thus no disruptions or impacts to geologic formations would occur. Geologic conditions are discussed where pertinent to the well-field hydrology analysis (see Water Resources section).

- Mineral resources. Although various kinds of mineral resources may be present under some affected lands, implementation of the proposed action or any of the alternatives would not preclude future development of these resources.

- Soils. Soils would be affected by the proposed action and some of the alternatives. Project construction activities would cause disturbance of topsoil, soil compaction, alteration of soil profile along the excavated pipeline trench, and accelerated soil erosion. Impacts would be minimized or eliminated by implementation of reclamation procedures described in the Erosion Control and Revegetation Plan (Appendix C-1). Thus information concerning soil types is not presented but is available from Woodward-Clyde Consultants. This information was used in assessing impacts on vegetation and agriculture.

- Climate and noise. The proposed action or alternatives would not have any effect on climate. Sufficient noise to cause an impact would not be generated by the proposed action or alternatives, except the no-action alternative.

- Threatened and endangered plant species. In compliance with Section 50 CFR 402 (Interagency Cooperation) of the Endangered Species Act of 1973, the Fish and Wildlife Service (FWS) is required to furnish a list of endangered or threatened plant species that could occur in an area involving a federal action. According to the FWS list

(1980a), no federally listed threatened or endangered plant species are known to occur in the affected vicinity of any of the coal slurry pipeline project components, except for the Colorado alternative. Since the list was furnished, FWS has indicated the Colorado butterfly-weed has been proposed for listing.

- Wilderness. No federally designated wilderness areas are present in the vicinity of any component of the proposed action or alternatives. This includes Wilderness Study Areas (WSA) designated by the Bureau of Land Management, and Roadless Area Review and Evaluation (RARE II) areas designated by the Forest Service.

Baseline data were collected for each resource topic from the pipeline right-of-way or surface facility sites shown on the strip maps in Appendix A to a distance where impacts could no longer be identified with the project. This area is defined as the affected area. For some resources such as vegetation and soils the affected area is confined to the immediate vicinity of the construction sites. For other resources such as socioeconomics the affected area may extend a considerable distance (10 to 20 miles or more) beyond construction sites. For cultural resources a corridor concept was utilized. Baseline data for known cultural sites were obtained for a 10-mile-wide corridor centered on the pipeline right-of-way shown on the strip maps in Appendix A.

3.A PROPOSED ACTION

The proposed action has many components and routes that are the same as those for some of the alternatives. The affected environment discussed for the proposed action would be the same for these areas in common (see Map 1-1 in Chapter 1 and Map A-1 in Appendix A). These affected areas in common are summarized in this chapter at the beginning of the discussion for each alternative.

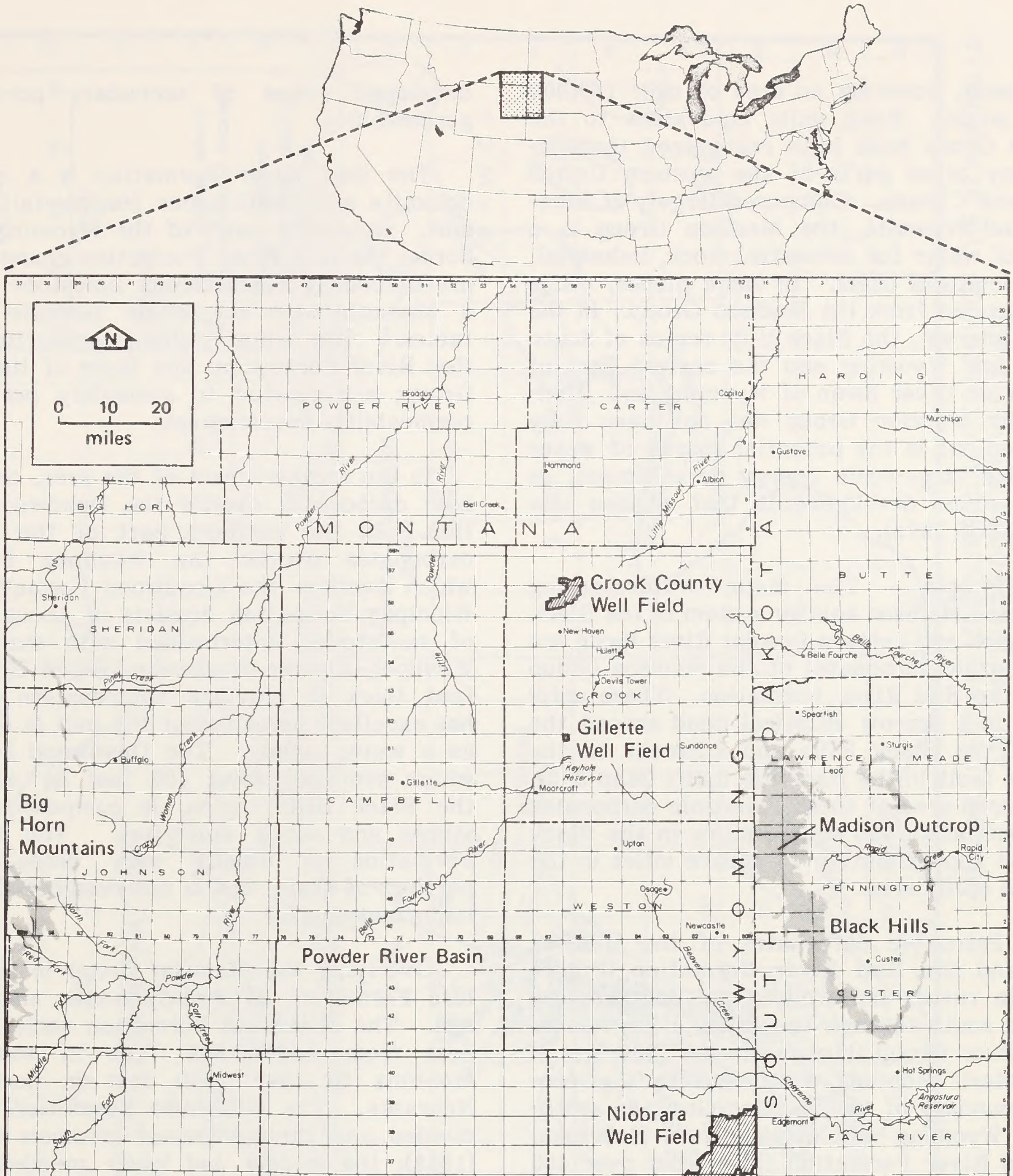
3.A.1 WATER RESOURCES

Ground Water

Studies were made of available geologic and hydrologic information on the Madison aquifer system, including earlier attempts to assess potential impacts caused by pumping from the proposed Niobrara County well field. A conceptual model was developed from these studies that explains the hydraulic behavior of the Madison aquifer system. Major physiographic features in the vicinity of the well field are shown on Map 3-1. Based upon the conceptual model, a numerical model was designed to simulate the behavior of the Madison aquifer system in the vicinity of the proposed ETSI developments. This numerical model was used to calculate future water-level declines, water-quality changes, and spring flow and stream flow reductions caused by withdrawals of ground water by present (Section 3.A.1) and planned Madison aquifer users (Section 5.A.1), as well as by ETSI (Section 4.A.1). The city of Gillette well field, which would be the source of ETSI's reserve water supply, was not considered as a presently operating well field but as a planned well field (Section 5.A.1). The hydrogeology of the Madison aquifer system is discussed in more detail in the Well Field Hydrology Technical Report (WCC 1980b), which is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado, 80228.

Hydrogeology of the Madison Aquifer System. The Madison aquifer system is a regional system composed of geologic units from the Precambrian-age basement rocks to the Cretaceous-age shales. The most important aquifer within this system is the Mississippian-age Madison Group (also called the Madison Limestone, Madison Formation, Pahasapa Formation, or Guernsey Formation) and adjacent hydraulically connected strata.

The Madison Group is found in parts of Wyoming, Montana, North and South Dakota,



Map 3-1. PHYSIOGRAPHIC FEATURES NEAR THE NIOBRARA, GILLETTE, AND CROOK COUNTY WELL FIELDS

and Canada, covering an area of over 180,000 square miles. Rock units equivalent to the Madison Group have been recognized throughout many other parts of the western United States and Canada. Composed largely of limestone and dolomite, the Madison Group is a source of water for domestic, stock, industrial, and agricultural users. In some places, oil is also produced from the Madison Group. In the area of interest, the Black Hills region of South Dakota and Wyoming and the eastern part of the Powder River Basin of Wyoming and Montana, the Madison Group has not been fully developed but is the potential source of water supply for large-scale energy development, as well as other developments that require less water (USGS 1975).

Stratigraphy. The major water-bearing units in the Madison aquifer system in the Black Hills region and eastern Powder River Basin are the Paleozoic carbonates of the Madison Group and of the Red River Formation. These units outcrop in a narrow elliptical band around the core of the Black Hills and adjacent to the Rawhide fault in the Hartville uplift (Map 3-2). The outcrop area of these Paleozoic carbonates is approximately 480 square miles in the Black Hills and approximately 13 square miles in the Hartville uplift area.

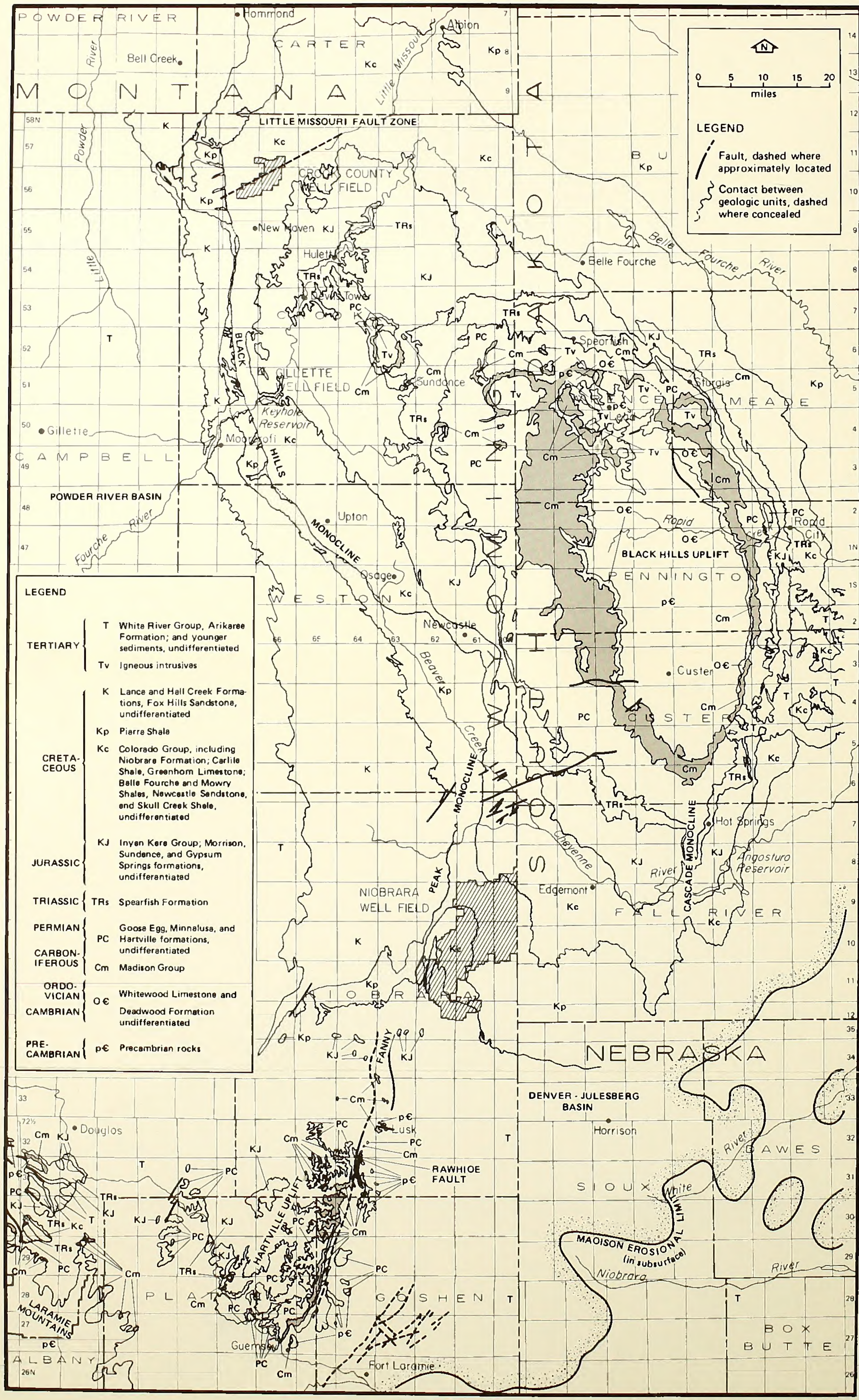
The Paleozoic carbonates of the Madison Group and the Red River Formation (Figure 3-1) thin rather uniformly from southeastern Montana south through the Black Hills region. The Madison Group thins from over 1200 feet in southeastern Montana southward to the erosional boundary of the Madison Group in southeastern Wyoming and northwestern Nebraska. The Red River Formation thins from over 400 feet in southeastern Montana to zero thickness in the northern part of the Black Hills uplift.

The Madison Group in the Black Hills region is composed almost entirely of carbonates, with dolomite comprising over 50 percent of these carbonates. For the most part, the carbonates are dense, with low porosity and permeability, though high intergranular porosity exists in localized beds of coarsely crystalline dolomite. The importance of the Madison Group as an aquifer is due largely to the presence of well-developed zones of secondary porosity and permeability.

The Red River Formation is a crystalline dolomite and fossiliferous fragmental limestone unit. Generally south of the Wyoming-Montana border the Red River Formation changes from a predominantly fossiliferous limestone facies to a characteristic crystalline sucrosic dolomite facies. The water-yielding properties of the Red River Formation, like those of the Madison Group, are related to secondary porosity and permeability development.

In the southern part of the area, the Paleozoic carbonates overlie the Deadwood Formation. In the northern part of the area, the carbonates overlie the Winnipeg Formation, which overlies the Deadwood Formation. The Winnipeg Formation consists of about 200 feet of sandstones, interbedded with shales. The Winnipeg-Aladdin Sandstone, which is over 100 feet thick in extreme northeastern Wyoming, has excellent porosity but the unit is not tapped as a water supply. The Deadwood Formation, which averages about 400 feet in thickness in the Black Hills region, is composed of sandstones and sandy dolomites. The Deadwood Formation is usually very dense, includes partings of shale, and is not considered to be an important aquifer.

Overlying the Madison Group is the Minnelusa Formation of Pennsylvanian and Permian age. The Minnelusa Formation varies in thickness from about 400 feet in southeastern Montana to over 1400 feet in northwestern Nebraska. The Minnelusa Formation has been divided into three informal members by Foster (1958); the middle and lower members, which are composed predominantly of dolomites and limestones interbedded with shales, evaporites, and sandstones, and the upper member, composed of sandstone, carbonates, and evaporites. The basal part of the lower member, called the Bell Sand, is a discontinuous clastic unit which can be as thick as 200 feet. The Bell Sand fills the irregular karstic surface on the top of the Madison Group. The upper member of the Minnelusa Formation changes from predominantly sandstones of up to 400 feet in thickness in the northern part of the Black Hills region to



Map 3-2. GENERALIZED SURFICIAL GEOLOGY OF THE BLACK HILLS AND EASTERN POWDER RIVER BASIN

SYSTEM	SERIES	STRATIGRAPHIC UNIT	THICKNESS (FEET)	DESCRIPTION
Quaternary	Recent and Pleistocene	Alluvium and stream terraces		Silt, sand, and gravel.
		Unconformity		
Tertiary	Oligocene	White River Formation	0 - 150	Light-gray medium- to coarse-grained sandstone at base overlain by light brownish-gray claystone and siltstone.
		Unconformity		
Tertiary	Eocene	Wasatch Formation	300 +	Grayish-yellow sandstones and gray shale, numerous coal beds; thick extensively burned coal bed (Roland bed of U.S. Geol. Survey Bull. 796-A) at base.
Tertiary	Paleocene	Fort Union Formation: Tongue River member	500 - 800 ±	Yellowish-gray massive sandstone and light-gray shale; numerous coal beds: thickest in Montana; thins southward.
Tertiary	Paleocene	Fort Union Formation: Lebo shale member	200 - 250	Medium- to dark-gray shale, light-gray sandstone, and a few thin coal beds.
Tertiary	Paleocene	Fort Union Formation: Tullock member	500 - 1,100	Light-gray and light-brown sandstone, gray shale, and numerous thin coal beds: thinnest in Montana; thickens southward.
Cretaceous	Upper Cretaceous	Lance Formation	500 - 1,600	Gray to yellowish-gray sandstone and gray shale; a few thin beds of carbonaceous shale; thinnest in Montana; thickens southward.
Cretaceous	Upper Cretaceous	Montana Group: Fox Hills Sandstone: Colgate member, 50-100 ft.	125 - 200	Brown sandy shale and siltstone, light-gray sandstone, and brown ferruginous sandstone concretions; the Colgate member, a prominent massive white sandstone, at top in Montana.
Cretaceous	Upper Cretaceous	Montana Group: Pierre Shale: Upper part: Kara bentonitic member, 100 ± ft.; Monument Hill bentonitic member, 150-220 ft.	800 - 1,500	Dark-gray shale and claystone; locally beds of siltstone; abundant limestone concretions some fossiliferous in upper and lower parts; thickens southward from Montana. Kara and Monument Hill bentonitic members, gray bentonitic shale and impure bentonite with a few limestone concretions and small barite concretions.
Cretaceous	Upper Cretaceous	Montana Group: Pierre Shale: Mitten black shale member	145 - 1,000	Dark-gray to black shale with beds of yellowish-gray bentonite at base and numerous large yellowish-brown-weathering fossiliferous septarian limestone concretions in upper part; thickens southward from Montana.
Cretaceous	Upper Cretaceous	Montana Group: Pierre Shale: Gammon ferruginous member: Groat sandstone bed, 0-125 ft.	0 - 1,000	Light-gray claystone and shale with abundant reddish-brown iron-stained concretions and thin lenses of siderite. Groat sandstone bed, mapped north of T. 55N., consists of gray fine-grained glauconitic and ferruginous sandstone.
Cretaceous	Upper Cretaceous	Colorado Group: Niobrara Formation	150 - 225	Chalk marl and calcareous shale; numerous thin beds of bentonite, dark gray when fresh, weathers light yellow.
Cretaceous	Upper Cretaceous	Colorado Group: Carlile Shale: Sage Breaks member	200 - 300	Grayish-black noncalcareous shale with numerous beds of septarian limestone concretions that weather light gray.
Cretaceous	Upper Cretaceous	Colorado Group: Carlile Shale: Turner sandy member	150 - 260	Dark-gray shale, locally sandy and silty, with numerous beds of light-yellow and red silty limestone concretions; commonly a thin bed of light-gray medium-grained sandstone at the base.
Cretaceous	Upper Cretaceous	Colorado Group: Carlile Shale: Lower unnamed number	40 - 130	Dark-gray shale with a few limestone concretions; locally slightly silty and sandy; thickest in Montana.
Cretaceous	Upper Cretaceous	Colorado Group: Greenhorn Formation	70 - 370	In northeastern and southeastern parts, gray calcareous shale and marl with some light-gray, thin-bedded limestone; in central part; gray noncalcareous shale containing prominent light-gray weathering septarian limestone concretions; thins westward.
Cretaceous	Upper Cretaceous	Colorado Group: Belle Fourche Shale	350 - 850	Dark-gray to black shale with numerous dark purplish-red weathering siderite concretions in lower part, and several beds of light-gray and yellow-weathering limestone concretions in middle and upper parts; thickens westward.
Cretaceous	Lower Cretaceous	Colorado Group: Mowry Shale	180 - 230	Dark-gray siliceous shale, weathers light gray; numerous fish scales along partings; many thin bentonite beds; Clay Spur bentonite bed at top.
Cretaceous	Lower Cretaceous	Colorado Group: Newcastle Sandstone	0 - 95	Lenticular beds of light-gray sandstone and siltstone and dark-gray shale and claystone; a few beds of impure coal and bentonite; thickness varies within short distances, but averages about 40 feet.
Cretaceous	Lower Cretaceous	Colorado Group: Skull Creek Shale	180 - 270	Black shale with a few dark-red ferruginous concretions.
Cretaceous	Lower Cretaceous	Inyan Kara Group: Fall River Formation	95 - 200	Fine- to medium-grained light yellowish-brown to brown sandstone with interbedded gray and black shale and gray siltstone; averages about 135 feet in thickness near its outcrop.
		Unconformity		
Cretaceous	Lower Cretaceous	Inyan Kara Group: Lakota Formation	45 - 300	Light yellowish-gray to white fine- to coarse-grained sandstone and conglomeratic sandstone irregularly interbedded with red, green, yellow, gray, and black claystone; coal beds near base locally; thickness varies within short distances.
Jurassic	Upper Jurassic	Morrison Formation	0 - 150	Greenish-gray, green, and grayish-red claystone with a few thin discontinuous beds of light-gray sandstone and limestone; thickness at most places between 80 and 120 feet.
Jurassic	Upper Jurassic	Sundance Formation: Redwater shale member	30 - 195	Greenish-gray soft fissile sandy and silty shale; includes some thin beds of glauconitic sandstone and oolitic and coquinoid limestone; thickness at most places between 160 and 190 feet.
Jurassic	Upper Jurassic	Sundance Formation: Lak member	40 - 80	Yellow and pink crudely bedded fine-grained sandstone and siltstone.
Jurassic	Upper Jurassic	Sundance Formation: Hulett sandstone member	55 - 90	Yellowish-gray fine-grained thin-bedded to massive calcareous sandstone; locally pink northeast of Devils Tower.
Jurassic	Upper Jurassic	Sundance Formation: Stockade Beaver shale member	50 - 90	Soft gray calcareous shale with some thin beds of yellowish-gray sandstone.
Jurassic	Upper Jurassic	Sundance Formation: Canyon Springs sandstone member	0 - 40	Friable yellowish-gray or pink sandstone, some light greenish-gray siltstone.
		Unconformity		
Jurassic	Middle Jurassic	Sundance Formation: Gypsum Spring member	0 - 125	At base, massive white gypsum with interbedded red gypsiferous claystone; overlain near Hulett by interbedded gray cherty limestone and red claystone; thins southward from a maximum observed thickness of 125 feet near the junction of Deer Creek and the Belle Fourche River (SW ¼ sec. 13, T. 55 N., R. 64 W.).
		Unconformity		
Triassic and Permian		Spearfish Formation	450 - 825	Red sandy shale, siltstone, and sandstone; beds of massive white gypsum in lower half.
Permian		Goose Egg Formation: Minnekahta Limestone	40 ±	Light-gray thin-bedded limestone, pink on outcrop.
Permian		Goose Egg Formation: Opeche Formation	60 - 90	Reddish-brown and maroon fine-grained sandstone, siltstone, and shale.
		Unconformity		
Permian and Pennsylvanian		Minnelusa Formation	650 - 800	Light-gray and red sandstone, gray limestone and dolomite, red shale, local gypsum and anhydrite.
		Unconformity		
Mississippian		Madison Group	500 - 600	Light-gray limestone, locally dolomitic.
Mississippian	Lower Mississippian	Englewood Limestone	50 - 60	Pink or purplish-gray thin-bedded limestone; locally shaly.
		Unconformity		
Ordovician	Upper Ordovician	Red River Formation	50 - 60	Mottled grayish-yellow massively bedded dolomite, locally cherty near top.
Ordovician	Middle Ordovician	Winnipeg Formation	60 - 70	Upper part greenish-gray siltstone, lower part greenish-gray shale (Furnish, Barragy, and Miller, 1936; Carlson, 1958).
		Unconformity		
Cambrian and Ordovician	Upper Cambrian and Lower Ordovician	Deadwood Formation	300 - 500	Brown sandstone, gray glauconitic limestone and edgewise limestone conglomerate, and green shale.
		Unconformity		
Precambrian				Metamorphic and igneous rocks.

Source: Robinson, Mapel and Bergendahl, 1964.

Figure 3-1. GENERALIZED STRATIGRAPHIC COLUMN FOR THE EXPOSED SEDIMENTARY ROCKS ON THE NORTHERN AND WESTERN FLANKS OF THE BLACK HILLS UPLIFT

a unit of over 600 feet in thickness composed of predominantly carbonates and evaporites south of the Black Hills. The upper member of the Minnelusa yields large quantities of water in Crook County, Wyoming, and in Butte and Lawrence counties, South Dakota.

Above the Minnelusa Formation in the Black Hills region is a 1000- to 1500-foot-thick sequence consisting predominantly of clastic sediments (mainly siltstones) comprising the Goose Egg, Spearfish, Sundance, and Morrison formations. The Minnekahta Limestone member of the Goose Egg Formation and the Hulett Sandstone member of the Sundance Formation are, locally, water-yielding units within this sequence. Overlying the Morrison Formation is the Inyan Kara Group, which varies in thickness from 150 to 400 feet in the Black Hills region. The Fall River Formation (Dakota Sandstone equivalent) of the Inyan Kara Group is an important aquifer in Niobrara and Crook counties; wells open to this unit yield small to moderate quantities of potable water.

A 4000- to 5500-foot sequence of Cretaceous shales, which includes the Skull Creek Shale, the Mowry Shale, the Greenhorn Formation, the Carlile Shale, the Niobrara Formation, and the Pierre Shale, overlies the Inyan Kara Group. This thick sequence of shales has a very low vertical hydraulic conductivity that, in effect, hydraulically isolates the aquifer systems below the shales from the Cretaceous aquifers above the shales. Important aquifers above the Cretaceous shales are the Cretaceous Fox Hills and Lance Creek formations, and the Tertiary Fort Union, Wasatch, and Arikaree formations.

Structure. Water movement in the Madison aquifer system is influenced by the geologic structure in the Black Hills and eastern Powder River Basin region (Map 3-3). The Madison Group is exposed on the flanks of the Black Hills and in the Hartville uplift, but the Madison Group lies more than 10,000 feet below land surface in the deepest part of the Powder River Basin about 100 miles west of the Black Hills. A sharp line of folding and faulting defines the western extent of the Black Hills uplift and the eastern extent of the Powder River Basin. This sharp zone of folding and faulting has from 2000 to 10,000 feet of structural relief with dips as great as 90 degrees, and is generally interpreted as a series of basement faults that are generally expressed at the surface as drape folding in monoclines. The Madison Group may be faulted and displaced along this zone, as occurs in the Hartville uplift. This structure, which extends southwest of the Crook County site through the Hartville uplift, is called the Black Hills monocline north and west of Newcastle, and the Fanny Peak monocline between Newcastle and the proposed Niobrara County well field. South of the Niobrara well field, the sharp zone of folding and faulting splits into the Shawnee flexure, which separates the Powder River Basin from the Hartville uplift, and the Rawhide fault, which separates the Hartville uplift from the Denver-Julesberg Basin.

Large, sharp monoclinal flexures do not occur east or north of the Black Hills, but a sharp monoclinal flexure called the Cascade anticline, which dips westward at up to 70 degrees and has a maximum structural relief of over 1600 feet, occurs south of the Black Hills. Several large Madison aquifer or Minnelusa aquifer springs occur at the apex of the Cascade anticline.

Prominent zones of faulting in which little displacement of strata occurs also may influence water movement in the Madison aquifer. The Little Missouri fault zone, a zone several miles wide in which many faults with displacements of less than 30 feet occur, parallels the Little Missouri River near the Crook County well field in northeastern Wyoming and southeastern Montana. The Dewey fault zone, located northeast of the proposed Niobrara well field, is a zone of small faults running from the Madison outcrop area in the Black Hills to the Fanny Peak monocline. North of the Black Hills region a structure trending along the strike of the Lake Basin fault zone (a major structure mapped to the northwest in central Montana) apparently influences ground-water movement in the Madison aquifer system, since hydraulic properties appear to change north and south of this trend.

Ground-water Movement. The potentiometric surface of the Madison aquifer has been recently mapped by Miller and Strausz (1980) (Map 3-4). The potentiometric surface of the Madison aquifer in the vicinity of the Black Hills has also been mapped by Swenson and others (1976) and Eisen and others (1980). The contour maps prepared by the three groups are similar, except that Eisen and others (1980) mapped the Madison aquifer potentiometric surface within the Madison Group outcrop area of the Black Hills. Potentiometric data are abundant near the Black Hills where there are many wells and springs, but data points are few outside the Black Hills uplift area.

The vertical component of the potentiometric gradient in the Madison aquifer system can be described by the relationship between potentiometric heads in the Madison aquifer and land surface elevations (Figure 3-2). The potentiometric surface of the Madison aquifer is above land surface in most of the area north, east, and south of the Black Hills and in the larger stream valleys west and northwest of the Black Hills. The potentiometric surface of the Madison aquifer is generally below land surface outside major stream valleys west of the Black Hills and in the Powder River Basin south of the Wyoming-Montana state line.

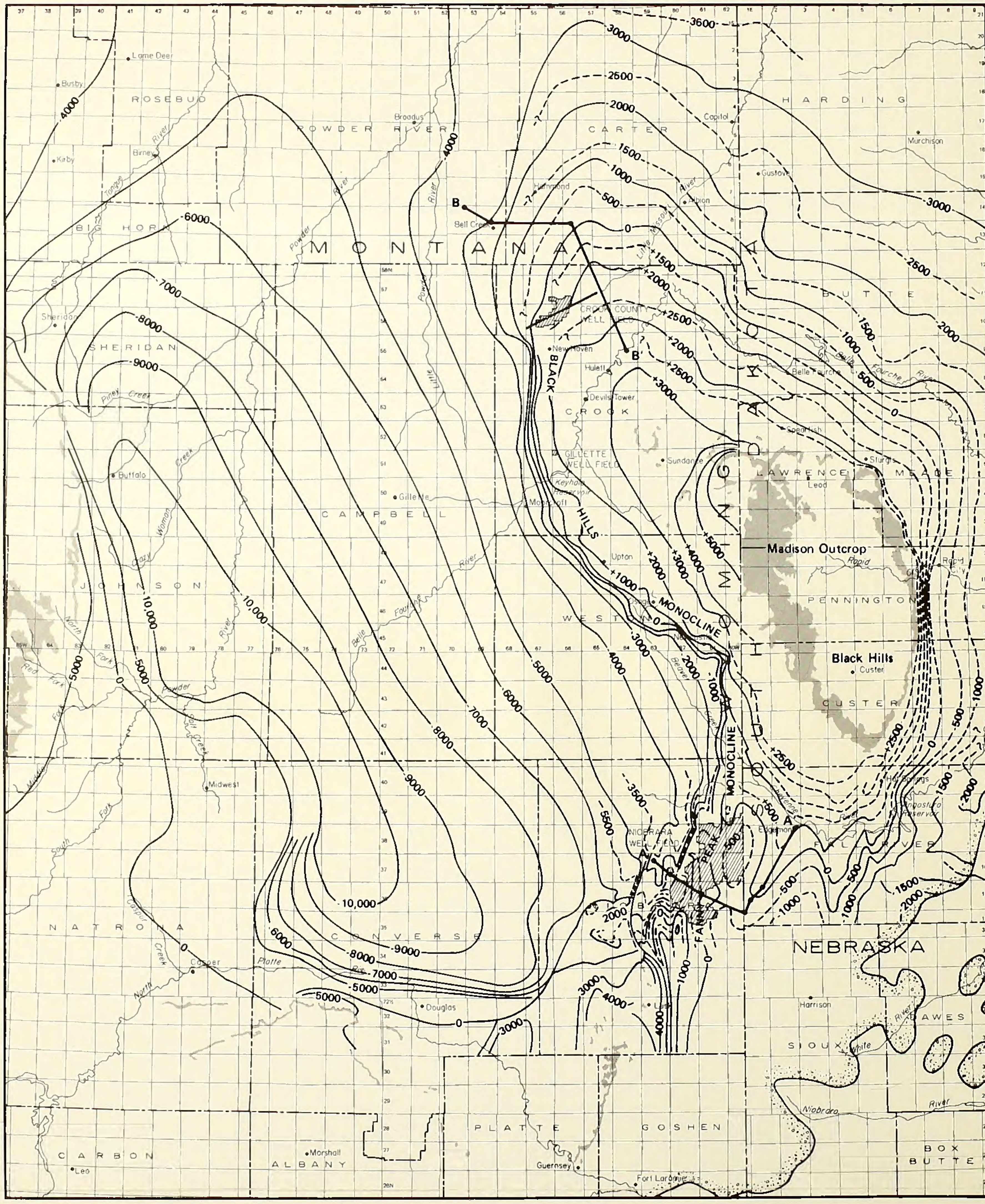
The potentiometric gradients in the Madison aquifer indicate that water recharges the Madison aquifer system at outcrop areas in the Black Hills and in the Hartville and Laramide uplifts, and then flows away from these outcrop areas. Ground water that recharges the Madison aquifer on the northern and eastern flanks of the Black Hills moves toward the northeast. The major discharge area for this water is probably the Missouri River valley, as hypothesized by Swenson (1968). Water that recharges the Madison aquifer in the Hartville uplift also moves toward the east and northeast. The water that recharges the Madison aquifer on the western flanks of the Black Hills and in the Laramide uplift flows toward the Powder River Basin (Figure 3-2).

The steep monoclinal flexures that define the western, southern, and eastern sides of the Powder River Basin are likely zones of relatively low transmissivity, which effectively limit ground-water movement into the basin. The ground water that does flow into the basin from the outcrop areas across these low-transmissivity zones probably moves very slowly toward the north, where steep monoclinal flexures do not define the basin, or toward the southeast.

North, east, and south of the Black Hills, the Madison Group dips steeply away from the outcrop areas. Within several miles of the outcrop areas, a thick sequence of Cretaceous shales separates the Madison aquifer from the land surface. As a result of the thick capping of Cretaceous shales, large upward potentiometric gradients exist in the Madison aquifer north, south, and east of the Black Hills. The low effective vertical hydraulic conductivity of these shales does not permit significant amounts of ground water to leak upward from the Madison aquifer, even where large potentiometric gradients exist.

Ground water that recharges the Madison aquifer at the western Black Hills outcrop areas moves in a semiradial pattern away from these recharge areas. Most of this ground water probably discharges from the Madison aquifer east of the Black Hills and Fanny Peak monoclines as springs and seeps in the stream valleys, and to shallower aquifers where an upward potentiometric gradient exists (Figure 3-2). The Pennsylvanian- to Lower Cretaceous-age sediments west of the Black Hills uplift between the Madison Group outcrop area and the Black Hills monocline provide a hydrogeologic environment that is conducive to upward leakage of significant amounts of ground water from the Madison aquifer (Figure 3-2).

Recharge to the Madison Aquifer. Potential recharge to the Madison aquifer includes: (1) the direct recharge that occurs by precipitation falling on the outcrop area, (2) indirect recharge that occurs by the downward movement of water from the Minnelusa Formation, and (3) recharge by influent streams that cross the outcrop area. In some areas, the Madison aquifer may also receive recharge from strata that are stratigraphically below the Madison Group.



LEGEND

Structure contour on top of Madison Group, elevation in feet (Mean Sea Level). Dashed where approximately located; queried where uncertain.

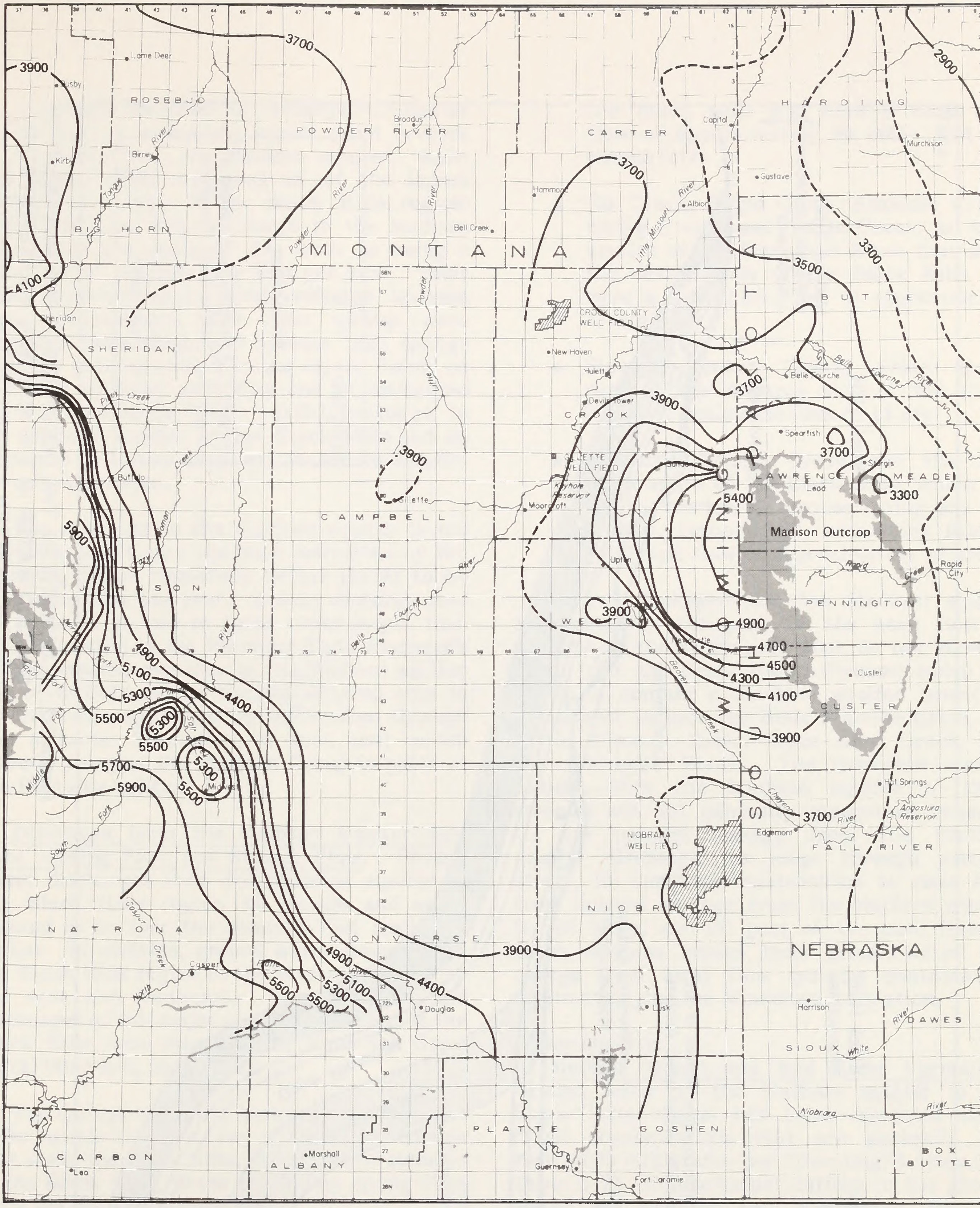
B———B' Location of geologic cross section

0 5 10 15 20
miles

Source: Adapted from DeGolyer and MacNaughton, 1974; Gott and others, 1974; Head and Merkel, 1977; Horton, 1953; Keefer, 1974; Keene, 1973; Lisenbee, 1978; Northrup, 1939; Old West Regional Commission, 1976; Petroleum Information Service, 1980; Stafford, 1979; Swenson and others, 1976; Whitcomb, 1965; Wulf, 1963; Wulf, 1974; Pierce and Girard, 1952.

NOTE: The structure contours on this map were constructed by adapting the shape of structure contours prepared by various source authors on higher stratigraphic units such as the Fall River Sandstone, the top of the Minnelusa, and the Minnelusa Red Shale Marker. The depth interval between the higher stratigraphic unit and the Madison at oil well control points was determined and used to adjust the contours.

Map 3-3. STRUCTURAL GEOLOGY ON THE MADISON GROUP IN THE BLACK HILLS AND POWDER RIVER BASIN AND LOCATIONS OF CROSS SECTIONS



Source: Miller and Strausz, 1980.

LEGEND

—?—?—4700— Line of equal potentiometric head distribution (in feet). Dashed where approximately located, queried where uncertain

N

0 5 10 15 20 miles

Map 3-4. POTENTIOMETRIC HEAD DISTRIBUTION IN THE MADISON AQUIFER (feet)

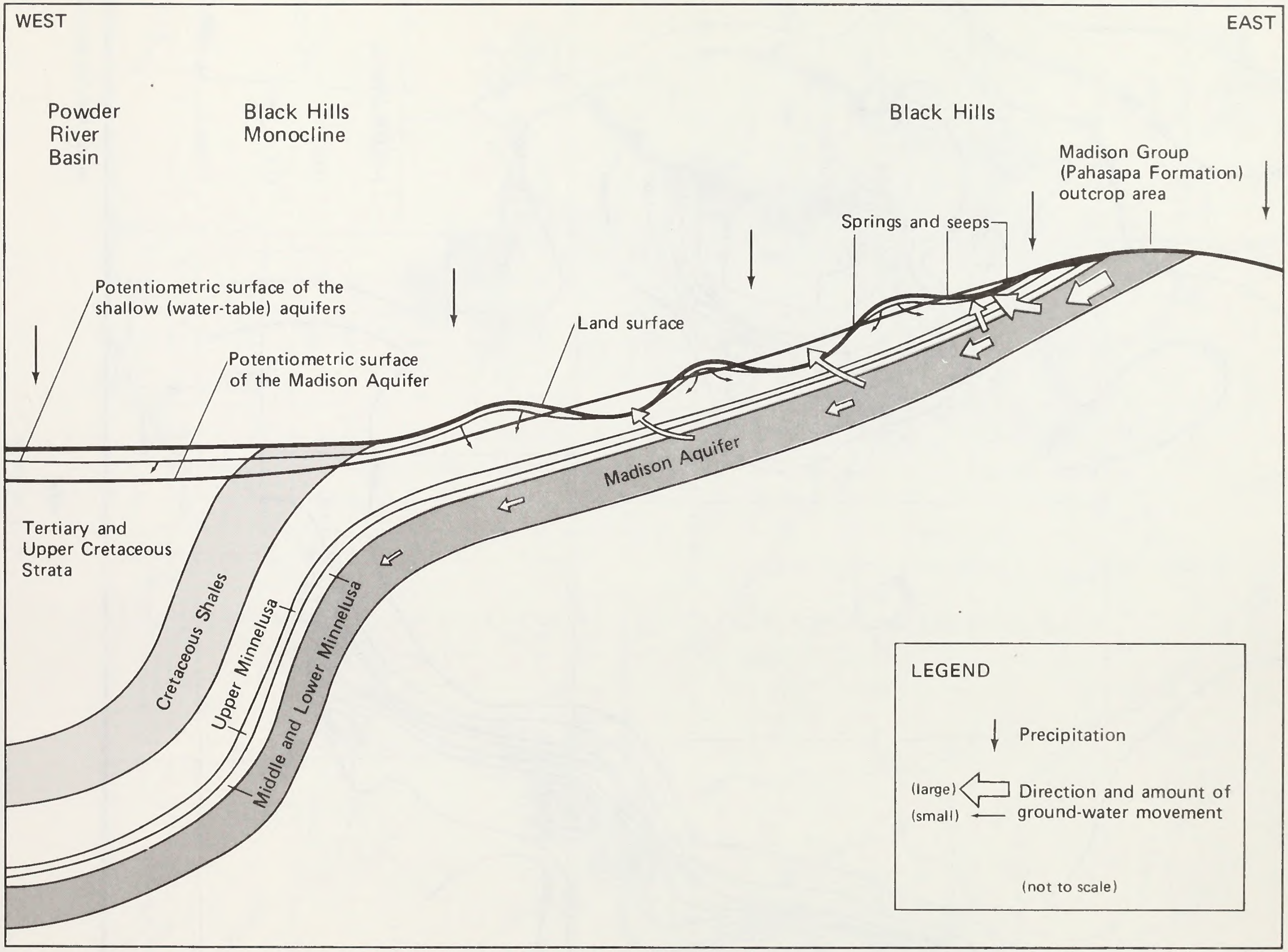


Figure 3-2. SCHEMATIC OF THE OCCURRENCE AND MOVEMENT OF GROUND WATER IN THE MADISON AQUIFER SYSTEM ON THE WESTERN FLANKS OF THE BLACK HILLS

The lower bound on the recharge rate can be determined by measuring known point sources of discharge from the Madison aquifer. Rahn and Gries (1973) measured all of the known springs and seeps in the Black Hills region. They estimated total recharge to the Madison aquifer on the basis of this work as being a minimum of 139,000 acre-feet per year. Their work underestimated total recharge because they acknowledged that some springs were probably overlooked, and because only springs near the outcrop area were surveyed. Based on the work by Rahn and Gries and on calculated potential recharge (WCC 1980b), recharge to the Madison aquifer in the Black Hills can be stated to be in the range of 140,000 to 400,000 acre-feet per year.

The recharge to the Madison aquifer in the Hartville uplift area has been estimated by the Wyoming State Engineer's Office (1976) to be 2800 acre-feet per year. Actual recharge may be as much as two to three times larger than that estimated by the Wyoming State Engineer's Office because recharge to the Madison aquifer can occur both at the Madison outcrop area in the Hartville uplift and by infiltration through the Arikaree Formation, a rock unit which directly overlies the Madison Group in parts of the Hartville uplift.

Discharge from the Madison Aquifer System: Spring Flow and Stream Flow. Ground water discharges from the Madison aquifer in the Black Hills region as springs and seeps located in or near the streams that drain the region. In addition, ground water flows out of the Black Hills region in the Madison aquifer to the east and northeast. The locations and discharges of the major springs and seeps in the Black Hills were measured by Rahn and Gries (1973) (Map 3-5, Table 3-1).

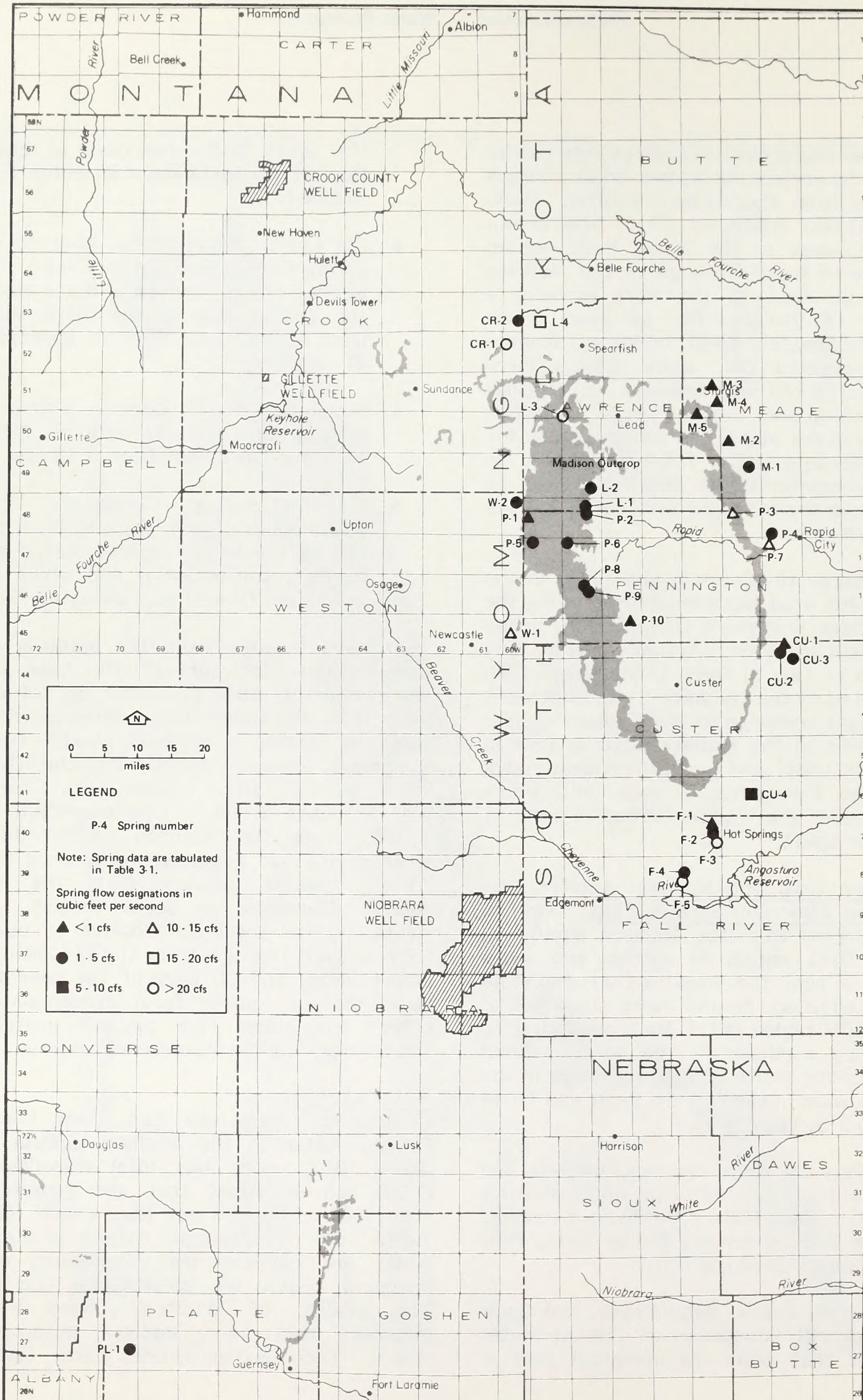
The springs and seeps measured by Rahn and Gries sustain the base flow of all major streams that drain the Black Hills. These major streams in the Black Hills, which are fed by spring flow from the Madison Group, are:

- Spearfish Creek, Sand Creek, and Crow Creek, all tributaries of the Redwater River that drain the northeast part of the Black Hills and have a total base flow of approximately 80 cubic feet per second (cfs)
- Elk Creek, Rapid Creek, Boxelder Creek, Spring Creek, and Battle Creek, all tributaries of the Cheyenne River that drain the eastern side of the Black Hills and have a total base flow of approximately 47 cfs
- Stockade-Beaver Creek, which drains part of the western side of the Black Hills and has a base flow of 13 cfs
- Cascade Springs Creek and the Fall River south of the Black Hills, which are fed by the large Cascade Spring and Hot Springs, respectively, and which have a total base flow of approximately 50 cfs

Upward leakage from the Madison aquifer also accounts for part of the base flow of streams in the study area that do not directly drain from the Black Hills. Streams which are likely to contain a Madison aquifer base-flow component include the Belle Fourche River, the Little Missouri River, Inyan Kara Creek, and the Cheyenne River. The base-flow contributions from the Madison aquifer to these streams are not generally recognized because: (1) the upward leakage from the Madison aquifer discharges as seeps through younger strata, (2) the total contribution to base flow from upward leakage from the Madison aquifer is not large, and (3) part of the base flow of these streams comes from ground-water discharge from local flow systems contained in strata overlying the Minnelusa Formation.

Water Quality.

Madison Group and Red River Formation. Ground water in the Madison aquifer in the Black Hills region has total dissolved solids (TDS) concentrations that are generally less than 1000 milligrams per liter (mg/l) (Map 3-6, Table 3-2). The principal cations in the ground water are calcium and magnesium, and the principal anions are bicarbonate and sulfate. The quality of Madison ground water is generally best near Madison outcrop areas where TDS concentrations are less than



Source: Cox, 1962;
Rahn and Gries, 1973;
Stockdale, 1974.

Map 3-5. SPRINGS IN THE BLACK HILLS AND EASTERN POWDER RIVER BASIN

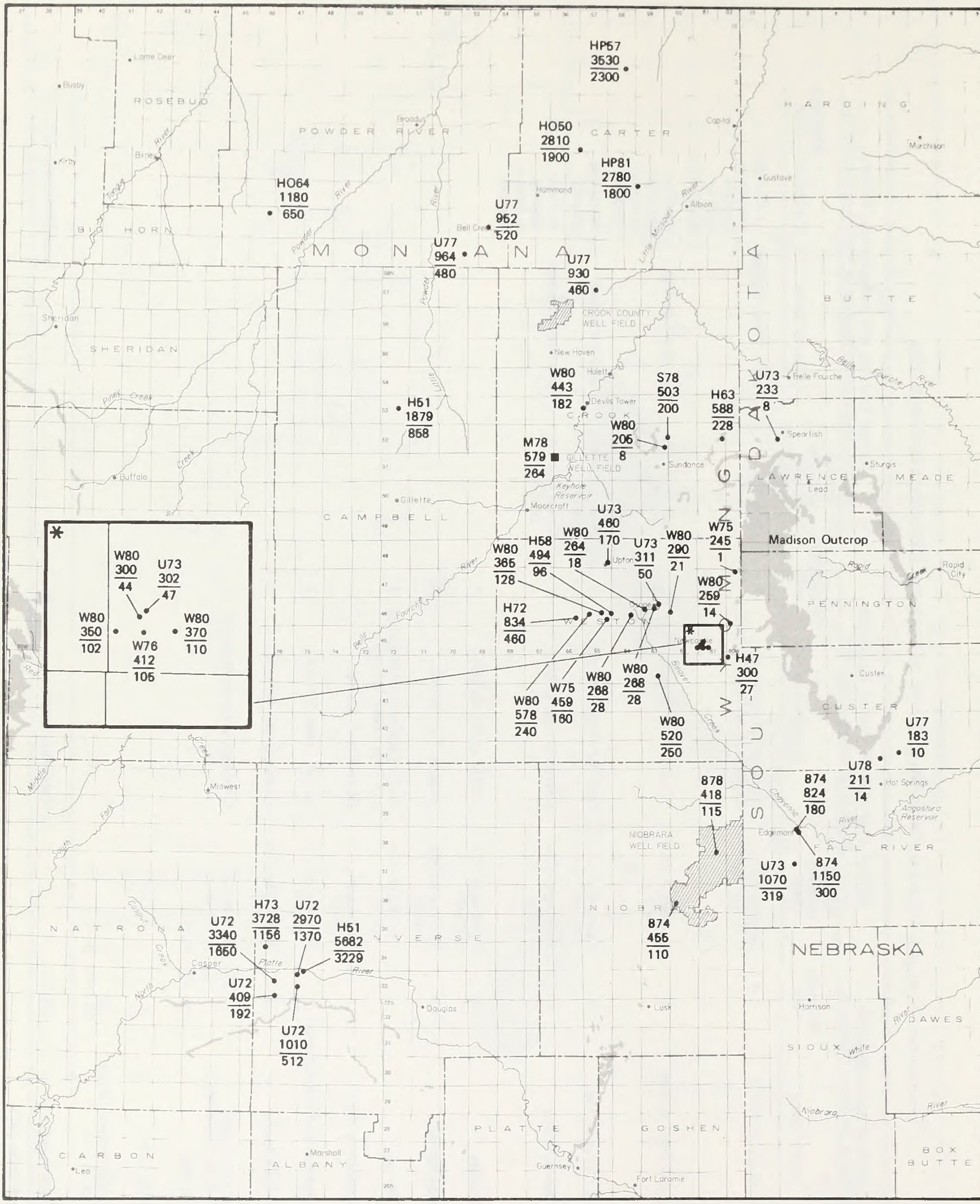
TABLE 3-1

SPRINGS OF THE BLACK HILLS REGION AS THEY RELATE TO REGIONAL GEOLOGY AND GEOGRAPHY

Springs That Occur at the Minnekahta-Spearfish Contact or in the Spearfish or Sundance Formation			Springs on or near the Central Black Hills Madison Limestone Plateau			Springs That Are Not in the Central Plateau, and That Occur in the Madison or Minnelusa Formation			
Spring Location (No.)*	Spring Name	Discharge (cfs)	Spring Location (No.)*	Spring Name	Discharge (cfs)	Spring Location (No.)*	Spring Name	Comment	Discharge (cfs)
Custer Co. (Cu-1)	Deadman Gulch Spring	0.8	Lawrence Co. (L-1)	Headquarter Spring on South Fork of Rapid Creek	3	Custer Co. (Cu-2)	Battle Creek Springs	At Madison-Minnelusa contact east of Black Hills	1
Custer Co. (Cu-3)	Grace Coolidge Springs	1	Lawrence Co. (L-2)	Tilson Creek Springs	2	Fall River Co. (F-2)	Hot Brook Springs	Madison outcrop in stream channel	2
Custer Co. (Cu-4)	Beaver Creek Spring	9	Lawrence Co. (L-3)	Spearfish Creek Springs	40	Pennington Co. (P-7)	Cleghorn Spring	Minnelusa outcrop	10
Fall River Co. (F-1)	Cold Brook Spring	0.7	Pennington Co. (P-5)	Beaver Creek Spring	2	Crook Co. (CR-1)	Sand Creek Springs	Madison outcrop in stream channel	24
Fall River Co. (F-3)	Hot Springs	23	Pennington Co. (P-6)	Castle Creek Spring	4				
Fall River Co. (F-5)	Cascade Spring	23	Pennington Co. (P-2)	Rhoads' Fork Spring	4				
Fall River Co. (F-4)	Cold Spring	1	Pennington Co. (P-8)	South Fork of Castle Spring and Pole Creek Springs	1				
Lawrence Co. (L-4)	Crow Creek Springs	17	Pennington Co. (P-9)	Ditch Creek Springs	3				
Meade Co. (M-1)	Elk Creek at Piedmont Spring	2	Pennington Co. (P-10)	Spring Creek Springs	0.2				
Meade Co. (M-3)	Bear Butte Spring	0.6	Pennington Co. (P-1)	Soldier Creek Springs	0.4				
Meade Co. (M-4)	Alkali Creek near Black Hills Cemetery	0.6	Weston Co. (W-2)	Cold Spring Creek Springs	2				
Pennington Co. (P-4)	City Spring	1							
Crook Co. (CR-2)	Montana Lake								
Weston Co. (W-1)	Stockdale-Beaver Creek Springs	13							
	Total Discharge:	92.7		Total Discharge:	61.6			Total Discharge:	37

Data source: Rahn and Gries 1973.

*See Map 3-5 for locations of springs.



LEGEND

Source code (see sources)
H78 — Year collected
1120 — Total dissolved solids, mg/l
400 — Sulfate ion concentration, mg/l

N

0 5 10 15 20
miles

Source:
- B - Bechtel, undated
- H - Hodson, 1974
- HO - Hopkins, 1976
- M - Montgomery Engineers, 1979
- U - U.S. Geological Survey data bank, collected by USGS, all U73 samples collected by Back
- W - Eisen and others, 1980

Map 3-6. WATER QUALITY IN THE MADISON GROUP, BLACK HILLS, AND EASTERN POWDER RIVER BASIN

TABLE 3-2

REPRESENTATIVE WATER QUALITY ANALYSES OF THE MINNELUSA FORMATION, MADISON GROUP, AND RED RIVER FORMATION IN THE VICINITY OF THE NIOBRARA COUNTY, CROOK COUNTY, AND GILLETTE WELL-FIELD SITES (in milligrams per liter, except as noted)

Well No. (Township-Range-Section)	Date of Sample	Temp (°C)	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	Total Dissolved Solids	pH (units)
MINNELUSA FORMATION												
Near Minnelusa Outcrop Areas												
54N-64W-7BC, Wyo.	06-04-68	-	110	36	3	2	286	180	2	-	485	7.7
47N-60W-30AA, Wyo.	06-03-69	-	68	24	1	1	305	12	1	-	280	7.9
6N-2F-10DA, S. Dak.	11——54	-	63	21	7	-	296	8	4	-	247	-
Near the Black Hills Monocline, Crook County, Wyoming												
51N-66W-09db	-	-	620	220	130	-	293	2200	16	-	3,300	8.0
52N-67W-19cc	01-22-58	-	740	230	5	-	330	2400	14	-	3,580	7.0
52N-68W-20dd	08-04-64	-	580	190	30	68	232	2000	40	-	3,040	8.4
Niobrara County, Wyoming												
35N-63W-15bd	02-14-65	-	600	240	250	-	709	2100	160	-	3,710	7.3
36N-64W-26ada	09-14-65	-	240	37	750	-	185	2000	130	-	3,210	7.2
West of Black Hills Monocline, Campbell County, Wyoming												
52N-69W-11cc	06-10-70	-	2400	650	76,000	-	131	2200	120,000	-	202,000	6.0
52N-69W-28db	01-07-63	-	610	230	1,100	-	378	2200	1,600	-	5,920	7.3
52N-70W-15da	07-10-63	-	1700	750	20,000	35	488	3300	34,000	-	60,500	8.1
MADISON GROUP												
Niobrara County, Wyoming												
36N-62W-28 aba	04-15-74	-	114	30.9	36.4	5.9	256	122	110.0	1.56	704	7.80
	04-26-74	46.0	110	35.0	36.0	6.1	242	120	130.0	3.60	584	7.00
36N-62W-28 baa	05-22-74	-	88	51.0	29.2	4.2	232	98	125.0	2.20	661	7.50
	05-24-74	54.0	98	35.0	28.0	6.1	219	110	110.0	3.00	526	7.00
	06-02-74	-	84	29.0	30.3	5.8	207	120	72.5	1.44	579	7.65
	06-08-74	-	78	25.5	29.8	4.8	207	104	70.0	1.28	556	7.65
	06-12-74	-	80	23.0	29.6	6.3	201	109	57.5	1.20	536	7.65
	06-13-74	-	90	24.0	27.8	4.2	207	108	62.5	1.20	554	7.50

TABLE 3-2 Concluded

Well No. (Township-Range-Section)	Date of Sample	Temp (°C)	Ca	Mg	Na	K	HCO_3	SO_4	Cl	F	Total Dissolved Solids	pH (units)
MADISON GROUP (cont.)												
	06-20-74	-	85	24.0	42.0	6.0	232	110	74.0	-	-	7.30
38N-61W 35d	09-30-78	-	80	17.0	44.0	7.0	256	115	32.0	0.57	414	8.10
Crook County, Wyoming												
51-66-6 cab	12-12-79	22.0	148	56	11.0	2.0	272	335	28	2.65	707	7.5
51-66-6 bc	02-20-80	23.0	104	40	4.0	1.0	281	195	4	0.66	488	6.8
52-63-25 dc	03-16-73	-	65	16	2.1	1.2	268	7.4	1.7	0.6	-	8.3
	12-13-79	9.0	52	17	3.0	1.0	250	4	2	0.36	204	7.6
	02-15-80	10.0	50	16	1.0	1.0	229	0	3	-	182	7.6
	03-13-80	-	57	16	3.0	1.0	244	6	4	-	205	7.8
	04-12-80	-	55	16	2.0	1.0	244	8	2	-	205	7.1
	05-13-80	-	63	14	3.0	1.0	254	10	4	-	221	7.8
53-65-18 bbd	07-11-62	-	112	43	4.0	1.0	264	275	1.5	0.5	579	7.2
	04-28-70	15.0	112	35	3.3	1.5	261	210	3.4	1.2	504	7.9
	09-27-73	-	112	36	3.0	2.0	194	185	1.5	0.3	500	7.5
	08-30-75	17.0	110	38	3.7	1.5	273	210	2.6	0.5	512	7.6
	08-30-75	10.0	66	24	1.9	1.2	307	15	1.7	0.2	273	7.6
	12-12-79	15.0	115	42	4.0	1.0	264	240	5	0.52	539	7.8
	02-15-80	13.0	98	35	2.0	1.0	220	194	6	0.56	442	7.9
	03-13-80	-	101	34	4.0	1.0	244	182	4	0.54	443	7.5
	04-12-80	-	110	39	3.0	2.0	278	200	4	0.58	494	7.1
	05-13-80	-	115	36	2.0	1.0	273	200	5	0.58	493	7.9
57-65-15da	08-05-77	47.6	180	48	35	8	190	450	51	-	902	-
RED RIVER FORMATION												
57-65-15da	08-12-71	50.0	84	39	5	2	220	190	3	-	460	-

Note: A more complete tabulation of Madison and Minnelusa water quality is contained in the Well-Field Hydrology Technical Report (WCC 1980b). Data sources are also listed in the technical report.

300 mg/l and sulfate concentrations are less than 10 mg/l. Sulfate and TDS concentrations in the Madison aquifer increase with distance from the outcrop areas. At the Niobrara County well field, which is located approximately 24 miles north of Madison Group outcrops in the Hartville uplift, TDS and sulfate concentrations average approximately 450 and 110 mg/l, respectively. At the Gillette well field, which is located approximately 35 miles west of the Madison Group outcrop in the Black Hills, TDS concentrations range from 480 to 700 mg/l and sulfate concentrations range from 195 to 335 mg/l. At the proposed Crook County well field, which is located approximately 60 miles northwest of the Madison Group outcrops in the Black Hills, TDS concentrations range from 500 to 900 mg/l and sulfate concentrations range from 200 to 460 mg/l.

Relatively high concentrations of uranium, radium 226, and strontium 90 are found in some Madison aquifer ground water. Ground water from an ETSI test well (38N-61W-35) in Niobrara County had a radium 226 concentration of 8 picocuries per liter (pCi/l) when sampled in September 1978. This concentration exceeds the Environmental Protection Agency (EPA) mandatory drinking water criterion for radium 226 of 5 pCi/l. Radium 226 levels in Madison ground water at the towns of Philip and Midland, South Dakota, have been measured as 100 and 15 pCi/l, respectively (Wilson 1979). The high concentrations of uranium and uranium decay products that are found in Madison ground water are probably related to the uranium mineralization that occurs in the Inyan Kara Group in the Black Hills region. The origin of the uranium is not known, but Gott and others (1972) suggested that the uranium reached the Inyan Kara Group by upward migration from deeper strata. Regardless of the mechanism of origin, the data available imply only that locally, relatively high concentrations of radioactive elements are found in Madison ground water.

Minnelusa Formation. The chemical quality of ground water in the Minnelusa Formation differs markedly from that in the Madison Group (Table 3-2). The lithology of the Minnelusa Formation is highly variable; as a result, ground-water quality variations in the Minnelusa Formation section are significant. Generally, three distinct lithologic units can be defined: (1) a basal clastic unit, called the Bell Sand; (2) a middle unit, consisting of carbonates with interbedded sandstones, shales, and evaporites; and (3) an upper sandy unit that is often interbedded with evaporites. Each of these lithologic units functions as a separate hydrologic unit; the upper and lower units locally yield large quantities of water to wells and the middle unit typically does not; therefore the water quality in each of these units is discussed separately.

Water quality in the sandy upper Minnelusa unit, though it is quite variable, can be divided into three distinct types:

- Calcium bicarbonate and calcium bicarbonate sulfate-type ground water with TDS concentrations of less than 1000 mg/l. This water type occurs near outcrop areas of the Minnelusa Formation.

- Calcium sulfate-type ground water with TDS concentrations of greater than 2000 mg/l. This water type occurs in the upper Minnelusa unit in the Black Hills region away from the outcrop areas. Anhydrite and gypsum in the upper Minnelusa unit are the source of the calcium and sulfate. Calcium sulfate ground water with TDS concentrations ranging from 2000 to 4000 mg/l is found in the upper Minnelusa unit in most of the Black Hills region.

- Sodium chloride-type ground water with TDS concentrations ranging from 4000 to over 200,000 mg/l west of the Black Hills monocline and possibly west of the Fanny Peak monocline. Near the Black Hills monocline in Crook County, Wyoming, sodium chloride waters are found in stratigraphic traps with oil; calcium sulfate waters occur away from these stratigraphic traps. Calcium sulfate-type water cannot be found more than a few miles west of the Black Hills monocline, except near the Montana-

Wyoming border where the monocline flattens out (Map 3-3). The high concentrations of sodium chloride in the ground water west of the Black Hills and Fanny Peak monoclines are probably the result of very slow ground-water movement.

The few water quality samples that have been taken from the middle Minnelusa unit east of the Black Hills monocline suggest that water quality in the middle Minnelusa is similar to that in the upper Minnelusa Formation.

The basal clastic unit usually contains calcium carbonate-type ground water with TDS concentrations of less than 1000 mg/l. The water quality in this unit is similar to that in the Madison aquifer and differs markedly from water quality in the upper and middle units of the Minnelusa Formation (Eisen and others 1980). Only one well is known to be completed solely in this unit, but several wells are completed in both this clastic unit and the Madison Group.

Historical Use of the Madison Aquifer System. Locations of Wells and Quantity Pumped. The first uses of ground water from the Madison aquifer in the eastern Powder River Basin and Black Hills area began in the early 1900s with the drilling of the Cambria well near Newcastle, Wyoming, and the Chicago, Burlington & Quincy (CB&Q) well in Edgemont, South Dakota. Since that time, more than 75 Madison wells are known to have been drilled and developed. Most of these wells have been drilled since 1950 and are located near Madison Group outcrop areas (Map 3-7). In the Black Hills region, current annual production exceeds 10,000 acre-feet per year. Almost all of this production occurs in four small areas: Bell Creek, Montana; Osage and Newcastle, Wyoming; and Edgemont, South Dakota. The ground water is produced for oil field water flooding operations and municipal uses, or flows to waste. Total ground-water production from the Madison aquifer in the western Black Hills region since 1900 is estimated to be approximately 300,000 acre-feet (Table 3-3). No water, oil, or gas is produced from the Madison Group in Nebraska (Ginsberg 1980, Souders 1980).

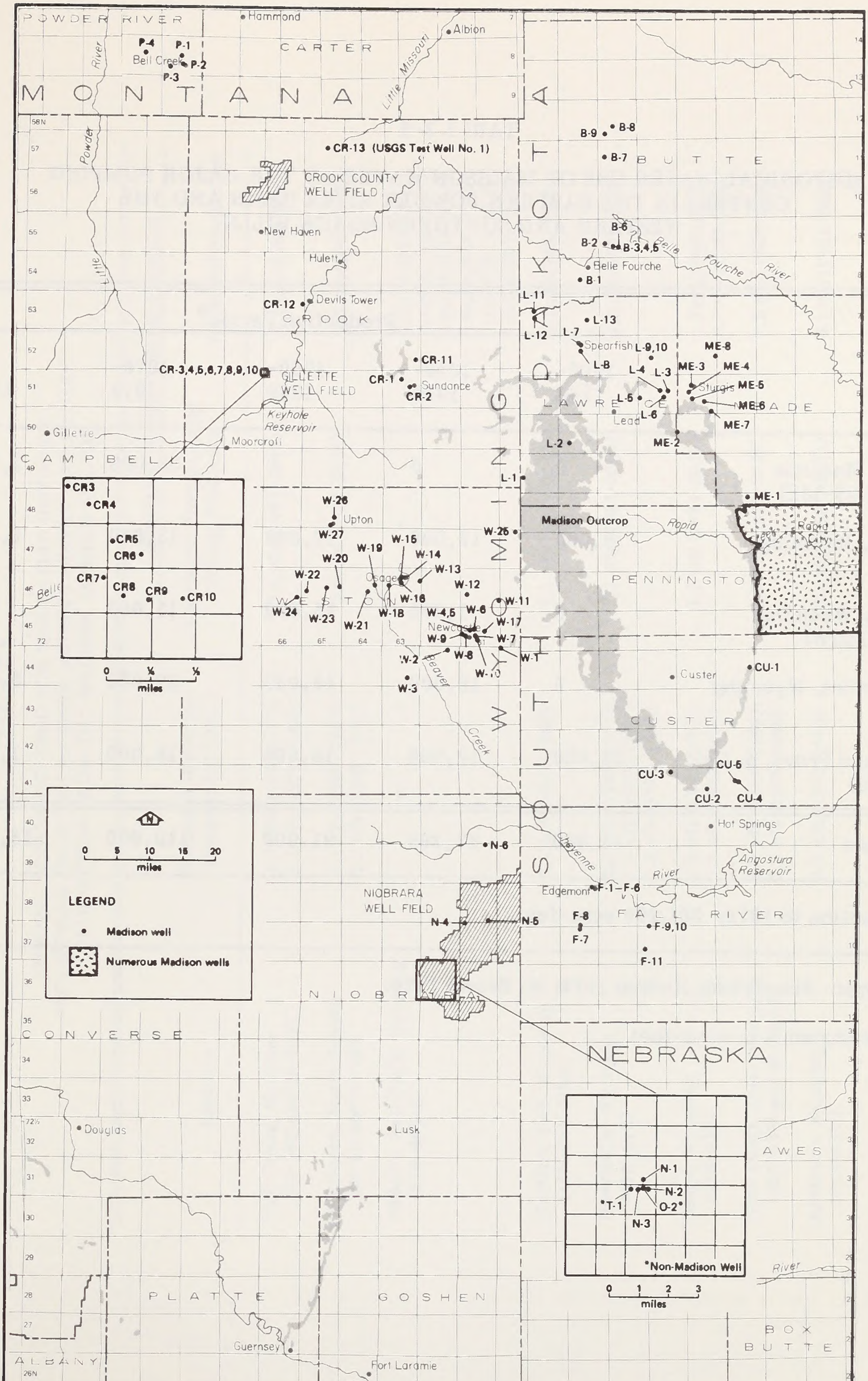
Historic changes in the Madison potentiometric surface could not be accurately determined from existing information because of a limited data base.

Calculated changes in the potentiometric surface of the Madison aquifer in the Black Hills region, from the beginning of production in the early 1900s to 1980 (Table 3-4) are shown in Map 3-8. Drawdowns greater than 25 feet occur only in the vicinity of Edgemont, Osage, Newcastle, and Bell Creek (Table 3-5, Map 3-9). If the current rates of water production from the Madison aquifer were to continue during the projected 50-year life of the ETSI project (1985 to 2035), additional drawdowns in the potentiometric surface of the Madison aquifer would be small (Table 3-5). The additional drawdowns that would be caused by current users for the period 1985 to 2035 were calculated to be 8, 14, and 19 feet at Edgemont, Osage, and Newcastle, respectively. Reductions in stream and spring flow that would result from these declines in the potentiometric surface would be less than 0.5 cfs.

Ground-water production in the Black Hills region from the Minnelusa Formation is largely concentrated in the Spearfish-Belle Fourche area of South Dakota (Map 3-10). Cox (1962) estimated that about 10,000 acre-feet of ground water from the Minnelusa Formation was being produced in this area for irrigation needs. Water is produced from the Minnelusa Formation by the city of Hulett, Wyoming, for municipal uses and for domestic and stock purposes by many small users near outcrop areas in the Black Hills.

Except possibly in or near outcrop areas, little use is made of the Minnelusa Formation for ground-water supply in the Black Hills region because of its relatively poor quality. No water, oil, or gas is produced from the Minnelusa Formation in northwestern Nebraska (Ginsberg 1980, Souders 1980).

The Inyan Kara Group is the only other major aquifer below the Cretaceous shales that supplies ground water to wells in the western Black Hills area. There are numerous wells completed in this rock unit, but well yields are



Note: More detailed information on these wells is provided in Appendix E of the Well Field Hydrology Technical Report (WCC 1980b).

Map 3-7. MADISON WELLS IN THE BLACK HILLS AND EASTERN POWDER RIVER BASIN

TABLE 3-3

HISTORICAL WATER USE OF MADISON WATER AT THE MAJOR PUMPING CENTERS IN THE EASTERN POWDER RIVER BASIN AND THE WESTERN AND SOUTHERN BLACK HILLS

	Production Period[a]				
Location	1900-1949	1950-1959	1960-1969	1970-1979	1979
Bell Creek, Montana (8S-54E and 95-53E)	0	0	0	25,000	1,400
Osage Area, Wyoming (46N-63E)	9,000	12,000	12,000	13,000	1,300
Osage Area, Wyoming (46N-64 and 65W)	0	1,200	15,000	11,000	800
Newcastle Area, Wyoming (45N-61W)	0	16,000	46,000	52,000	5,700
Edgemont and Provo, S. Dak. (8 and 9S-2E)	35,000	18,000	18,000	18,000	1,800
Yearly Totals	44,000	47,200	91,000	119,000	11,000

Total Production to 1979: 301,200 acre-feet

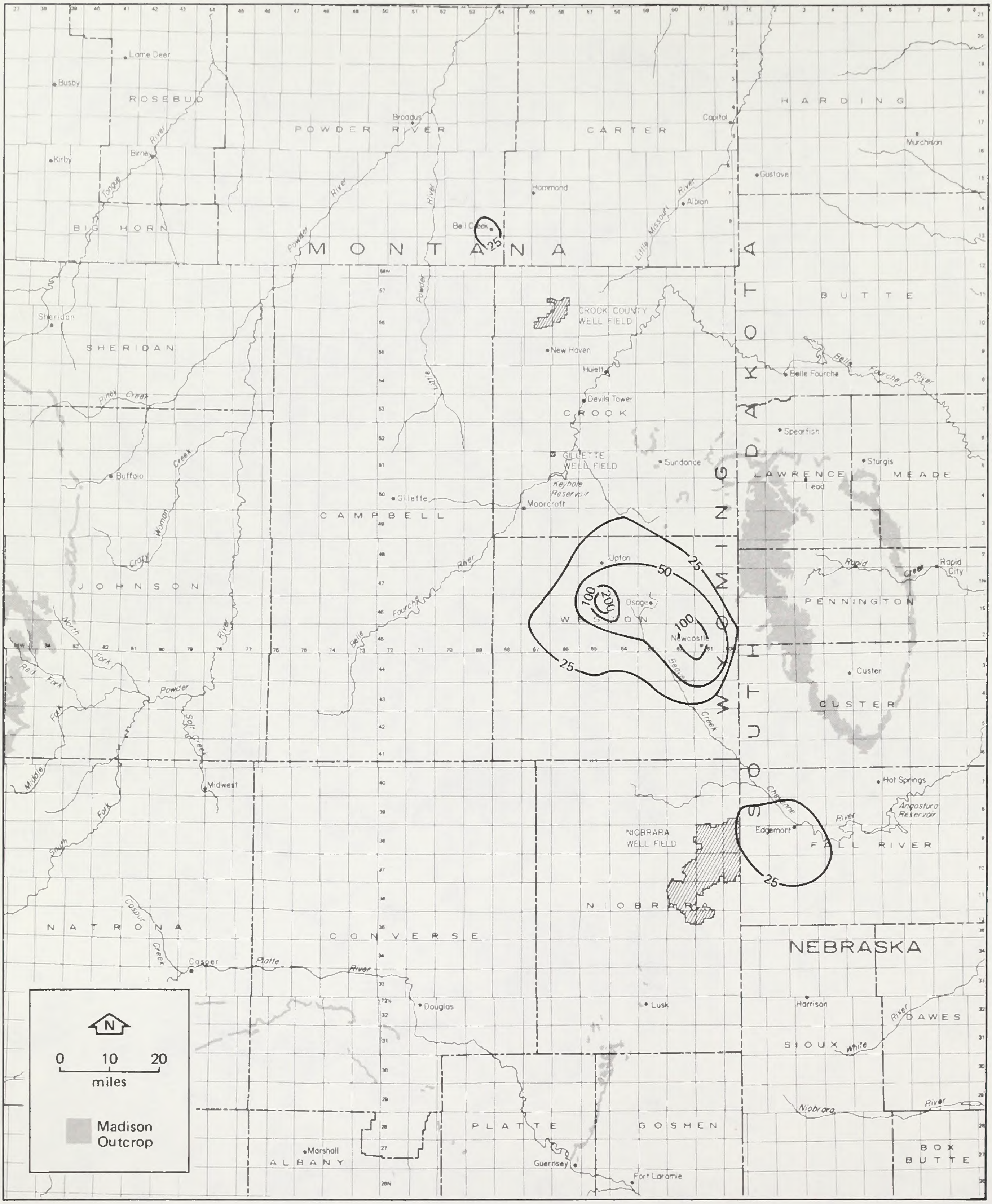
Data sources: Eisen 1980; Hodson 1974; M. Brown 1979.

[a] Amount produced is in acre-feet

TABLE 3-4

PUMPING SCHEDULES USED FOR SIMULATING HISTORICAL PRODUCTION FROM THE MADISON AQUIFER SYSTEM AND FUTURE PRODUCTION FROM THE MADISON AQUIFER SYSTEM

Location	Simulated Historical Pumping Schedule	Simulated Future Pumping Schedules	
		Continued Production by Existing Producers	Projected Production
Bell Creek, Montana (8S-54E and 9S-53E)	4.3 cfs (1970-1977); 2.1 cfs (1978-1980)	2.1 cfs (1981-2035)	2.1 cfs (1981-2035)
Edgemont, South Dakota (8S-2E and 9S-2E)	1.1 cfs (1907-1945); 2.5 cfs (1946-1980)	2.5 cfs (1981-2035)	2.5 cfs (1981-2035)
Gillette Well Field, Wyoming (51N-66E-6)	—	—	2.1cfs(1981-1985); 4.1cfs(1986-1995); 5.8cfs(1996-2005); 6.6cfs(2006-2015); 7.1cfs(2016-2025); 7.3 cfs (2026-2035)
Marten's Well, Wyoming (46N-60E-31ba)	0.1 cfs (1942-1980)	0.1 cfs (1981-2035)	0.1 cfs (1981-2035)
Newcastle, Wyoming (45N-61E)	2.2 cfs (1949-1962); 7.1 cfs (1962-1977); 7.8 cfs (1978-1980)	7.8 cfs (1981-2035)	7.8 cfs (1981-2035)
Osage, Wyoming (46N-63E)	1.2 cfs (1941-1951); 1.7 cfs (1950-1980)	1.7 cfs (1981-2035)	1.7cfs(1981-1995); 3.7 cfs (1996-2035)
West Osage Area, Wyoming (46N-64W and 46N-65W)	2.1 cfs (1960-1969); 1.5 cfs (1970-1980)	1.5 cfs (1981-2035)	1.5 cfs (1981-2035)
Sundance, Wyoming (51N-63W)	0.1 cfs (1971-1980)	0.1 cfs (1981-2035)	0.1 cfs (1981-2035)
Upton, Wyoming (48N-65W)	0.2 cfs (1949-1975); 0.3 cfs (1976-1980)	0.3 cfs (1981-2035)	0.3 cfs (1981-2035)



Note: Pumping rates used in simulation are listed in Table 3-4.

Map 3-8. DRAWDOWNS (in feet) IN THE MADISON POTENTIOMETRIC SURFACE IN THE BLACK HILLS REGION IN 1980 CAUSED BY PUMPING BY PRESENT MADISON GROUP WATER USERS

TABLE 3-5

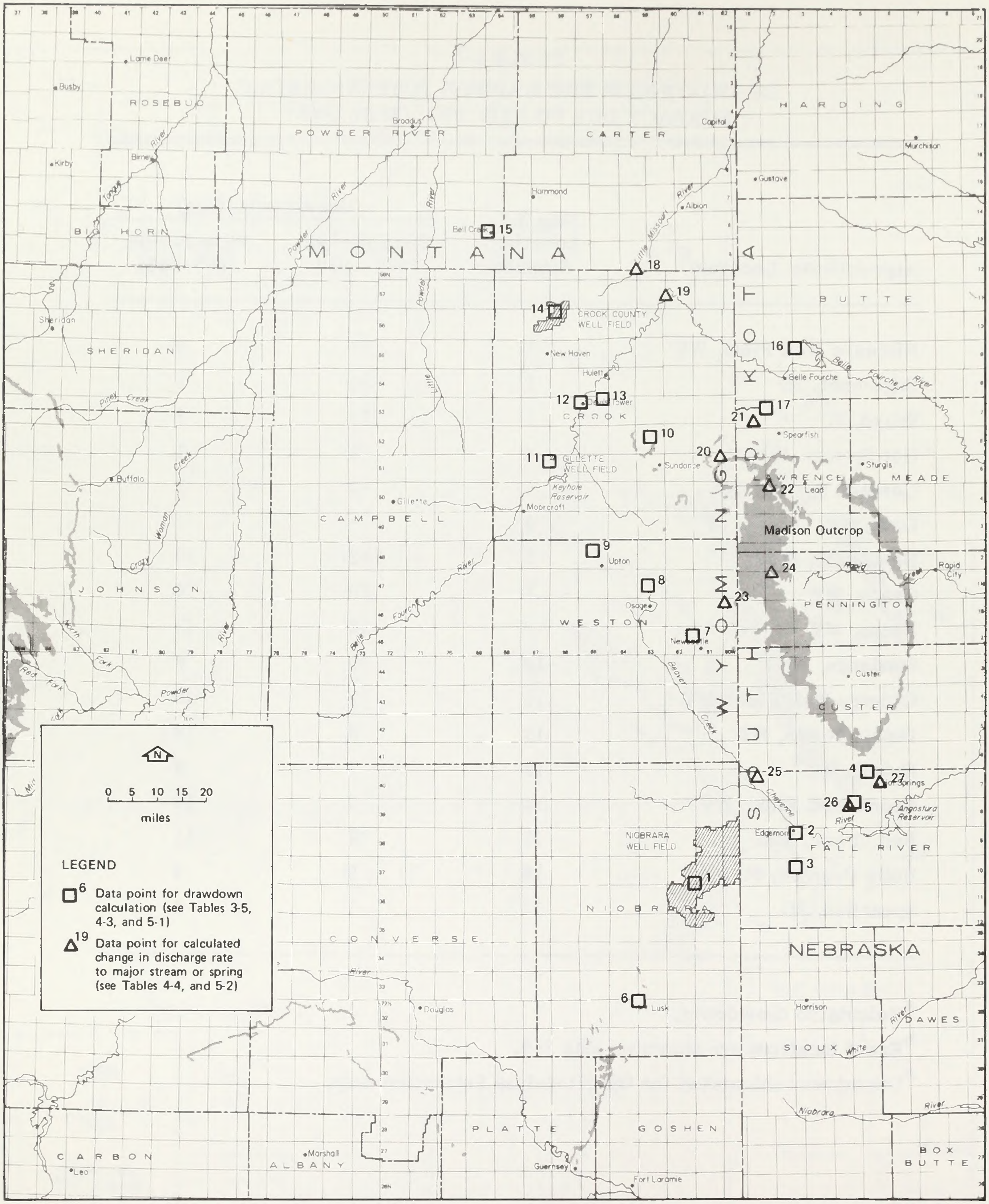
DRAWDOWNS IN THE MADISON POTENTIOMETRIC SURFACE DUE TO EXISTING USERS ONLY

Approximate Location[b]	Map 3-9 Location Number	Drawdowns (feet) Time Period: 1900-1980	Time Period: 1985-2035
Niobrara Well Field, WY	1	18	9
Edgemont, SD	2	44	8
Provo, SD	3	31	8
Hot Springs, SD	4	1	1
Cascade Springs, SD	5	3	3
Lusk, WY	6	-	1
Newcastle, WY	7	132	19
Osage, WY	8	70	14
Upton, WY	9	34	13
Sundance, WY	10	5	8
Gillette Well Field, WY	11	11	10
Devils Tower, WY	12	8	10
Hulett, WY[c]	13	7	9
Crook Well Field, WY	14	9	10
Bell Creek, MT	15	28	11
Belle Fourche, SD	16	2	4
Spearfish, SD	17	1	4

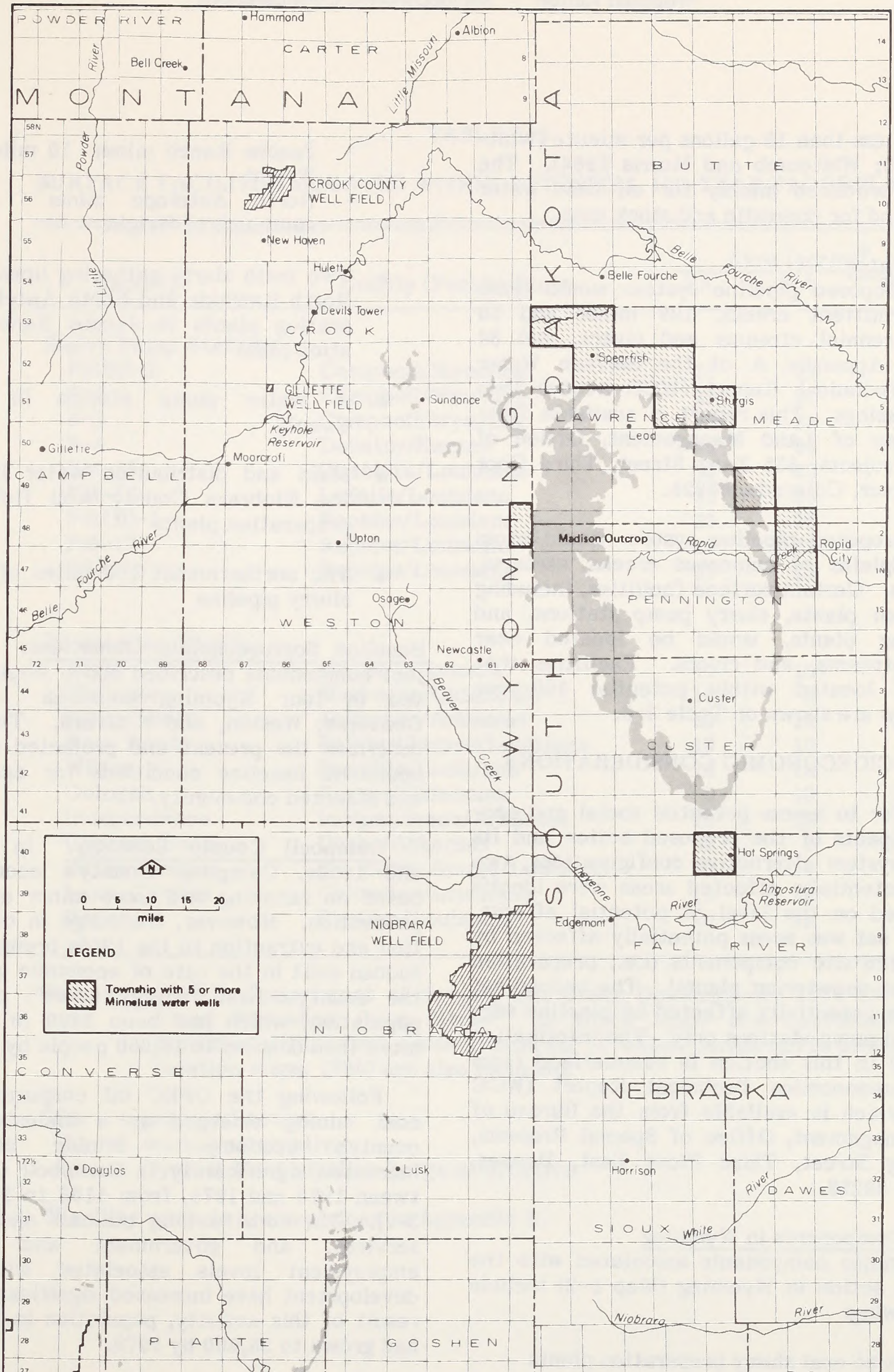
[a]Calculated drawdowns.

[b]Exact locations are shown on Map 3-9.

[c]Drawdowns calculated for the Minnelusa Formation only.



Map 3-9. LOCATIONS OF DATA POINTS FOR TABLES 3-5, 4-3, 4-4, 5-1, AND 5-2 WHERE DRAWDOWNS FOR THE VARIOUS WELL-FIELD PUMPING COMBINATIONS AND CHANGES IN DISCHARGE RATES TO MAJOR STREAMS AND SPRINGS ARE SHOWN



Source: Howells, 1980.
Eisen and others, 1980.

Map 3-10. MINNELUSA WELLS IN THE BLACK HILLS AND EASTERN POWDER RIVER BASIN generally less than 10 gallons per minute (Whitcomb 1965; Whitcomb and Morris 1964). The water is produced mainly for oil field water flooding and for domestic and stock uses.

Surface Water
The proposed pipeline system would cross 408 intermittent creeks, 109 minor and 59 major perennial streams and rivers, and 84 bayous. Appendix A of the Surface Water Quality Technical Report (WCC 1980c) lists these crossings. This report is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third floor East, Denver, Colorado, 80228.

The proposed pipeline system would cross the floodplains of numerous creeks, streams, and rivers. Certain surface facilities, including preparation plants, slurry pump stations, and dewatering plants, would be located near creeks, streams, and rivers. Facilities that could be located within potential 100-year floodplains are shown on Table 3-6.

3.A.2 SOCIOECONOMIC CONSIDERATIONS

In order to assess potential social and economic impacts of the proposed action and its pipeline system alternative configurations, two sets of potentially affected areas were identified, based on the level of potential effects. The first set was areas potentially affected by major fixed-site components (i.e., preparation plants and dewatering plants). The second set was areas potentially affected by pipeline segments and pump stations only. The information presented in this section is summarized from the Socioeconomics Technical Report (WCC 1980d), which is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado 80228.

Project Components in Wyoming
The major components associated with the proposed action in Wyoming (Map 1-2) include the following:

- Three coal slurry preparation plants
  - North Rawhide mine: 10 miles north of Gillette
  - Jacobs Ranch mine: 10 miles east of Wright
  - North Antelope mine: 25 miles southeast of Wright
- Two main slurry gathering lines from the North Rawhide and North Antelope preparation plants to Jacobs Ranch preparation plant
- A water pump station in Niobrara County
- Main and distribution water lines from the Niobrara County well field to the preparation plants
- The northernmost 100 miles of the main slurry pipeline

Baseline Socioeconomic Conditions. The project components described above would be located in four Wyoming counties: Campbell, Converse, Weston, and Niobrara. This section describes the present and projected social and economic baseline conditions for each county and affected community.

Campbell County Economy. In the 1940s and 1950s, Campbell County's economy was based on ranching and some minor agricultural production. However, the surge in oil exploration and extraction in the 1960s brought about a sudden shift in the rate of economic growth and the county's first "energy boom"; countywide population, which had been 5800 in 1960, had more than doubled to 13,000 people by 1970.

Following the OPEC oil embargo in 1974, coal mining emerged as a mainstay in the county's economy. Mining employment increased significantly in Campbell County between 1970 and 1975, from 1108 to 1402 (Table 3-7). The construction, business and consumer services, and government and education employment levels associated with mining development have increased significantly. As a result of this activity, population in the county had grown to 26,600 by 1979.

The two communities in Campbell County that have been most affected by energy devel

TABLE 3-6

SURFACE FACILITIES LOCATED WITHIN POTENTIAL 100-YEAR FLOODPLAINS

Facility	County (Parish)/State	Area (acres)[a] PA	MA	BA
Slurry Pump Stations[b]				
PMBC-1	Campbell/Wyoming	25	25	25
P-2	Campbell/Wyoming	25	25	25
P-3	Campbell/Wyoming	25	25	25
P-6	Decatur/Kansas	25	25	25
PM-15	Ouachita/Louisiana	25	25	0
PM-16	LaSalle/Louisiana	25	25	0
PM(B)-1	Rapides/Louisiana	25	25	0
PM-17	Rapides/Louisiana	25	25	0
PM(NW)-1	Rapides/Louisiana	25	25	0
Dewatering Plants				
Pryor	Mayes/Oklahoma	10	10	10
Muskogee	Muskogee/Oklahoma	10	0	0
White Bluff	Jefferson/Arkansas	10	10	10
New Roads	Pointe-Coupee/Louisiana	10	10	0
Wilton	Iberville/Louisiana	10	10	0
Oologah	Rogers/Oklahoma	0	10	10
Independence	Independence/Arkansas	10	10	10
Cypress Bend	Desha/Arkansas	0	0	205
Baton Rouge	W. Baton Rouge/Louisiana	0	10	0
Lake Charles	Calcasieu/Louisiana	10	10	0
Boyce	Rapides/Louisiana	10	10	0

Sources: (1) U.S. Department of Housing and Urban Development, 1978-1980. Flood Insurance Rate Maps. (2) Where maps are unavailable, facilities within first contour interval of watercourses (ETSI project location maps, 1980) are also included.

[a]PA = proposed action
MA = market alternative
BA = Cypress Bend pipeline-barge alternative

[b]Facility symbols are explained in Appendix A.

TABLE 3-7

EMPLOYMENT BY SECTOR FOR AFFECTED WYOMING COUNTIES

	Sector						
County	Agriculture	Mining	Construction	Manufacturing	Business & Consumer Services	Government and Education	Total Employment (persons)
Campbell							
1970	157	1108	473	27	2157	772	4694
1975	188	1402	1031	84	2733	966	6404
1978	b	3028	2015	141	b	b	b
Converse							
1970	198	155	177	19	848	491	1888
1975	239	654	286	42	1332	555	3108
1978	b	1468	465	66	b	b	b
Niobrara							
1970	96	78	56	33	442	203	908
1975	116	89	23	31	425	210	894
1978	b	137	137	42	b	b	b
Crook[a]							
1970	130	135	64	120	351	367	1167
1975	157	190	127	133	416	388	1411
1978	b	356	163	174	b	b	b
Weston							
1970	78	439	26	102	924	491	2060
1975	93	484	63	250	953	510	2353
1978	b	566	212	204	b	b	b

Sources: Bureau of Land Management 1979, pp. R2-116, R2-117, for 1970 and 1975. Wyoming Employment Security Commission undated.

[a]Crook County employment data are provided as baseline when estimating the Crook Well Field Alternative.

[b]Data are unavailable.

opments are Gillette (because of its location and available services) and Wright (because of its location).

1. Gillette/Gillette Planning Area. With a population of 13,800 in 1979, the city of Gillette accounted for half the county's population (Table 3-8). Table 1-7 shows the operating and proposed coal mines and other energy developments in the region. Gillette is the county seat and is the center of the county's economic activity, including commercial and retail services. Over all, the city's economy is very similar to the county's in that it is heavily dependent on energy development.

The Gillette Planning Area (GPA) encompasses a 5- by 6-mile area that includes the city of Gillette (Map 1-2). The reasons for addressing the GPA rather than just the city are the following: (1) an increasing number of residential settlements being located (or being approved by the county for location) just outside the city limits will eventually require services from Gillette; (2) the city, which has been annexing properties adjacent to its boundaries both to provide municipal services to these outlying communities and to include commercial and industrial properties into its tax base, will probably continue this practice over the next few years and thereby extend the city limits toward the GPA boundaries. The population of the GPA is estimated to be 18,600, which is roughly 70 percent of the county's population base (Table 3-8).

In June 1979, the Gillette/Campbell County Department of Planning and Development estimated the total number of housing units in the city (4300 units) and county (8200 total dwelling units) (Table 3-9).

2. Wright. A newly formed (1976) and rapidly growing community, Wright is located near the heart of coal mining operations in southern Campbell County. Founded by the Atlantic Richfield Company (ARCO) in anticipation of housing needs for ARCO mine employees and other energy-related workers in the area, it is the closest place to reside with any sense of community. It is approximately 40 miles from Gillette, 70 miles from Douglas in Converse County, and 40 miles from Newcastle in Weston County (Map 1-2).

Wright's economy is based principally on coal and other energy developments in the region. Although there are no current employment estimates, it can be expected that a large majority of the residents (839 in 1978) is either directly or indirectly associated with the energy industry. The community is planned to comprise 1800 to 2000 units, or between 6000 and 6500 people, and is anticipated to be completed by 1985 or 1987 (Housing Services Inc. 1979).

Data on the planned housing supply (and the housing mix) can be found in Table 3-10. Note that nearly 44 percent of the completed units will be single-family units, 30 percent multi-family units, and about 26 percent mobile homes.

Table 3-11 indicates that there is substantial temporary housing available in Wright, including both motel rooms and mobile home and recreational vehicle (RV) spaces. As a temporary solution to the excess housing demand, much of the land planned for single-family units and mobile homes was made available for travel trailers.

Projected Baseline for Campbell County. This section discusses an employment, population, and housing baseline for 1984 and 1990 based on the anticipated construction and production schedules for energy developments in the area except for the ETSI project. The purpose of selecting these specific years is to compare the impact of anticipated peak ETSI employment periods with the projected baseline (Section 4.A.2). The methodology for estimating the increase in population and the general effects on housing, public services, and the economy is discussed in Appendix H.

Anticipated growth over the next few years would alter the socioeconomic complexion of Gillette and the GPA. The anticipated increase in mining and other energy-related activities will result in a doubling of the demand for labor both to work directly on the projects and to staff the operations of the support and service

TABLE 3-8

POPULATION STATISTICS FOR WYOMING CITIES AND TOWNS WITHIN COMMUTING DISTANCE OF PROJECT COMPONENTS: PROPOSED ACTION

County	City or Town	Census 1970 Pop.[a]	Estimated 1975 Pop.[a]	Estimated 1979 Pop.[b]	Annual[c] Growth Rate
Campbell		12,957	13,090	26,600	19.4
	Gillette	7,763	8,215	13,800	13.9
	Gillette Planning Area	NA	NA	18,600	--
	Wright	NA	NA	825	--
Converse		5,938	8,048	13,400[b]	13.6
	Douglas[d]	2,677	3,839	8,500	22.0
	Glenrock[d]	1,515	2,071	2,900	8.8
Niobrara		2,924	2,895	3,132	2.0
	Lusk	1,495	1,628	1,750	1.8
Crook[e]		4,535	4,883	5,661	3.8
	Moorcroft	981	1,030	1,200[f]	5.2
	Sundance	1,056	1,282	2,500[f]	39.7
Weston		6,307	6,245	7,900	6.1
	Newcastle	3,432	3,421	3,900	3.3
	Upton	987	927	1,500	12.8

NA = not applicable.

[a] Source: U.S. Bureau of the Census 1977.

[b] Sources: Campbell County data from Campbell County Planning Office and Gillette Planning Department; countywide estimates for Converse, Weston, Crook, and Niobrara from Wyoming, Department of Administration and Fiscal Control 1980; information on individual cities and towns from respective planning or city managers' offices.

[c] Compound annual growth rate. Source: Bureau of Land Management 1979, Table R2-33.

[d] 1978 estimates for Douglas and Glenrock may not be strictly comparable with earlier years due to sprawl outside community boundaries.

[e] Crook County population estimates are provided as baseline when estimating the Crook County well field alternative.

[f] Moorcroft estimated population is for 1978. Sundance estimated population is for 1977. (Source: Schroder 1980a; Wyoming Department of Economic Development and Planning 1977).

TABLE 3-9

ESTIMATES OF HOUSING UNITS IN CAMPBELL COUNTY
DECEMBER 1977 AND JUNE 1979

	1977	1979	Percent of Total
City of Gillette			
Single-Family	1628	2098	49
Multifamily	680	815	19
Mobile Homes	1530	1391	32
Total	3838	4304	100
Gillette Planning Area			
Single-Family	2138	2646	46
Multifamily	712	883	15
Mobile Homes	2438	2190	39
Total	5288	5719	100
Campbell County[a]			
Single-Family	2661	3452	42
Multifamily	716	895	12
Mobile Homes	3821	3681	46
Total	7198	8028	100

Source: Gillette-Campbell County Department of Planning and Development 1979.

[a] Includes Gillette Planning Area, Wright, and other rural sections of Campbell County.

TABLE 3-10

HOUSING AND POPULATION PROJECTIONS FOR WRIGHT, WYOMING

	Single-Family Detached	Single-Family Attached	Multi-family	Mobile Homes	Recreation Vehicles[a]	Total
Housing Projections						
1978	24	-	-	206	37	267
1985[b]	546	273	561	500	-	1880
Population per Dwelling Unit[c]	3.53	3.25	3.00	3.30	2.00	
Population Projections						
1978	85	-	-	680	74	839
1985	1927	887	1683	1650	-	6147

Source: Housing Services Inc. 1979.

[a]Because of the shortage of housing in the area, 37 recreation vehicle spaces are presently occupied on a semipermanent basis (with an Atlantic Richfield Company estimate of two residents per unit). The plan is to eliminate long-term use of these spaces when sufficient permanent housing is developed at Wright.

[b]The present development plan for Wright anticipates that the total project will be completed in 1985. The 1985 figures, therefore, are the estimated totals for the entire community.

[c]The population per housing-unit levels are based on a survey of 400 households completed by the Gillette-Campbell County Department of Planning and Development in July 1978. The indicated figures are the averages for Campbell County, outside the city of Gillette.

TABLE 3-11

TEMPORARY HOUSING AVAILABLE IN 1980 AT LIKELY PIPELINE CONSTRUCTION SPREAD HEADQUARTERS IN WYOMING

Wyoming Community	Existing Hotel/Motel Rooms	Hotel/Motel Construction (Rooms)	Existing Rental Units (Apartments & Houses)	Rental Vacancy Rate	Rental Units Planned or Under Construction	Existing Mobile Home Park Spaces	Existing R.V. Park Spaces	Mobile Home Spaces Planned or Under Construction
Gillette	560	60	815	5%	252	1391	NA	471
Wright	11	40	NA	low	75	311	75	200
Douglas	260	100	344	4-5%	0	130	40	72
Glenrock	54	0	312	3%	68	250	0	220
Moorcroft	63	0	425	5%	12	12	0	0
Lusk	150	0	330	low	20	50	0	0
Newcastle	210	0	170	low	0	400	20	100

Sources: Sientz 1980; Zaborac 1980; Sewell 1980; Bruner 1980; Holdt 1980; Stuart/Nichols Associates 1978a; and Schroder 1980a.

NA = data not available.

sectors. It was estimated that by 1984 there would be approximately 2640 additional construction workers employed in the county; there would be 279 by 1985 and only 70 by 1990. It was estimated that permanent workers would increase from 2942 in 1980 to approximately 6000 by 1984, and 9200 by 1990.

Estimates of future employment and population for the GPA are found in Table 3-12. Population in the city of Gillette would nearly double, going from 13,800 to 24,500 in just 5 years; the population in the GPA would grow from 18,600 to 31,600; countywide population would increase to 43,200.

An increase in population in the GPA will also require a doubling of the housing supply in an already constrained market. There will likely be a greater emphasis on mobile homes to serve the construction work crews and also as a means to provide large numbers of dwelling units in a limited time frame. With a doubling of the population in only 5 years, local and state officials will likely find it difficult to provide for orderly and managed growth. Many of the new housing developments have located and will continue to look to locating in the area outside the city in the GPA because the county has exhibited less stringent land use and zoning controls than adopted by the city of Gillette.

Wright Economy. The town of Wright is a planned community and is therefore capable, in principle, of regulating its growth in accordance with predetermined rates and in conjunction with availability of public services. It is assumed that town planners will be able to control the flow of in-migration to avoid any significant impacts. It is concluded, therefore, that no further discussion of Wright is required in this report.

Converse County Economy. Converse County is located due south of Campbell County (Map 1-2). With some exceptions, the economy of Converse County is quite similar to that of its northerly neighbor. The demand for energy products, such as coal and uranium, spurred mining activities in the county; employment increased from 1888 in 1970 to 5932 by 1979 (Department of Administration and Fiscal Control 1978). During this time, mining employment grew from 155 to 1445 workers. The economy has been quite healthy over the past few years, with the unemployment rate generally being near 2.5 to 3.0 percent. In September of 1979, the unemployment rate had dipped below 2.0 percent.

In addition, the economic base of Converse County, though not as large as Campbell County's, is more diversified. There are several uranium mines and mills either planned or in operation in the county. Also, because the two principal towns of Douglas and Glenrock are located along a major interstate highway, the economic base receives support from travel and tourist-related expenditures (Table 3-7).

Douglas and Glenrock grew substantially during the 1970s. As can be seen from Table 3-8, the population of Douglas tripled between 1970 and 1978, growing from 2677 to 8500; Glenrock's population doubled (growing from 1515 to 2900) by 1978.

From 1970 to 1979, the number of dwelling units in Converse County more than doubled. The Converse County area planning officer estimated that of the 4717 units available in early 1979, 63 percent were single-family homes, 27 percent mobile homes, and 10 percent multifamily homes. Nearly half the units are estimated to be located in Douglas, close to 20 percent in Glenrock, and the remainder outside of the two communities.

In addition to the permanent housing, Douglas and Glenrock have 294 hotel and motel rooms. A new 100-room hotel is also planned for Douglas in the next year. These rooms could serve as temporary housing, especially for short-term construction workers during peak employment periods (Table 3-11).

Projected Baseline for Converse County. Converse County will grow substantially as a result of the development of energy resources in the county, including several uranium mines, an oil refinery, and a power plant. Details on employment levels by project may be found in the Socioeconomics Technical Report (WCC 1980d, Table 4-11). In addition, there are other

TABLE 3-12

PROJECTED BASELINE FOR GILLETTE PLANNING AREA

SOCIAL/ECONOMIC INDICATORS	BASELINE Existing[a] 1979	Projected[b] 1984	1990
Employment	8,000	14,000	14,800
Population	18,600	31,700	33,500
Housing/Households	5,719	10,000	10,500

[a] Data sources for existing population and housing were obtained from the Gillette-Campbell County Planning Department 1979. Existing employment data was calculated using assumptions of 1.45 workers per household and a 3 percent rate of unemployment. The rationale for deriving these assumptions may be found in Appendix H.

[b] The methodology for estimating the projected baseline is presented in Appendix H.

activities, the most significant of which will be the Panhandle Eastern Coal Gasification Plant. The magnitude of this plant is uncertain at this time.

Future population estimates for the towns of Glenrock and Douglas appear in Table 3-13. While Douglas is not expected to grow substantially over the next 10 years, Glenrock's population is expected to grow from 2900 to 4700 in 1985 and 5100 in 1990.

Weston County Economy. Weston County is located due east of Campbell County, and while it has very little in the way of known strippable coal deposits (BLM 1979), it serves as a "bedroom community" for those working in Campbell County. Many of those employed by the major energy development companies in south Campbell County have chosen to locate in nearby Newcastle in Weston County rather than in Gillette or Wright. It has been estimated that between 60 and 65 percent of the workers at Kerr-McGee's Jacobs Ranch mine commute daily from Newcastle, a distance of 50 miles, on company-provided buses (Newcastle City Engineer 1980).

Over all, the county has a substantial and diversified economic base. Besides the coal mining in Campbell County, much of the employment is based on oil drilling and pumping, forestry and the processing of forest products, and trucking (two major regional trucking firms are located in Newcastle) (Newcastle City Engineer 1980).

The county's population has steadily grown over the past few years; between 1970 and 1979, countywide population increased from 6300 to 7900, with much of the increase coming in the last three years. A large part of this increase in population has settled in Newcastle and Upton.

Newcastle is the larger of the two communities, with an estimated 1979 population of 3900 people, an increase of 500 people since 1970. Upton in 1975 had a population of 927; by 1979, the population had grown to 1500.

Housing in Newcastle is adequate for the existing population. There are about 1200 single-family dwelling units, 6 apartment buildings (with about 80 units), and 20 mobile home parks (accommodating about 400 mobile homes). Vacancy rates in the city are quite low. There is little housing information available for Upton.

Projected Baseline for Weston County. It is anticipated that Weston County, unlike neighboring Campbell and Converse counties, will have only a modest growth over the next 10 years (Table 3-14). Its continued principal economic base will be its role as a bedroom community for those employed in Campbell County. It is not anticipated that the oil sector will grow by any appreciable amount.

As a result, most population projections for Weston County show a possible increase from 7900 in 1979 to 8700 by 1984 and 10,000 by 1990 (Wyoming Department of Administration and Fiscal Control 1980). Stuart/Nichols Associates (1978b) reports a slightly higher estimate for 1985 of 9700 people.

Future population estimates for Newcastle reflect a slightly higher growth, from 3900 in 1979 to 6000 by 1990 (Newcastle City Engineer 1980). This estimate, however, reflects an optimistic outlook. There are very few data for identifying the future housing impacts for Newcastle.

Niobrara County Economy. Located south of Weston County (Map 1-2), Niobrara County is principally rural, with agriculture playing a vital role in its economy. The northern two-thirds of the county are principally open range; the southern portion supports dry-land and irrigation farming. Between 30 and 35 percent of the jobs available in the county (420 jobs) in 1979 were in the agricultural sector (Lusk Town Planner 1980).

During 1970 through 1975, population decreased slightly. Since then, however, energy development in the neighboring counties has resulted in a population increase, from 2895 in 1975 to 3132 in 1979 (Table 3-8).

Over 55 percent of the population resides in Lusk, the county seat. Located in the southern

TABLE 3-13

PROJECTED BASELINE FOR CONVERSE COUNTY

SOCIAL/ECONOMIC INDICATORS	BASELINE Existing[a] 1979	Projected[b] 1984	1990
Employment	5,932	7,600	8,400
Population	13,400	14,700 - 18,700	15,600 - 21,800
Housing/Households	4,700	5,900	6,600

[a] Employment and population data are taken from Wyoming Department of Administration and Fiscal Control 1980. Data on housing comes from the Converse Area Planning Office 1979.

[b] The projected population for 1984 and 1990, which is obtained from Wyoming Department of Administration and Fiscal Control 1980, serves as the basis for estimating future housing (using a ratio of 3.18 persons per household) and future employment (assuming 1.45 workers per household and a 3 percent rate of unemployment). See Appendix H for the rationale for deriving these assumptions.

TABLE 3-14

PROJECTED BASELINE FOR WESTON COUNTY

SOCIAL/ECONOMIC INDICATORS	BASELINE Existing[a] 1979	Projected[b] 1984	1990
Employment	3,346	3,300	4,400
Population			
Weston County	7,900	8,700	10,000
Newcastle	3,900	5,000	6,000
Housing/Households	2,700	2,900	3,400

[a] Employment and population data are taken from Wyoming Department of Administration and Fiscal Control 1980. Data on housing comes from the Newcastle City Engineer 1980.

[b] The projected population for 1984 and 1990, which is obtained from Wyoming Department of Administration and Fiscal Control 1980, serves as the basis for estimating future housing (using a ratio of 3.18 persons per household) and future employment (assuming 1.45 workers per household and a 3 percent rate of unemployment). See Appendix H for the rationale for deriving these assumptions.

portion of the county, Lusk has grown considerably in the past few years (1628 people in 1975, 1750 in 1979). It serves as a bedroom community for those working in Converse County. The increased population in the city is also made up of inmigration from ranch to town as well as higher numbers of retired people moving into the area (Niobrara County Planning Commission and Tri-County Planning Office 1977).

Housing in Lusk consists of about 650 total units. A quarter of the single-family units are rental. In addition, there are 6 apartment buildings, 50 mobile homes, and 6 motels (150 units) (Table 3-11). Due to increased demand for low income housing, the town has applied to the Department of Housing and Urban Development (HUD) to build 20 rental homes.

Projected Baseline for Niobrara County. It is anticipated that Niobrara County will continue to be a bedroom community for Converse County but will experience very little increase in population. Countywide population is projected to be 3200 by 1984 and 3300 by 1990, only a slight increase from 3132 in 1979. City officials expect that the population of Lusk will double by 1984 (Table 3-15) and have therefore planned for the expansion of wastewater treatment capacity and water supply. However, the city's projections may be too optimistic, particularly in light of the county's projection. Therefore, the city's 1984 and 1990 population projections are estimated at 1900 and 2000, respectively. The school district's projections are optimistic too; the combination of existing excess capacity and the use of temporary modular units should provide sufficient capacity for the lower projected population.

Project Components Outside Wyoming

Slurry Pipeline System. This section discusses the areas affected by pipeline and pump stations only, as shown on Table 3-16. Segments of pipeline and pump stations near dewatering plants are discussed in the Dewatering Plants section. The environment potentially affected by the pipeline and pump stations was identified as being: (1) all host counties (that is, counties containing project components) and (2) selected communities within 1-1/2 hours drive of a project component. The size of each host county, in terms of population and recent tax revenues, is shown in Table 3-16. Selected communities within 1-1/2 hours drive of project components are listed in Table 3-17. These communities were selected on the basis of the following two assumptions:

- Seekers of services will locate where services exist (i.e., construction workers will travel farther in order to secure services rather than live uncomfortably while located closer to the job site).
- Construction workers have been known to commute over 100 miles per day to a construction site (Old West Regional Commission 1975). Therefore, an estimated drive of 1-1/2 hours to the pipeline was used.

Use of these communities (all within 1-1/2 hours drive of construction areas) for services would not mean that services would not be sought in other communities--even in some smaller communities closer to construction areas. Rather, it is expected that nearby communities would provide services to the extent that they can and that these larger, and in some cases more distant, communities would be used to meet the residual demand for services.

Dewatering Plants. Nine areas were defined as the areas potentially affected by construction and operation of the dewatering plants and associated pipelines and pump stations (Table 3-18). These areas include all counties in which dewatering plants would be located and selected adjacent counties from which the work force would come. Each of these areas is relatively urbanized and contains a large construction labor force that in many cases has been associated with prior construction of the power plant that the proposed dewatering plant would serve. Table 3-18 identifies these areas and the counties included. Brief area summaries follow.

Ponca City. The Ponca City dewatering plant site is 15 miles south of Ponca City,

TABLE 3-15

PROJECTED BASELINE FOR NIOBRARA COUNTY

SOCIAL/ECONOMIC INDICATORS	BASELINE		
	Existing[a] 1979	Projected[b] 1984	1990
Employment	1,429	1,450	1,500
Population			
Niobrara County	3,132	3,200	3,300
Lusk	1,750	1,900	2,000
Housing/Households			
Niobrara County	1,160	1,185	1,222
Lusk	650	700	740

[a] Employment and population data are taken from Wyoming Department of Administration and Fiscal Control 1980. Data on housing comes from the Lusk Town Planner 1980.

[b] The projected population for 1984 and 1990, which is obtained from Wyoming Department of Administration and Fiscal Control 1980, serves as the basis for estimating future housing (using a ratio of 3.18 persons per household) and future employment (assuming 1.45 workers per household and a 3 percent rate of unemployment). See Appendix H for the rationale for deriving these assumptions.

TABLE 3-16

COUNTIES IN AREAS OUTSIDE WYOMING POTENTIALLY AFFECTED BY MAIN SLURRY PIPELINE AND PUMP STATIONS: PROPOSED ACTION

County/Parish	Pump Station[a]	1975 Population[b]	Fiscal Year 1976-77 Tax Revenues[c] ($000)
Nebraska			
Sioux		2,000	611
Box Butte		12,400	3,557
Morrill		6,100	2,295
Garden	P-4	2,900	1,571
Deuel		2,400	1,410
Keith		10,100	4,134
Perkins		3,500	2,022
Chase		4,800	2,743
Hayes		1,500	648
Hitchcock		4,000	2,201
Red Willow	P-5	12,800	4,602
Kansas			
Decatur	P-6	5,100	2,192
Norton		6,700	2,452
Graham		4,400	2,145
Trego		4,400	1,608
Ellis		27,400	6,902
Rush		4,800	2,566
Barton		31,600	9,368
Stafford	P-7	6,200	3,100
Reno		63,700	18,236
Kingman		8,900	3,834
Harper		7,900	3,382
Sumner		24,500	7,213

[a] Pump station designations are explained in Appendix A.

[b] U.S. Bureau of the Census 1978.

[c] U.S. Bureau of the Census 1979b.

TABLE 3-16 Concluded

County/Parish	Pump Station[a]	1975 Population[b]	Fiscal Year 1976-77 Tax Revenues[c] ($000)
Oklahoma			
Sequoyah		28,600	1,290
Arkansas			
Crawford	P-11	33,400	2,277
Franklin		13,700	1,270
Johnson		17,100	1,220
Pope	PMB-12, PMB(I)-1	36,100	7,490
Conway		18,600	1,614
Van Buren	PMB(I)-2	11,800	692
Cleburne		15,800	1,462
Perry		7,400	556
Cleveland		6,900	476
Bradley	PM-14	12,700	1,089
Ashley		26,400	2,830
Louisiana			
Morehouse		33,700	3,496
Ouachita	PM-15	130,700	13,354
Caldwell		10,200	1,374
La Salle	PM-16	15,200	1,976

[a] Pump station designations explained in Appendix A.

[b] U.S. Bureau of the Census 1978.

[c] U.S. Bureau of the Census 1979b.

TABLE 3-17

SELECTED COMMUNITIES IN AREAS OUTSIDE WYOMING POTENTIALLY AFFECTED BY MAIN SLURRY PIPELINE AND PUMP STATIONS: PROPOSED ACTION

Pipeline Spread[a]	Community/State	1975 Population[b]
I	Torrington, WY	4,667
I	Scottsbluff, NE	12,665
I	Alliance, NE	6,990
I	Sidney, NE	6,150
I	Ogallala, NE	5,442
I	North Platte, NE	21,882
I and II	McCook, NE	8,455
II	Hays, KS	16,544
II	Great Bend, KS	16,098
II	Larned, KS	4,827
II	Hutchinson, KS	40,925
II	Pratt, KS	6,661
II	Kingman, KS	3,650
II	Wichita, KS	264,901
II	Wellington, KS	7,653
II	Ponca City, OK	25,819
III	Ft. Smith, AR	64,734
III and V	Russellville, AR	13,790
V	Morrilton, AR	6,630
V	Little Rock, AR	141,143
V	Warren, AR	6,139
V	Crossett, AR	6,290
V	Bastrop, LA	14,266
V	Monroe, LA	61,016

[a] See Table 1-6 for pipeline spread responsibilities.

[b] U.S. Bureau of the Census 1978.

TABLE 3-18

AREAS POTENTIALLY AFFECTED BY CONSTRUCTION AND OPERATION OF DEWATERING PLANTS: PROPOSED ACTION

Dewatering Plant Site	Counties/Parishes in Potentially Affected Area[a]	1975 County Population[b]	Area Construction Labor Pool[c]
Ponca City, OK	Grant	6,948	3,800
	Kay	47,825	
	Noble	10,524	
	Pawnee	13,128	
	(Payne)	54,834	
Pryor, OK	Osage	31,390	8,340
	Washington	41,967	
	Rogers	33,671	
	Mayes	27,213	
	(Tulsa)	416,892	
Muskogee, OK	Wagoner	27,225	11,985
	Muskogee	61,894	
	(McIntosh)	13,603	
	(Cherokee)	25,143	
	(Okmulgee)	36,423	
Independence, AR	Independence	24,232	565
	(Jackson)	21,193	
White Bluff, AR	Saline	40,177	20,917
	Pulaski	308,294	
	Jefferson	83,750	
Boyce, LA	Rapides	121,088	3,250
	Grant	14,330	
	Avoyelles	38,171	
Lake Charles, LA	Evangeline	32,365	5,400
	Allen	20,356	
	Jefferson Davis	30,250	
	Calcasieu	151,334	
New Roads, LA	St. Landry	80,553	24,675
	Pointe Coupee	21,855	
	W. Baton Rouge	17,522	
Wilton, LA	Iberville	30,601	61,075
	Ascension	40,691	
	St. James	19,507	

[a] Counties listed in parentheses would not have project components but are potentially affected by project activities.

[b] U.S. Bureau of the Census 1978.

[c] Source of employment figures varies by state. For individual state figures, see the Socioeconomics Technical Report (WCC 1980d).

Oklahoma, in Noble County but adjacent to Pawnee County. In 1975 the four-county study area (Noble, Pawnee, Kay, and Payne counties) had a population of 126,311. Within 25 miles of the site are the towns of Ponca City, Pawnee, Perry, and Stillwater, with a combined population of 70,000. The pool of contract construction workers numbered approximately 3400 in 1976.

Pryor. The dewatering plant would be located in Mayes County, 40 miles from the city of Tulsa. While no project component would be located in Tulsa County, it is included because it would be a major source of construction labor. The city of Tulsa alone has a population in excess of 300,000, which includes construction employment of more than 8000.

Muskogee. The Muskogee dewatering plant would be located in the Muskogee Industrial Park in Muskogee County. Muskogee is a service and employment center for the surrounding area and has been designated a growth center by the state Department of Transportation and the federal Economic Development Administration. Tulsa, approximately 50 miles away, has a population of approximately 300,000 and would be a major source of construction labor.

Independence. The Independence dewatering plant site is located near the town of Newark, approximately 1-1/2 hours drive from Little Rock. Prior construction of a plant for Eastman Kodak Company used 800 construction workers, many of whom could potentially work on the ETSI project. Rental housing is scarce despite recent construction of units.

White Bluff. The site of the proposed White Bluff dewatering plant is in Jefferson County between the cities of Pine Bluff and Little Rock. The White Bluff study area includes Saline and Pulaski counties, both part of the Little Rock - North Little Rock Standard Metropolitan Statistical Area (SMSA), and Jefferson County, which is part of the Pine Bluff SMSA. Little in-migration of construction workers was experienced during construction of the White Bluff power plant in 1978, 1979, and 1980.

Boyce. The site of the proposed Boyce dewatering plant is within the Alexandria (Louisiana) SMSA, which is made up of Grant and Rapides parishes. The local study area includes these parishes as well as Avoyelles. Population of this three-parish area was 174,000 in 1975, with 3,250 persons employed in construction.

Lake Charles. The site of the proposed Lake Charles dewatering plant is 5 miles northwest of Lake Charles, Louisiana, in Calcasieu Parish. The 1975 population of Lake Charles was 76,000, while the population in the four-parish area (Calcasieu, Evangeline, Allen, and Jefferson Davis) was 234,000. The annual average number of construction workers is in excess of 5000.

New Roads. The site of the proposed New Roads dewatering plant is approximately 5 miles from the community of New Roads and about 30 miles from Baton Rouge. Baton Rouge has a large construction labor pool that in 1978 numbered more than 24,000 persons. Baton Rouge was the source of most of the 1500 workers who built Big Cajun Power Plant units 1 and 2.

Wilton. The site of the proposed Wilton dewatering plant is about 40 miles from Baton Rouge and 65 miles from New Orleans. Both of these cities would be sources of construction labor for the proposed ETSI facilities. Construction employment in the region was more than 61,000 in 1978.

3.A.3 VEGETATION

The proposed action would traverse or have permanent facilities located on agricultural lands, short-grass prairie, midgrass prairie, tallgrass prairie, shrub and brush rangeland, ponderosa pine forest, nonforested wetland, forested wetland, cross timbers, oak-hickory forest, southern pine-hardwood forest, and barren land. These areas are used mainly for agriculture (cropland), livestock grazing, wildlife habitat, and recreation. Acreages and mileages for each vegetation type that would be affected by the proposed action and each alternative are shown in Section 4.A.4,

Table 4-16. Each of these vegetation types is described in detail in Appendix B of the Terrestrial Biology Technical Report (WCC 1980e).

Threatened and Endangered Plant Species

No federally listed threatened or endangered plant species are known to occur in the affected vicinity of any project components associated with the proposed action (or any of the alternatives, with the exception of the Colorado alternative [Section 3.D.3]) (FWS 1980a). At present, state-level endangered species legislation does not protect plant species in states that would have project components.

3.A.4 WILDLIFE

Several terrestrial communities composed of a more or less distinct assemblage of plants and animals occur in the vicinity of the proposed action. These are discussed in detail in the Terrestrial Biology Technical Report (WCC 1980e), which is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado 80228. All terrestrial communities are somewhat influenced by vegetation. Many animals, such as small birds, rodents, weasels, snakes, and frogs, tend to have territories or ranges that are small relative to the area of the vegetative type. Therefore they do not usually leave the type community. Some creatures, such as beavers, squirrels, and some insects, are restricted to certain vegetation because they are food-specific. On the other hand, some species or groups of species are not restricted but occur over large areas with diverse vegetative types. Some animals adapt to varied conditions and can live in numerous habitats, even though individuals tend to remain in small areas. Deer, elk, larger birds, and larger carnivores have relatively large territories or feeding ranges and may traverse several vegetation types in their activities. Large mobile or migratory species are influenced by weather and other factors and tend to move between one or more communities during the year. For instance, deer and elk move from the higher coniferous forests of their summer range to lower forests, prairies, or agricultural vegetative habitats to winter where snow cover is not so deep and food is more plentiful. Some avian species, such as ducks, geese, shorebirds, and songbirds, are migratory and remain for only short periods in communities during their travels. Table 3-19 lists the preferred vegetative habitats of wildlife species of concern which could be encountered by coal slurry pipeline project components.

Game Mammals

Big game species that occur in the vicinity of the proposed pipeline corridors are mule deer, pronghorn antelope, and white-tailed deer. Pronghorn would occur mostly in Wyoming and Nebraska, and mule deer range south into Kansas. White-tailed deer occur in all states that would have components of the coal slurry transportation project. The vegetative habitats where big game species could be encountered are listed in Table 3-19. Small game species, including rabbits and squirrels, occur in all states that would have project components and occupy most vegetative habitats that would be traversed.

Nongame Mammals

Nongame mammals that would be expected to occur in areas which would have project components include insectivores, bats, and rodents. Rodents, especially mice, voles, and gophers, are very common in cultivated areas and grasslands. Shrews tend to live in damp areas along rivers. Most bats hunt and probably rest in or near grasslands or open forest areas. Streams, lakes, and ponds also tend to attract feeding bats.

Game Birds

Upland game birds are abundant within the project region and provide a wide diversity for hunters. Some important upland game species that would be encountered along the proposed pipeline corridor include sage grouse, ring-necked pheasant, bobwhite quail, sharptailed grouse, wild turkey, and mourning dove. These species are largely dependent on waste grains, weed seeds, and insects for food and on brushy stream bottoms, ditch banks, and fence rows for escape cover. As indicated in Table 3-19, upland game species would be expected to occur in most habitat types that would betraversed. Waterfowl

TABLE 3-19

TERRESTRIAL SPECIES OF SPECIAL CONCERN AND THEIR PREFERRED VEGETATIVE HABITATS

Species	State	Vegetative Habitat[a,b] A	SGP	MGP	TGP	SBR	PPF	NFW	FW	CT	OHF	SPHF	Project[c]
Endangered or Threatened: Federal List													
Black-footed ferret	SD, WY, CO, NE, KS	X	X	X		X							All
Florida panther	AR, LA								X		X	X	PA, MA, CB
Red wolf	LA							X	X				PA,MA
Gray bat	KS, OK, AR	Colonies restricted to caves or cave-like habitats.											PA, MA, CB
Indiana bat	OK, AR	Colonies in caves.											PA, MA, CB
Ozark big-eared bat	OK, AR	Colonies restricted to caves.											PA, MA, CB
Bald eagle	All states	Wide-ranging raptor that may occur in most habitat types.											All
Peregrine falcon	All states	Wide-ranging raptor that may occur in most habitat types.											All
Whooping crane	SD, NE, KS, OK							X					PA, MA, CB
Red-cockaded woodpecker	AR, LA											X	PA, MA, CB
American alligator	AR, LA							X	X				PA, MA, CB
Endangered or Threatened: State Lists													
Northern swift fox	SD, NE		X	X									PA, MA, CB, OA
Greater prairie chicken	CO, SD, NE, KS, OK			X	X								PA, MA, CB, CA
Interior least tern	SD, NE, KS							X					PA, MA, CB, OA
Big Game													
Pronghorn antelope	SD, WY, CO, NE		X	X		X							All
Mule deer	SD, WY, CO, NE, KS		X	X		X	X						All
White-tailed deer	All states	X						X	X	X	X	X	PA, MA, CB, CA, OA
Small Game													
Desert cottontail rabbit	SD, WY, NE, CO		X	X	X	X	X						All
Eastern cottontail rabbit	NE, KS, CO, OK, AR, LA	X						X	X	X	X	X	PA, MA, CB, CA, OA
Swamp rabbit	OK, AR, LA								X				PA, MA, CB
White-tailed jackrabbit	SD, WY, CO, NE		X	X		X							All

TABLE 3-19 Concluded

Species	State	Vegetative Habitat[a,b] A	SGP	MGP	TGP	SBR	PPF	NFW	FW	CT	OHF	SPHF	Project[c]
Black-tailed jackrabbit	NE, KS, CO, OK, AR, LA		X	X		X							All
Gray squirrel	NE, KS, OK, AR, LA	X							X	X	X	X	PA, MA, CB
Fox squirrel	KS, OK, AR, LA	X							X	X	X	X	PA, MA, CB
Game Birds													
Sage grouse	WY			X		X							All
Ring-necked pheasant	NE, KS, SD	X		X				X					PA, MA, CB, OA
Bobwhite quail	All states	X			X			X	X	X			PA, MA
Sharptailed grouse	WY, SD, NE		X	X		X							PA, MA, CB, OA
Wild turkey	WY, NE, KS, OK, AR, LA						X	X	X	X	X	X	PA, MA, CB, OA
Mourning dove	All states	X						X	X	X	X	X	All
Other Species of Special Interest													
Golden eagle	SD, WY, CO, NE		X	X	X	X							All
Black-tailed prairie dog	SD, WY, CO, NE, KS, OK	X	X	X		X							All
White-tailed prairie dog	CO	X	X	X		X							CA
Sandhill crane	NE							X	X				PA, MA, CB
Great blue heron	KS, NE							X	X				PA

[a]See Appendix B of the Terrestrial Biology Technical Report (WCC 1980e) for detailed descriptions of habitats.

[b]A = agriculture; SGP = short-grass prairie; MGP = midgrass prairie; TGP = tall-grass prairie; SBR = shrub and brush rangeland; PPF = ponderosa pine forest; NFW = nonforested wetlands; FW = forested wetlands; CT = cross timbers; OHF = oak-hickory forest; SPHF = southern pine-hardwood forest.

[c]PA = proposed action; MA = market alternative; CB = Cypress Bend pipeline-barge alternative; CA = Colorado alternative; CC = Crook County alternative water supply system; OA = Oahe alternative water supply system.

would be encountered in wetland areas and at some river crossings.

Nongame Birds

A variety of nongame bird species would be expected to occur in the areas that would be affected by pipeline project components. Birds of prey (raptors) hunt in most of the vegetative habitats that would be traversed. Many of these birds are most often observed near bodies of water, cultivated fields, grasslands, and other areas where low vegetative cover facilitates hunting. In addition, their prey, consisting primarily of rodents, rabbits, and small birds, is more common in grasslands than in forests.

Threatened and Endangered Wildlife Species

According to the Fish and Wildlife Service (1980a), fourteen wildlife species listed as threatened or endangered by the Department of the Interior could occur near components of the coal slurry pipeline project. These species are the black-footed ferret, Florida panther, red wolf, gray bat, Indiana bat, Ozark big-eared bat, bald eagle, peregrine falcon, whooping crane, Bachman's warbler, red-cockaded woodpecker, Eskimo curlew, ivory-billed woodpecker, and American alligator. In addition, the northern swift fox and interior least tern receive state-level protection. Preferred vegetative habitat types for each of these species are given in Table 3-19, and each species is discussed in greater detail in the Threatened and Endangered Species Technical Report (WCC 1980f), which is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado 80228. Only a general discussion of each protected species that could be affected is presented here.

Federally Protected Species.

Black-Footed Ferret. The black-footed ferret was once found throughout the Great Plains, mountain basins, and semiarid grasslands of North America (Hillman and Clark 1979). Henderson et al. (1974) indicate the ferret was characteristic of the short- and midgrass prairies, and Clark (1978) indicates that 97 percent of ferret sightings in Wyoming were in shrub and brush and prairie vegetation types. Even though ferrets have been seen in haystacks, under buildings, and in ground squirrel colonies, most evidence indicates their principal habitat is prairie dog colonies (Clark 1978). Potential habitat for ferrets (prairie dog towns) occurs throughout the northern states that would have proposed action components, including Wyoming, Nebraska, Kansas, and Oklahoma. The Fish and Wildlife Service (FWS 1980b) considers the ferret extinct in Oklahoma.

In Wyoming a number of sightings of the ferret have been made (Clark 1978; Hehnke 1979). Seven ferret skulls were located in the state of Wyoming during the summers of 1978 and 1979 (Martin and Schroeder 1978).

The Nebraska Game and Parks Commission (1977) reported only 14 reliable sightings of black-footed ferrets since about 1965. The 14 sightings were made at 12 different locations in 9 counties, primarily in the panhandle and the southwestern part of the state. Prairie dog colonies are present in 48 of the state's 93 counties and probably total 10,000 to 12,000 acres (500 to 600 separate dog towns).

In Kansas, one ferret was observed in Cheyenne County in 1975 (Kansas Fish and Game Commission 1977). The last time a ferret was collected in Kansas was in 1957 (Kansas Fish and Game Commission 1977). About a half-dozen sightings of ferrets were reported between 1969 and 1973 (Henderson and Little 1973); two of these were in counties that would be crossed by proposed action alignments (Trego and Barton counties).

Bald Eagle. Although the bald eagle formerly nested throughout much of the United States, it now breeds primarily in the northern states and Florida. During the winter the bald eagle may be found along many bodies of water, especially larger rivers and lakes, throughout states that would have components of the proposed action.

Bald eagle nests are usually constructed in the tops of tall trees and are renovated yearly. Snow (1973) reported that large numbers of bald eagles gather at communal roosts, usually near a food source or shelter. Since the bald eagle is primarily a fish eater, large winter concentrations are usually found near rivers and reservoirs. Where carrion is plentiful, bald eagles tend to be more scattered and often roost away from large water bodies. Such is the case in portions of Wyoming that would be affected by the proposed action. Habitat requirements of the bald eagle are discussed in greater detail in the Threatened and Endangered Species Technical Report (WCC 1980f).

Although bald eagles nest in all states that would be affected by the proposed action, at the present time no active or inactive nest sites are known to be present near proposed project components. No communal roosts are known to exist in the affected vicinity of the proposed action. The closest known winter roost area is approximately 3 miles east of the proposed North Rawhide slurry gathering line near the Belle Fourche River crossing in Campbell County, Wyoming. According to the National Wildlife Federation's 1980 midwinter bald eagle counts, bald eagles winter on most large rivers that would be traversed by the proposed action pipeline. Major rivers that would be traversed by the proposed action pipeline, where overwintering bald eagles may be found, are the Belle Fourche, North Platte, South Platte, and Republican rivers in Nebraska; the Arkansas River in Kansas; the Neosho and Arkansas rivers in Oklahoma; and the Arkansas River in Arkansas. Only one specific location identified is of known concern: the Arkansas River in Oklahoma near Ponca City, at approximately MP P-720 of the proposed action route. Large cottonwoods along this fairly shallow and clear river offer prime bald eagle winter habitat; according to Short (1980), many bald eagles overwinter in the area.

Peregrine Falcon. The peregrine falcon formerly bred and wintered throughout most of North America, with the primary exception being the southeastern portion of the United States. This falcon still breeds throughout much of the western United States but is fairly rare in the east.

Most peregrine falcon nests are located on cliffs, particularly ones that are extremely high, overlooking water, and offering an extensive view. An adequate food supply in the vicinity of the nest is also a necessity. Nesting sites are normally reused yearly (Snow 1972). Habitat requirements of the peregrine falcon are described in more detail in the Threatened and Endangered Species Technical Report (WCC 1980f).

The peregrine falcon was probably always rare in Wyoming because of limited suitable habitat (Clark and Dorn 1979). The peregrine occurs most frequently as a migrant through Wyoming, although it may breed sparingly in the western portion of the state.

The only known record of peregrine nesting in Nebraska occurred in 1903 in Dawes County. According to the Nebraska Game and Parks Commission (1977), the peregrine occurs in Nebraska as a rare fall migrant and a rare winter resident. There are no known records of nesting peregrine falcons in Kansas during this century (American Peregrine Falcon Recovery Team 1977). According to Platt et al. (1974), the peregrine falcon occurs in Kansas as a fall and spring migrant and a winter resident. Typically, sightings occur around marshes, lakes, and rivers.

Chamberlain (1974) reported that the peregrine falcon breeds sparingly in western Oklahoma and occurs in eastern Oklahoma only as an occasional winter visitor. Seldom are more than a few birds reported in eastern Oklahoma in any one year. Eastern records include sightings near Washita National Wildlife Refuge, Hulah Reservoir, and Stillwater (Chamberlain 1974). Arkansas records suggest the peregrine is a rare fall and winter visitor in that state. Chamberlain reported recent records from Lonoke, Magazine Mountain, and Union County. The last record of nesting activity in Arkansas occurred in 1888 (Arkansas Department of Planning 1974). Louisiana sightings occur most frequently in coastal areas, although Chamberlain suggested the peregrine is a rare winter resident in scattered locations in the state. Lowery (1974a) reported peregrine records from Louisiana for early September through mid-May. The only known recorded breeding in the state occurred in 1942 near Tallulah in Madison Parish (Gulf South Research Institute 1976).

The peregrine is not known to nest near any components of the proposed action, and it would occur over most of the route only as an occasional fall and winter visitor.

Whooping Crane. The whooping crane formerly bred from the southern MacKenzie District and northeastern Alberta in Canada south through the prairie provinces and the northern prairie states. An additional nonmigratory breeding population occurred in southwestern Louisiana. The migratory population wintered on the Gulf Coast from Florida to Mexico (Lippincott undated).

The preferred summer and winter habitats of the whooping crane are marshes, but open water is often used. During migration, sandbars and mudflats are used; data indicate that harvested grain fields are visited during fall migration (Lippincott undated).

The whooping crane could occur in each state that would be affected by the proposed action. In Wyoming, Clark and Dorn (1979) considered the whooping crane an occasional migrant through the eastern and western thirds of the state, although it is more frequent in the western portion. The whooping crane occurs in Nebraska only as a migrant during the fall and spring (Nebraska Game and Parks Commission 1977). While in Nebraska, the crane utilizes sandbars on the Platte and Niobrara rivers as well as wetlands and croplands for roosting, resting, and feeding. In May 1978, the Fish and Wildlife Service designated the area of the Platte River from Lexington to Denman, Nebraska (approximately 53 river miles), as critical habitat for the whooping crane (FWS 1978).

In Kansas the whooping crane occurs only as a transient visitor during March, April, and October (Platt et al. 1974). Cheyenne Bottoms State Waterfowl Refuge in Barton County, Kansas, is designated as critical habitat for migrating whooping cranes. The pro posed action would traverse the southwestern corner of Barton County approximately 16 miles southeast of the refuge.

In Oklahoma the whooping crane appears as a transient visitor in the eastern two-thirds of the state. Salt Plains National Wildlife Refuge in Alfalfa County has been declared critical habitat for the whooping crane. Alfalfa County is located approximately 60 miles west of the proposed action route. The last whooping crane sighting in Louisiana was in 1950 near White Lake, Vermilion Parish, in the coastal wetlands area (Lowery 1974a).

Red-Cockaded Woodpecker. The red-cockaded woodpecker is found in scattered locations throughout the southeastern United States. Oklahoma, Arkansas, and Louisiana are the states in the present range of the red-cockaded woodpecker that would be affected by the proposed action.

The basic habitat requirement of the red-cockaded woodpecker is open stands of at least 60-year-old pines. Longleaf pine is most commonly used, but other species of southern pine are also acceptable (FWS 1980c). Hardwoods and dense pine stands with a dense understory are avoided. Roosting cavities typically occur in living pines and most frequently in trees that are infected with a fungus producing red-heart disease. Eggs are laid during April, May, and June. The female uses her mate's roosting cavity for a nest. From egg laying to fledging requires about 38 days, and another several weeks are needed before the young become completely independent.

The proposed action route in both Arkansas and Louisiana would traverse or pass near areas reported to have red-cockaded woodpeckers. Known colonies would occur between mileposts (MP) PMB-1060 and PMB-1070 (Barkley et al. 1980; James and Burnside 1979) and from MP PM-1160 to PM-1170 (Smith 1980) in Arkansas. The red-cockaded woodpecker could be encountered along the alignment in Arkansas from about MP PMB-1060 to PM-1175, and in Louisiana from MP PM-1240 to PM-1245 and from MP PM-1255 to PM-1275 (Dunham 1980).

Ivory-Billed Woodpecker. The ivory-billed woodpecker formerly occurred in the south Atlantic and Gulf states from North Carolina to eastern Texas and, to the north, in the Missis sippi Valley to Missouri, southern Illinois, and southern Indiana (FWS 1980c). Most authors agree this woodpecker is now extinct, but during the late 1960s and early 1970s there were unconfirmed reports of sightings in the Big Thicket area of east Texas and in southern Louisiana (Lowery 1974a).

Ivory-bills mated for life and normally traveled in pairs. Nesting usually occurred in cavities excavated in dead or partially dead trees. Breeding occurred between January and May (FWS 1980c). The ivory-billed woodpecker is not expected to occur along any proposed pipeline corridors.

American Alligator. The American alligator occurs on the Atlantic coastal plain in North Carolina and extends southward and around the coastline to Texas and from there northward along the Mississippi drainage to Arkansas and southeastern Oklahoma.

Oklahoma, Arkansas, and Louisiana are the states in the range of the American alligator that would have components of the coal slurry pipeline project. The American alligator could be encountered in southeastern Arkansas and along most of the proposed action route in Louisiana, where the alignments would traverse river systems, canals, lakes, swamps, bayous, and coastal marshes.

Eskimo Curlew. The Eskimo curlew formerly nested in the Arctic tundra and wintered in the grasslands of South America (FWS 1980c). The fall migration of the Eskimo curlew began in July. During the fall migrations these birds flew from Nova Scotia over the Atlantic Ocean directly to eastern South America. Spring migration began in late February, with the birds arriving on the coasts of Texas and Louisiana in early March. From the Gulf Coast the Eskimo curlew gradually migrated northward through the prairies of the middle United States to eastern South Dakota (FWS 1980c).

At one time, the Eskimo curlew probably visited each state that would contain components of the coal slurry pipeline project; however, there have been no recent sightings of this migratory species within those states. The last sighting in Wyoming was in 1897 (Clark and Dorn 1979); in Kansas, the last sighting was in 1891 (Platt et al. 1974). The last sighting in Nebraska was in 1926 (Nebraska Game and Parks Commission 1977), and the last sighting in Louisiana was in 1964 (Lowery 1974a). The Eskimo curlew is not expected to occur along the proposed pipeline corridors.

Bachman's Warbler. At one time, Bachman's warbler occupied wet forested areas in the southeastern United States during its breeding season (FWS 1980c). Nesting usually occurred from late March to early June. The present distribution of Bachman's warbler is unknown, but most authorities agree that if the warbler still exists it is most likely to be in the I'On Swamp area in Berkley and Charleston counties, South Carolina. There are no confirmed nesting records from this century for this species in any of the states that would have components of the coal slurry pipeline project. Bachman's warbler is not expected to occur along any of the proposed pipeline corridors.

Gray Bat. The gray bat occurs primarily in Alabama, Arkansas, Kentucky, Missouri, and Tennessee; a few colonies occur in Florida, Georgia, Kansas, Indiana, Illinois, Oklahoma, Virginia, and possibly North Carolina (FWS 1980c). Kansas, Oklahoma, and Arkansas are the states in the range of the gray bat that would have components of the coal slurry pipeline project.

Gray bat colonies are restricted entirely to caves or cave-like habitats. During summer the bats are highly selective for caves providing specific temperature and roost conditions, and in winter they use only deep, vertical caves having a temperature of 6° to $11^{\circ}C$. Consequently, only a small number of the caves in any area are used regularly. There are nine known roosting caves, which are believed to house roughly 95 percent of the hibernating population (FWS 1980c).

The only record of the gray bat in Kansas is from Cherokee County (Hays and Bingman 1964). The present distribution of the gray bat in Oklahoma includes the limestone cave regions of Adair, Cherokee, Delaware, and Ottawa counties in the northeastern corner of the state (FWS 1980b).

According to McDaniel and Gardner (1977), the gray bat is still abundant and widely distributed in the cave region of northern Arkansas. The gray bat occurs in the limestone and sandstone cave region of the northern portion of the Arkansas Ozarks comprising the Salem and Springfield plateaus. Maternity colonies have been reported in Benton, Madison, Stone, and Washington counties (Sealander 1979). Although records of gray bats exist for some counties that would have project components, cave habitats would be avoided by the project.

Indiana Bat. The Indiana bat occurs in the Midwest and eastern United States from the western edge of the Ozark region in Oklahoma to southern Wisconsin, east to Vermont, and as far south as northern Florida (FWS 1980c; Barbour and Davis 1968). Oklahoma and Arkansas are the states in the range of the Indiana bat that would be affected by the coal slurry pipeline project.

The Indiana bat uses mainly limestone caves for winter hibernation. A few individuals have been found under bridges and in old buildings, and several maternity colonies have been located under loose bark and in the hollows of trees. Summer foraging by females and juveniles is limited to riparian and floodplain areas. Creeks are apparently not used if riparian trees have been removed. Males forage over floodplain ridges and hillside forests and usually roost in caves.

Eastern Oklahoma is the extreme western edge of the known range of the Indiana bat. Glass (1975) reported Oklahoma records from Adair and Leflore counties. The Fish and Wildlife Service (1980b) reported additional collections from caves in Delaware and Pushmataha counties. Sealander (1956) reported Indiana bats from Baxter, Independence, Izard, Searcy, Stone, and Washington counties in Arkansas. Additional records exist from Newton, Benton, and Garland counties. Independence County is the only Arkansas county with records of the Indiana bat that would be affected by the slurry pipeline project.

The Indiana bat is not expected to occur near any of the coal slurry pipeline project components.

Ozark Big-Eared Bat. The Ozark big-eared bat has been reported from only a few caves in northwestern Arkansas, southwestern Missouri, and eastern Oklahoma (FWS 1980b and 1980c). Oklahoma and Arkansas are the states in the range of this bat that would have components of the coal slurry pipeline project.

Maternity and hibernating colonies of Ozark big-eared bats have been found only in caves. The only known maternity colony is in Kentucky (FWS 1980c). This bat is dependent on a few specific kinds of caves for hibernating and reproduction. It is highly susceptible to human disturbance and readily abandons roosts when disturbed.

According to the Fish and Wildlife Service (1980b), the Ozark big-eared bat has been reported from Cherokee and Adair counties in eastern Oklahoma. These Oklahoma records consist of occasional specimens found in caves. Harvey et al. (1978) reviewed the status of this bat in Arkansas but mentioned records for only Washington and Marion counties. The Fish and Wildlife Service (1980c) also reported the Ozark big-eared bat from Crawford, Madison, and Newton counties.

The Ozark big-eared bat is not expected to occur near proposed alignments or surface facilities of the pipeline project.

Florida Panther. Historically, the Florida panther ranged throughout the southeastern United States, including portions of Arkansas, Louisiana, Mississippi, Alabama, Georgia, Tennessee, and South Carolina (FWS 1980c; Hall and Kelson 1959). The Florida panther possibly still occurs in a number of small, isolated populations. Arkansas and Louisiana are the states in the historic range of the Florida panther that would have components of the coal slurry pipeline project.

Sealander and Gipson (1973) reported small panther populations near the Saline and Ouachita river bottomlands in southeastern Arkansas, in the White River National Wildlife Refuge near the confluence of the White and Arkansas rivers, in the western Ozark Mountains north of the Arkansas River, and in the Ouachita Mountains in west-central Arkansas south of the Arkansas River. Recent sightings indicate the panther is holding its own in Arkansas and population levels may be rising (Sealander and Gipson 1973). Most recent sightings have occurred in southeastern Arkansas. In Louisiana, Florida panther sightings have occurred recently in Natchitoches Parish (Goertz and Abegg 1966) and in Madison, Webster, St. Tammany, Concordia, Catahoula, and East Baton Rouge parishes (Lowery 1974b). The Florida panther's occurrence in areas that would have components of the coal slurry pipeline project is mostly a matter of conjecture (FWS 1980a).

Red Wolf. Although the red wolf was once found in numerous habitats throughout the southeastern United States (FWS 1980c), its recent range is restricted to less than 900 square miles in extreme southeastern Texas and less than 800 square miles of extreme southwestern Louisiana (Carley 1979). Louisiana is the only state in the present range of the red wolf that would have components of the coal slurry pipeline project.

The recent range of the red wolf in Louisiana is roughly the southwestern corner of the state, encompassing the area south of Interstate 10 and west of Calcasieu Lake. Generally, this area includes the western half of Cameron Parish and the southwestern quarter of Calcasieu Parish (Carley 1979).

The red wolf is not expected to occur in the vicinity of any proposed project components.

State-Protected Species.

Swift Fox. The historical range of the swift fox included the Great Plains from the southern Canadian provinces to the Texas panhandle (Hillman and Sharps 1978). Wyoming and Colorado have stable populations of this fox, but only remnant populations survive in South Dakota and Nebraska. The swift fox is considered threatened in South Dakota and endangered in Nebraska.

The swift fox is usually found on short- and midgrass prairies and is closely associated with black-tailed prairie dog colonies (Sharps 1980). These foxes excavate their own dens or modify prairie dog burrows or badger diggings (Hillman and Sharps 1978). Breeding probably occurs in early March, and the pups occupy natal dens until late May or early June. The swift fox occurs in areas traversed by the proposed action in northwestern Nebraska, particularly between MP PMB-120 and PMB-130 (L. Carlson 1980). At this location in Nebraska the route would pass near denning sites of the northern swift fox (L. Carlson 1980).

Interior Least Tern. The interior least tern breeds in Texas, Oklahoma, Kansas, South Dakota, Nebraska, Arkansas, Tennessee, Illinois, and Mississippi. It is a state-listed endangered species in South Dakota and a threatened species in Nebraska and Kansas.

River sandbars, sandflats, and other similar habitats are required for nesting. In Nebraska, nesting colonies of the interior least tern are known to occur along certain portions of the Platte River east of central Lincoln County (Nebraska Game and Parks Commission 1977). Platt et al. (1974) list the least tern as a summer resident of Kansas and report breeding records from the following Kansas counties: Hamilton, Meade, Rooks, Barton, and Stafford.

Coal Slurry Preparation Plants

The major vegetative habitat type for the proposed preparation plant sites (North Rawhide, Jacobs Ranch, and North Antelope) is midgrass prairie. Wildlife species of special interest that would occur or might occur on the proposed preparation plant sites include the black-footed ferret, bald eagle, peregrine falcon, and golden eagle.

If prairie dog towns occur at the coal slurry preparation plants, potential ferret habitat also occurs. Bald eagles would occur at the coal slurry preparation plants only as visitors; no nests or roosts are known to occur at these sites. Likewise, no golden eagle nests are known to exist at these sites. The peregrine falcon could occur infrequently over the preparation plants.

Water Supply System

Wildlife species of special interest that would occur or might occur in association with the proposed water supply system include the black-footed ferret, bald eagle, peregrine falcon, sage grouse, and golden eagle.

Any prairie dog towns traversed by the water supply system could provide potential ferret habitat. No bald or golden eagle nests or roost sites have been identified on the various water supply lines.

Sage grouse strutting grounds could occur on or very near the North Rawhide water supply line at MP NR-17, NR-23, NR-28, and NR-31. Peregrines could occur infrequently over any portion of the water supply system.

Slurry Pipeline System

Wildlife species of special concern that could occur along the slurry pipeline corridor between Jacobs Ranch (Wyoming) and its termination in Lousiana include the black-footed ferret, bald eagle, golden eagle, northern swift fox, peregrine falcon, sage grouse, American alligator, red-cockaded woodpecker, and interior least tern. In addition, concern was expressed for the golden eagle in Nebraska and the greater prairie chicken in Oklahoma.

Three golden eagle nests have been identified near the proposed action route in Nebraska, to the north of about MP PMB-233, PMB-237, and PMB-246 (L. Carlson 1980). The greater prairie chicken, a species of special concern in Oklahoma, could be encountered between MP P-690 and P-718 and between MP P-810 and P-825 in Noble, Mayes, and Wagoner counties, Oklahoma.

Where the proposed action route in Kansas would traverse Rattlesnake Creek (at about MP P-551) in Stafford County, known wetland habitat of value to a variety of wildlife (including various waterfowl) would be affected. Other wetland areas could be traversed near the North Fork Ninnescah River crossing (MP P-567) and near the South Fork Ninnescah River crossing (MP P-593) (Queal and Wood 1980). The proposed action route in Kansas would also traverse the Kingman Wildlife Area in the vicinity of MP P-589 (Queal and Wood 1980).

Two state nature areas that contain a variety of sensitive species are located south of the Independence lateral portion of the proposed pipeline route in Arkansas: Cove Creek Natural Area (south of MP PMB(I)-30) and Big Creek Natural Area (south of MP PMB(I)-68) (Smith 1980). The Quivira Wildlife Refuge in Kansas is located about 10 miles northeast of MP P-650.

The proposed action route in Arkansas would pass near or through the Harris Brake Wildlife Management Area between MP PMB-1020 and PM-1225 (Barkley et al. 1980). The area is managed for upland game.

The proposed pipeline route in Louisiana would traverse the following areas: (1) Georgia-Pacific Wildlife Management Area, near MP PM-1190; (2) Cities Service Wildlife Management Area, near MP PM-1205; and (3) Alexander State Forest, between MP PM-1315 and PM-1323 (Dunham 1980).

Dewatering Plants

Dewatering plants would be located mostly on urban and built-up lands. Some agricultural lands and southern pine-hardwood forest may also be affected.

3.A.5 AQUATIC BIOLOGY

For the purposes of aquatic biological analyses, the "affected environment" includes aquatic biota (plants and animals) and their physical habitats that would be either directly or indirectly disturbed by construction, opera tion, maintenance, or abandonment procedures. In general, directly disturbed resources include biota and habitats removed or displaced by proposed activities in the water body (e.g., riverbeds and biota disturbed by pipeline construction through a 100-foot right-of-way stream crossing). Indirectly disturbed aquatic biological resources include biota and habitats located downstream from areas that would be directly disturbed and hence affected by the flow of various materials away from the site of disturbance. Indirectly affected areas include streams and their biota, which would be affected by terrestrial components of the proposed action that could contribute to the stream sediment and pollutant loads without physically disturbing the stream bed (WCC 1980g).

Detailed aquatic biological descriptions of the affected environment for all project components and alternatives are included in the Aquatic Biology Technical Report (WCC 1980g), which is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Denver, Colorado 80228. Only those aquatic biota and habitats anticipated to be significantly affected by the proposed action or alternatives are described in this chapter.

Coal Slurry Preparation Plants

The three preparation plants would lie within a Missouri River subbasin that includes the Powder River and Cheyenne River drainages. This eastern Wyoming area is characterized as relatively flat, semiarid high plains, with annual precipitation averaging 10 to 18 inches (Pennak 1966; Missouri Basin Inter-Agency Committee 1969). The streams that might be affected by the proposed preparation plants (Table 3-20) would be ephemeral or intermittent (Baxter and Simon 1970).

Fish. The fish fauna of perennial reaches of these drainages consists largely of various minnows, shiners, chubs, suckers, black bullhead, and green sunfish (Wesche and Johnson 1980). Many of these same species would be expected to be found in the intermittent streams identified in Table 3-20 during periods of flowing water and, perhaps, in isolated pools during "dry" streambed conditions. Most of these fish are considered to be tolerant of intermittent and turbid stream conditions. They generally spawn from May through August in shallow, sandy stream areas (Baxter and Simon 1970).

Aquatic Invertebrates. Crustaceans, snails, and clams are limited in this region, primarily because of the intermittent nature of the streams, shifting substrates of the streams (Pennak 1966), and the lack of suitable fish hosts for the larval stages of many freshwater clams. Aquatic insects and worms are also adversely affected by unstable substrate conditions (Hynes 1970; Mackay and Kalff 1969; Cummins et al. 1964; Higler 1975). The result is low levels of biological production. Those areas of rivers and streams where coarse, stable substrates are available demonstrate dense and diverse populations of immature mayflies, caddisflies, flies, beetles, and aquatic worms. Wesche and Johnson (1980) reported low to moderate organism diversity and abundance in Thunder Basin streams.

Threatened and Endangered Species. No threatened, endangered, or other sensitive aquatic species would be affected by the proposed preparation plants. Extensive data regarding species classified as sensitive are reported in the Threatened and Endangered Species Technical Report (WCC 1980f).

Water Supply System

The four primary drainages potentially affected by the proposed water supply system are the Powder, Belle Fourche, Cheyenne, and Niobrara river basins. The proposed well field includes the intermittent headwaters of the Cheyenne River and a portion of its perennial mainstem. Approximately 32 intermittent streams would be crossed by the proposed water supply pipeline in Wyoming.

Fish. The Cheyenne, Belle Fourche, and Powder River fish faunas have been described above. The Niobrara basin shares much of its fish fauna with these drainages but also sustains populations of rainbow and brown trout, bluegill, and largemouth bass.

Aquatic Invertebrates. Aquatic invertebrates in the vicinity of the water supply system would be expected to be similar to the invertebrates discussed above.

Threatened and Endangered Species. It is not anticipated that any officially listed threatened or endangered aquatic species would be affected by the proposed water supply system.

TABLE 3-20
WYOMING RIVERS AND STREAMS CLOSEST TO THE PROPOSED COAL SLURRY PREPARATION PLANTS

Preparation Plant	Nearest Stream	Approximate Mileage from Plant Site to Stream
North Rawhide	Little Powder River	On site
	Dry Fork Little Powder River	On site
	Unnamed tributary to Little Rawhide Creek	On site
Jacobs Ranch	Little Thunder Creek	1.5 miles
	Unnamed tributary to Little Thunder Creek	1 mile
North Antelope	Porcupine Creek	1 mile
	Two unnamed tributaries to Porcupine Creek	1 mile

Slurry Pipeline System

Fish. In Wyoming, 2 perennial and approximately 75 intermittent streams would be crossed by the proposed coal slurry pipelines. Some important characteristics of the various Wyoming drainages that would be affected by the pipeline system are described above. The Niobrara River would be crossed by the pipeline at milepost (MP) PMB-90.5, where northern pearl dace and finescale dace may occur. These species are considered rare in Wyoming (Clark and Dorn 1979). Peak spawning activity for most Wyoming fish extends from late April through early August.

Permanent waters are encountered along the pipeline route in Nebraska as basins enlarge and as rainfall increases to 16 to 24 inches annually (Missouri Basin Inter-Agency Committee 1969). Approximately 11 perennial rivers and 41 intermittent or ephemeral streams would be crossed by the pipeline system in Nebraska. Major drainages crossed by the proposed pipeline route include the Niobrara, North and South Platte, and Republican River basins.

Tributaries of the North Platte and Niobrara rivers are spawning grounds for trout from Lake McConaughy and Box Butte Reservoir, respectively. Nebraska's trout fisheries play an important role in the state's total sport fishery (Nebraska Game and Parks Commission 1972a, 1972b; Van Velson 1978). Both brown and rainbow trout ascend the Niobrara River during the fall, and the proposed North Platte River crossing location (MP PMB-203) is rated Class I waters (highest-value fishery resource) by the U.S. Fish and Wildlife Service and Nebraska Game and Parks Commission (1978) because of its importance as a migration corridor for fall (November, December) and spring (March) spawning trout. Spawning activity for other Nebraska fish generally extends from April through July.

The North Platte, South Platte, and Republican rivers are generally broad, shallow, sluggish, sand-bottomed waterways with similar fish populations; there are about 45 species among them (Bliss and Schainost 1973a, 1973b, 1973c, 1973d; Kansas Forestry, Fish and Game Commission 1972a, 1972b, 1977a, 1977b; Nebraska Game and Parks Commission 1972a, 1972b; Missouri River Basin Commission 1975, 1976; Morris et al. 1974). Sport fishes found in one or more of these rivers include rainbow and brown trout, green sunfish, bluegill, largemouth and smallmouth bass, rock bass, northern pike, walleye, yellow perch, white crappie, and flathead and channel catfish. Spring Creek and the Republican River have been listed as Class I and II waters, respectively, (high-value fishery resources) by the U.S. Fish and Wildlife Service (1978) because of their catfish fisheries (Kansas Fish and Game Commission 1979; Bliss and Schainost 1973d).

Streams proposed to be crossed in the South Platte River basin have little value as sport fisheries (U.S. Fish and Wildlife Service and Nebraska Game and Parks Commission 1978). The South Platte River itself is considered Class IV waters (limited local sport fishery value) by the U.S. Fish and Wildlife Service.

Streams in roughly the northern half of Kansas are tributaries of the Missouri River, and streams in the southern half of the state are within the Arkansas River basin. Twenty-three perennial rivers and approximately 98 intermittent or ephemeral streams would be crossed by the pipeline in Kansas. Intermittent streams in the state seldom contain more than 10 to 15 fish species, but perennial streams commonly have more than 40 species (Cross and Collins 1975). Most large Kansas rivers have predominantly sand substrates, with reduced habitat and species diversity. These rivers contain gizzard shad, buffalofish, catfish, drum, chubs, and shiners.

Southeastern Kansas has some small, rocky streams providing the variety of habitat to support as many as 30 fish species. Numerous springs and increased annual rainfall (30 to 40 inches) contribute significantly to the availability and permanence of regional streams. Madtoms, sunfishes, and darters are characteristic of these areas (Cross and Collins 1975). In Kansas, fish spawning activity generally extends from March through July.

Similar conditions exist in north-central and northeastern Oklahoma, where rainfall averages

42 to 56 inches per year. The proposed pipeline route would cross numerous "prairie" streams and would border the Ozark region, which has many sinks, caves, and underground drainages (Webb 1970). In Oklahoma, 34 permanent and approximately 50 intermittent and ephemeral streams would be crossed by the pipeline.

The prairie streams of north-central Oklahoma are generally sluggish, with sand or silt bottoms, and may be clear or turbid. Abundant fish in the smaller streams include the plains killifish, various shiners and minnows, stoneroller, sunfishes, and catfishes. Buffalofish, gizzard shad, various suckers, and some bass species may be found in large prairie streams (Cross and Collins 1975).

Ozark rivers and streams tend to be high-gradient, clear, coarse-substrate waterways with a fish fauna dominated by madtoms, catfish, darters, chubs, suckers, sculpin, and shiners. Fourteen streams that would be crossed in Oklahoma are considered Class I waters (highest-value regional or statewide fishery) (FWS 1978). Some of these streams serve as important spawning areas or migration corridors for striped bass. In addition, smallmouth bass and sunfishes provide some sport-fishing opportunity. In Oklahoma, fish spawning activity generally extends from March through July.

The Arkansas, White, and Ouachita River systems flow southeasterly to their confluences with the Mississippi River in Arkansas (Moore 1966). Approximately 44 perennial rivers and 77 intermittent or ephemeral streams would be crossed by the slurry pipeline within these drainages.

Arkansas has the most diverse fish fauna of all the states potentially affected by the pipeline system, with 193 species, 4 of which are not found outside the state's boundary (Buchanan 1973). The Saline River (MP PM-1118), in particular, is considered to maintain one of the most diverse faunas in the southeastern United States (Smith 1980). Common warm water fishes that would be expected to be affected by the proposed action in Arkansas include carp, shad, gar, shiners, minnows, chubs, suckers, darters, catfishes, bass, sunfishes, and crappie. Fish spawning activity generally extends from March through July in Arkansas.

In Louisiana, approximately 134 perennial and 37 intermittent or ephemeral streams and rivers would be crossed by the proposed pipeline system. Five of the eight major drainages in the state would be affected, including the Red-Atchafalaya, Calcasieu, Lafourche, Mississippi, and Mermentau-Teche basins (Douglas 1974).

Approximately 148 freshwater fish species are known to occur in Louisiana. Common rough fishes include various species of chubs, minnows, shiners, and suckers. Common sport fishes that are statewide in distribution include white and black crappie, largemouth and spotted bass, numerous sunfish species, and catfishes. Spawning activity in Louisiana rivers and streams generally extends from March through July.

Aquatic Invertebrates. The aquatic macroinvertebrate fauna of Wyoming rivers and streams is described in this section. It is important to note that in general the invertebrate fauna of ephemeral and intermittent streams crossed by the slurry pipeline system would be less diverse and less dense than the fauna of perennial streams within the same drainages (Williams and Hynes 1977).

The generally sluggish and silted nature of the major Nebraska drainages has produced a macroinvertebrate community dominated by immature midges and worms, with a few beetles, mayflies, caddisflies, and stoneflies (Mackay and Kalff 1969; Pesek 1974; Colorado Division of Wildlife 1965). The silt substrate generally results in low levels of biological productivity (Carlander et al. 1966; Cather and Harp 1975).

Small, coarse-substrate streams in northern Kansas maintain macroinvertebrate populations of greater density, diversity, and productivity than the large, sand-substrate rivers (Robison and Harp 1971; Hynes 1970; Adams et al. 1976; Harp and Ricket 1977; Wilhm et al. 1978).

The potentially affected streams of southern Kansas, northeastern Oklahoma, and northwestern Arkansas are generally clear, coarse-substrate, often spring-fed streams with moderate to rapid current. The greatest degree of habitat and species diversity and macroinvertebrate productivity is found in the streams and rivers of this region.

The rivers and streams of southern Arkansas and Louisiana are turbid and sluggish, with sand, silt, and clay substrate. These waterways have lower macroinvertebrate density, diversity, and productivity than the Ozark streams. The snail and clam fauna, however, is well established (Burch 1973; Pennak 1978), and crustacean populations (primarily crayfish) are extensive (Hobbs 1976).

Macroinvertebrate populations of the lower Mississippi River include various mayfly, caddisfly, midge, beetle, worm, crustacean, snail, and clam species (Ragland 1974).

Threatened and Endangered Species. One of the two legislatively protected aquatic species that may be affected by the proposed action is the Arkansas darter, which is presently listed as threatened by the state of Kansas and may be proposed for federal protection under the Endangered Species Act. In Kansas, the Arkansas darter is restricted to small prairie streams and streams along the western Ozark border in the Arkansas River drainage (Cross and Collins 1975). Approximately 45 streams would be crossed by the proposed pipeline between MP P-532 and MP P-649 in Kansas, and many of them may sustain populations of Arkansas darters. Spawning activity extends from March through May (Cross and Collins 1975).

The other legislatively protected aquatic species of concern is the "fat pocketbook," a freshwater mussel that is considered endangered by the U.S. Fish and Wildlife Service. The fat pocketbook is found in various portions of the Mississippi River drainage (Burch 1973). It has been collected from both flowing and still water habitats with varied benthic substrates, although it seems to prefer flowing water and sand-silt substrates (EPA 1978a; U.S. Army Corps of Engineers 1979). It has been collected from shallow waters of just a few inches to depths of more than 8 feet (Parmalee 1967). Both historical and recent data indicate that the fat pocketbook inhabits the White and St. Francis river basins in Arkansas. These same data, however, suggest that this mussel is a large-river species, and it has been reported as such by the U.S. Army Corps of Engineers (1979), Starrett (1971), and Parmalee (1967). To date, the fat pocketbook has not been reported from ephemeral or intermittent streams or from small and medium-sized perennial streams. Therefore, it is suggested that the only river crossing location where this mussel may be expected to occur would be the White River crossing of the Independence lateral (MP PMB(I)-93).

Dewatering Plants
In Oklahoma, dewatering plants would be located adjacent to the Arkansas and Neosho rivers. In Arkansas, they would be located adjacent to the White and Arkansas rivers; and in Louisiana, dewatering plants would be located near the Calcasieu, Red, and Mississippi rivers and Castor Lake.

A general discussion of fish, aquatic invertebrates, and threatened and endangered species anticipated to exist in these rivers is included in the preceding discussion of species affected at pipeline river crossings. The invertebrate fauna of Castor Lake would probably be dominated by freshwater worms and various flies.

3.A.6 CULTURAL RESOURCES

A detailed synthesis of the prehistory and history of the region through which the pro posed action and alternative pipeline routes would pass is provided in the Cultural Resources Technical Report (WCC 1980h), available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado 80228. This synthesis includes cultural sequences through time and discussions of previous investigations within a 10-mile-wide study corridor. Information on known cultural resources within the 10-mile-wide corridor of the proposed and alternative pipeline routes has been compiled and is presented as estimated sites per square mile. This figure is based upon recorded site reviews and reflects the number of sites listed by all previous inventories in the area rather than the actual number of sites that may be encountered. Figures for alternatives are given only for areas that differ from the proposed action. The estimated square-mile site density figure indicates an approximate number of unrecorded sites that may be encountered during project construction.

Prehistoric resources are discussed for the various project components by state, cultural area, and site type. The proposed slurry transportation project would cross four major prehistoric culture areas: the Plains, the Ozarks, the Lower Mississippi Valley, and the Caddo. These areas are discussed in detail in the Cultural Resources Technical Report (WCC 1980h). Historic resources are discussed by geographic region, major historic theme, and site type.

The diversity of human occupation among the culture areas and through time is reflected in a wide variety of site types and locations. A site is a physical location of past human activities. Sensitive areas are those areas likely to contain sites that may be affected by the project. Sensitive areas are identified for the proposed action and alternatives.

Intensive on-the-ground inventories have not been conducted for any proposed or alternative project-related facility. Properties listed in the National Register of Historic Places (NRHP) are presented as Appendix F. Recorded resources not in the NRHP have not been evaluated as to their eligibility for the NRHP.

<u>Preparation Plants and Water Supply System</u>

<u>Prehistory</u>. The preparation plant sites and water supply system lie within the Plains Culture Area. Two sites have been recorded on the 1-square-mile study area for the proposed North Antelope preparation plant site. Large camps, consisting of extensive scatters of lithic artifacts and debitage, are the predominant site type in this area. No sites in the area are currently listed in the NRHP; however, several are considered potentially eligible. Based on known site locations, all areas near or adjacent to Porcupine Creek, East Fork Porcupine Creek, and their tributaries are considered sensitive. Several sites are located on the shores of ancient, now dry, lake beds. Because of the importance of these former lakes as areas of prehistoric resource exploitation, they are considered to be sensitive.

No sites have been recorded on the 1-square-mile study area for the proposed Jacobs Ranch preparation plant site. Forty-six sites have been recorded within the 160-square-mile distribution water pipeline study area. The predominant site type is the stone circle or tipi ring, representing seasonal or temporary camps. Several larger villages are also present. These represent more permanent settlement within the area. Most of these sites are located along terraces or ridges adjacent to North Prong Little Thunder Creek and Little Thunder Creek. One site is located along Olsen Draw. Although eligibility for the NRHP has not been determined, none of these sites is considered eligible. On the basis of known site locations, the alluvial valleys of the North Prong Little Thunder Creek and Little Thunder Creek are considered to be sensitive. Other potentially sensitive areas include uplands away from the major and minor drainages, which may have provided exploitable prehistoric resources such as lithic materials and game animals.

No sites have been recorded on the 1-square-mile study area for the proposed North Rawhide preparation plant. One hundred eighty six sites have been recorded in the 540-square-mile study area for the distribution water pipeline. The predominant site type is the lithic scatter, representing seasonal or temporary habitation. Stone circles (tipi rings) have also been recorded. One bison jump/kill site has been recorded and is considered eligible for inclusion in the NRHP. Sensitive areas would include any locale that tended to be part of a bison migration route, upland areas (bluff tops, ridges) for lithic resources, and timbered canyons and slopes of river bottoms for winter shelter. Sensitive areas in the immediate area would, then, include terraces and ridges along

Rawhide Creek, the Powder River and its tributaries, and all associated alluvial valleys and their upland margins.

The proposed water supply system lies in the Plains Culture Area. Three small, seasonal camps, consisting of lithic debris, fire-cracked rock, and hearths, are located in the proposed Niobrara County well field. No recorded inventories have been conducted within the 290-square-mile distribution water pipeline study area. Sensitive areas are drainage crossings and resource gathering areas in the uplands.

In the vicinity of the water supply system and preparation plants, a 732-square-mile study area was investigated and located 237 previously recorded sites. Approximate numbers of sites that may be encountered are 0.32 site per square mile or 1 site every 3 square miles. The predominant site type would be lithic scatter.

History. Native American groups that occupied the region were the Kiowa, Teton Dakota, Northern Arapaho, and Crow. Site types in eastern Wyoming associated with these groups are campsites, butchering sites, and trading areas. Eastern Wyoming was settled by homesteaders between 1870 and 1920. Settlement density in the initial phase of the homesteading wave was approximately four claims per square mile. No recorded historic sites are known to exist on preparation plant sites. Twenty-five historic sites are within the 10-mile study area for the proposed water supply system.

Slurry Pipeline System and Dewatering Plants

Sensitive areas near the dewatering plant sites, if any, are discussed under the appropriate state.

Prehistory. The prehistory of Wyoming is discussed under Preparation Plants and Water Supply System, above. Sensitive areas are alluvial valleys and drainages, especially the North Platte River in Platte and Goshen counties. Thirty-two sites are recorded within the 1060-square-mile Wyoming study area. Approximate numbers of sites that may be encountered are 0.03 site per square mile or 1 site per 33 square miles.

In Nebraska the predominant site types are large camps (or villages) with lithic and ceramic scatters, rock cairns, earth lodge villages, and burial grounds. A rock shelter is present. All drainages and alluvial valleys, especially the Niobrara and the North and South Platte rivers, are sensitive. Upland areas may have been utilized as resource gathering areas. Sixty-three sites are recorded as a result of 50 previous cultural resource inventories within the 2715-square-mile Nebraska study area. Approximate numbers of sites that may be encountered are 0.02 site per square mile or 1 site per 43 square miles. Three sites on the NRHP in the vicinity of the proposed pipeline in Nebraska are Agate Fossil Beds National Monument in Sioux County, Ash Hollow Cave National Historic Landmark within Ash Hollow Historic District in Garden County, and the Lovitt Site in Chase County.

Large camps are also found in Kansas. All drainages and alluvial valleys, especially the Arkansas River and its tributaries, are sensitive. Thirty-nine sites are recorded as a result of over 100 previous cultural resource inventories within the 2731-square-mile Kansas study area. Approximate numbers of sites that may be encountered are 0.01 site per square mile or 1 site per 70 square miles.

The proposed pipeline route lies within the Plains Culture Area in the northern section of Oklahoma. Near the Arkansas border and in northeast Oklahoma the proposed route enters the Ozark Culture Area. Large camps similar to those in Wyoming and Nebraska are also encountered along the route in Oklahoma. All alluvial valleys and drainages are sensitive, especially Lee Creek, Arkansas River, and Barren Fork Creek. Four hundred ten sites are recorded as a result of over 100 previous cultural resource inventories within the 2534-square-mile Oklahoma study area. Approximate numbers of sites that may be encountered are 0.16 site per square mile or 1 site per 6 square miles.

The proposed pipeline route lies within the Ozark and Lower Mississippi Valley culture areas in Arkansas. Numerous shelters have been located in bluffs along major streams. Large sites (and villages) seem to occur in alluvial valleys. Other site types that may be encountered are mounds, mortuary sites, petroglyphs, shell middens, and campsites with lithic and ceramic scatters. All alluvial valleys and drainages are sensitive, especially the Arkansas River and its tributaries, the Saline River, and the Ouachita River. Other sensitive areas are river features above the seasonal inundation level, such as natural levees, terraces, knolls, and upland areas. Five hundred ninety-two sites are recorded as a result of several hundred previous cultural resource inventories within the 3545-square-mile Arkansas study area. Approximate numbers of sites that may be encountered are 0.17 site per square mile or 1 site per 6 square miles.

The proposed pipeline route lies within the Lower Mississippi Valley and Caddo culture areas in Louisiana. All drainages and alluvial valleys that the proposed pipeline would cross are sensitive. Other sensitive areas are natural levees, abandoned river channels, terraces and ridges above and adjacent to major drainages, and other areas that are not seasonally inundated. Site types that may be encountered are camp and village sites, earthen mounds, kill and butchering sites, and fishing areas. Four hundred one sites are recorded as a result of several hundred previous cultural resource inventories within the 3239-square-mile Louisiana study area. Approximate numbers of sites that may be encountered are 0.12 site per square mile or 1 site per 8 square miles.

History. In the Plains Culture Area, the proposed pipeline would encounter site types associated with nomadic Native American groups that occupied the region, such as kill and butchering sites, hide preparation sites, tipi rings, ceremonial sites, and trading areas. Site types associated with semisedentary groups (part-time farmers) are village sites with associated farming remains, kill and butchering sites, village defense walls, and earthen lodges. In the Ozark Culture Area, the proposed pipeline route passes through the southern portion of the Osage hunting territory in northwest Arkansas. Site types that could be encountered are camps, kill and butchering sites, and lithic scatters. In the Lower Mississippi Valley and Caddo culture areas, site types that may be encountered are villages with associated farming remains, and hunting and fishing areas.

Most of the major historical themes of the western and central United States, from the initial European exploration to the present day, are reflected within the geographic regions that would be traversed by the proposed pipeline. Homesteading, ranching, oil and coal exploration, and westward travel by stage are expressed in known historic resources. In Wyoming, the Wyodak Coal Mine would be traversed by gathering lines near milepost (MP) NR-8 and NR-10.5. The remains of a historic sheep camp are located near MP PMB-4. Black Hills Stage Route is crossed near MP PMB-72. A stopover for the stage route (used between 1876 and 1881) is near MP PMB-72.

The Oregon, Mormon, and Emigrant trails are crossed by the proposed pipeline in Nebraska. Ash Hollow, known as a campground on the Oregon Trail, is approximately 1 mile northeast of MP PMB-246. Remains of the campground, wagon road, cemetery, and sites of Fort Grattan and a fur trading post are a part of the Ash Hollow Historic District. California Hill, an important place on the Oregon Trail, is near MP PMB-258. The proposed route crosses the Santa Fe Trail at MP P-530 in Kansas.

3.A.7 AGRICULTURE

The proposed (and alternative pipeline) routes would traverse and have surface facilities located on irrigated and nonirrigated cropland, native rangeland (used for livestock grazing), and woodland areas. Acreages and mileages for cropland and vegetation types affected by the proposed action (and each alternative) are shown in Table 4-16 in Section 4.A.4.

Soils in the northern portion of the project area are used primarily as native rangeland (livestock grazing) and, to a lesser extent, for nonirrigated cropland and irrigated cropland along major streams and on upland areas where ground water is available. Winter wheat, corn, other feed grains, sugar beets, beans, potatoes, and alfalfa are the main crops.

Soils in the central portion of the proposed project area are used primarily for nonirrigated cropland, native rangeland, and, to a lesser extent, irrigated cropland along major streams and on upland areas where ground water is available. Winter wheat, grain sorghum, corn, sugar beets, beans, potatoes, and alfalfa are the main crops.

Soils in the southern portion of the project area are used primarily as woodland (some grazing) and, to a lesser extent, cropland. Cash crops such as cotton, corn, other feed grains, and rice are some of the main crops.

Prime Agricultural Land

Since all surface facilities associated with the proposed project could potentially take agricultural land out of production for the life of the project (50 years), each major surface facility location was evaluated to determine whether it was prime agricultural land. Locations of ancillary facilities such as microwave towers and high-voltage transmission lines were not evaluated for agricultural land potential because of their insignificant size. The three proposed coal slurry preparation plants in Campbell County, the proposed well field and pump station in Niobrara County, and the pump stations associated with the two water distribution lines in Campbell County would not be located on prime agricultural land (Table 3-21).

Sixteen of the 23 slurry pump stations along the proposed main slurry pipeline would be located on potential prime agricultural land, but three of these sites are on urban and built-up land and thus are not prime (Table 3-21). In addition, several sites are not currently used as cropland. At least one pump station in each state traversed by the proposed main slurry pipeline would be located on potential prime agricultural land.

All nine of the dewatering plants associated with the proposed action system would be located on potential prime agricultural land, but three of these nine sites are on urban and built-up land and thus are not prime. One site is purposely flooded and thus is not prime (Table 3-22). In addition, two other sites are currently not used as cropland.

3.A.8 AIR QUALITY

The affected environment for air quality discussed below for the proposed action route and facilities also applies to the Market alternative. Similarly, the affected environment for the proposed action Niobrara County well field is also applicable for the Crook County and Oahe alternative water supply systems.

Coal Slurry Preparation Plants and Water Supply System

The proposed coal slurry preparation plants and the water supply system would be located in a semiarid area of Wyoming. No significant topographic features separate these project components, and both would be located in rural areas. Thus air quality conditions would be expected to be similar at both sites.

The ability of the atmosphere to disperse pollutants is strongly dependent on wind speed, wind direction, and atmospheric stability. Stability is usually classified into several classes (Pasquill 1961; Turner 1964), ranging from extremely unstable (Class A) to extremely stable (Class G). The National Climatic Center has published frequency distributions of wind speed, wind direction, and stability (STAR programs). The STAR (stability array) program for Casper shows that the area has good dispersion conditions, with neutral or unstable conditions (Classes A-D) occurring about 76 percent of the time on an annual average (U.S. Department of Commerce 1973). Another indication of good dispersion conditions is high afternoon mixing depth. Mixing depth is an indication of the depth of the layer in which pollutants are free to disperse. According to a study by Holzworth (1972), annual average mixing depth for the area is about 2200 meters, well above the national average. Because of similarities in topography and climate at the plant sites and at Casper, dispersion climatology at Casper is expected to represent that at the coal preparation plant sites.

TABLE 3-21

PUMP STATIONS ON PRIME AGRICULTURAL LAND: PROPOSED ACTION

Pump Station Designation[a]	Milepost[a]	Soil Association or Series	Land Use	Potential Prime Agricultural Land	Notes
NR	NR-0.0	Shingle-Wibaux-Rock Outcrop	Grazing/Wildlife Habitat	No	
NA	NA-0.0	Shingle-Wibaux-Rock Outcrop	Grazing/Wildlife Habitat	No	
N-1	N-0.0	Samsil-Gaynor-Limon	Grazing/Wildlife Habitat	No	
Jacobs Ranch N-2 N-3 PMBC-1	PMBC-0.0	Haverson-Bidman-Glenberg	Grazing/Wildlife Habitat	No	
P-2	PMB-46.1	Manvel-Shingle	Grazing/Wildlife Habitat	No	
P-3	PMB-91.9	Trelona-Vetal-Hargreave	Nonirrigated Cropland/Grazing/ Wildlife Habitat	Yes	Vetal portion only. Must have an adequate irrigation system to qualify as prime.
P-4	PMB-231.1	Colby	Grazing/Nonirrigated Cropland	No	
P-5	PMB-373.9	Holdrege-Keith	Nonirrigated Cropland/ Irrigated Cropland	Yes	Must have an adequate irrigation system to qualify as prime.
P-6	P-408.5	Holdrege-Uly	Nonirrigated Cropland/ Irrigated Cropland/ Grazing	Yes	Must have an adequate irrigation system to qualify as prime.
P-7	P-560.6	Smolan	Nonirrigated Cropland/ Irrigated Cropland	Yes	Must have an adequate irrigation system to qualify as prime.

TABLE 3-21 Continued

Pump Station Designation[a]	Milepost[a]	Soil Association or Series	Land Use	Potential Prime Agricultural Land	Notes
P-8	P-700.0	Bethany-Tabler-Kirkland	Nonirrigated Cropland/ Grazing	Yes	Tabler-Kirkland portion only.
PMB-9	P-807.5	Lula-Summit	Urban Land	Yes	This area is on urban and built-up land, thus not prime.
P-10	P-841.6	Yahola-Port-Reinach	Nonirrigated Cropland/ Irrigated Cropland/Grazing	Yes	Reinach portion only.
P-11	P-911.6	Mountainburg-Enders	Wildlife Habitat/Grazing	No	
Atkins Junction PMB(I)-1 PMB-12	PMB(I)-0.0 PMB-997.4	Pickwick-Leadvale	Grazing/Nonirrigated Cropland/Irrigated Cropland	Yes	
PMB(I)-2	PMB(I)-39.0	Linker-Mountainburg-Hartsells	Grazing/Cropland/ Wildlife Habitat	Yes	Linker portion only.
PMB-13	PMB-1077.6	Savannah-Boswell-Bowie-Shubuta	Urban Land	Yes	Savannah portion only. Does not qualify as prime if frequently flooded. This area is on urban and built-up land, thus not prime.
PM-14	PM-1137.6	Shubuta-Ruston-Alaga	Timber Production/ Grazing/Cropland	Yes	Shubuta-Ruston portion only. Does not qualify as prime if frequently flooded.
PM-15	PM-1203.6	Providence	Timber Production/ Grazing/Cropland	No	Slope range is too high.
PM-16	PM-1257.6	Frizzel-Providence-Guyton	Timber Production/ Grazing	Yes	Does not qualify as prime if frequently flooded.

TABLE 3-21 Concluded

Pump Station Designation[a]	Milepost[a]	Soil Association or Series	Land Use	Potential Prime Agricultural Land	Notes
Alexandria Junction					
PM(B)-1	PM(B)-0.0	Norwood	Woodland	Yes	Does not qualify as prime if frequently flooded. This area is not currently used as cropland.
PM-17	PM-1315.0				
PM(NW)-1	PM(NW)-0.0				
PM-18	PM-1360.0	Crowley-Mowata	Cropland/Grazing	Yes	Does not qualify as prime if frequently flooded.
PM(NW)-2	PM(NW)-75.6	Sharkey-Tunica	Urban Land	Yes	Does not qualify as prime if frequently flooded. This area is on urban and built-up land, thus not prime.
PM(NW)-3	PM(NW)-108.0	Sharkey-Commerce	Cropland/Grazing	Yes	Does not qualify as prime if frequently flooded.

Note: Land use for each pump station location was determined from Soil Conservation Service (SCS) surveys, maps, and publications and from 1:40,000 scale aerial photographs where available. The potential for prime agricultural land was determined from SCS lists and/or publications.

[a]Refer to strip maps in Appendix A for explanation of pump station designations and locations.

Sources: Kansas Agricultural Experiment Station 1973; Oklahoma Agricultural Experiment Station 1959; SCS 1967a, b; 1970a, b, c; 1974a; 1975a; 1977a, b, c, d, e; 1978a, b, c, d, e; 1979a, b, c; undated; U.S. Bureau of Chemistry and Soils 1924.

TABLE 3-22

DEWATERING PLANTS ON PRIME AGRICULTURAL LAND: PROPOSED ACTION

Dewatering Plant	Milepost[a]	Soil Association or Series	Land Use	Potential Prime Agricultural Land	Notes
Ponca City	P-700.0	Bethany-Tabler-Kirkland	Nonirrigated Cropland/ Grazing	Yes	Tabler-Kirkland portion only.
Pryor	P-807.5	Lula-Summit	Urban Land	Yes	This area is on urban and built-up land, thus not prime.
Muskogee	P-841.6	Yahola-Port-Reinach	Nonirrigated Cropland/ Irrigated Cropland/Grazing	Yes	Reinach portion only.
Independence	PMB(I)-93.0	Dundee-Dubbs	Cropland	Yes	Dubbs portion only. Does not qualify as prime if frequently flooded.
White Bluff	PMB-1077.6	Savannah-Boswell-Bowie-Shubuta	Urban Land	Yes	Savannah portion only. Does not qualify as prime if frequently flooded. This area is on urban and built-up land, thus not prime.
New Roads	PM(NW)-75.6	Sharkey-Tunica	Urban Land	Yes	Does not qualify as prime if frequently flooded. This area is on urban and built-up land, thus not prime.
Wilton	PM(NW)-141.5	Commerce-Sharkey	Cropland (flooded)/ Woodland	Yes	Does not qualify as prime if frequently flooded. This area appears to be purposely flooded, thus not prime.

TABLE 3-22 Concluded

Dewatering Plant	Milepost[a]	Soil Association or Series	Land Use	Potential Prime Agricultural Land	Notes
Boyce	PM(B)-24.0	Norwood	Woodland	Yes	Does not qualify as prime if frequently flooded. This area is not currently used as cropland.
Lake Charles	PM-1404.0	Wrightsville-Acadia Bibb-Mantachie	Timber Production/Grazing	Yes	Wrightsville-Acadia portion only. Does not qualify as prime if frequently flooded. This area is not currently used as cropland.

Note: Land use for each dewatering plant location was determined from Soil Conservation Service (SCS) surveys, maps, and publications and from 1:40,000 scale aerial photographs where available. The potential for prime agricultural land was determined from SCS lists and/or publications.

[a]Refer to strip maps in Appendix A for location of dewatering plants.

Sources: Oklahoma Agricultural Experiment Station 1959; SCS 1967b, 1970c, 1971, 1972a, 1975a, 1977c, f, 1978e, 1979c, undated.

The proposed coal preparation plants would be located in a rural area within the Wyoming Intrastate Air Quality Control Region (EPA 1972). This area has been designated as being "better than national standards" or "cannot be classified" for all criteria pollutants (EPA 1978b). Measurements of total suspended particulates have been made in the vicinity of the plant sites. These data indicate an annual geometric mean concentration of about 20 to 25 micrograms per cubic meter ($\mu g/m^3$) (ETSI 1979), which is below the Wyoming state standard of 60 $\mu g/m^3$.

Few measurements of gaseous pollutants have been taken in the project vicinity. Sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) measurements taken at Casper indicate annual average concentrations of about 6 $\mu g/m^3$ and 26 $\mu g/m^3$ respectively; maximum 24-hour SO_2 concentrations were about 28 $\mu g/m^3$ (Wyoming Department of Environmental Quality 1979). These values are far below both federal and state standards. No measurements of ozone or carbon monoxide are available for the vicinity of the proposed preparation plants; however, concentrations are expected to be well below standards.

<u>Slurry Pipeline System, Dewatering Plants, and Ancillary Facilities</u>

Air quality conditions along the proposed pipeline route, including dewatering plants and ancillary facilities, are discussed below.

According to the National Climatic Center STAR programs available for the project region, good dispersion conditions exist along the proposed pipeline route. Neutral to unstable conditions (Classes A-D) occur from about 76 percent of the time on an annual basis at Casper to about 58 percent of the time at Baton Rouge.

Holzworth's (1972) study of mixing depths in the United States indicates that mean annual afternoon mixing depths in the region of the proposed route range from about 1200 meters to 2000 meters, with most areas having mixing depths above the national average.

The proposed pipeline route would cross 15 different air quality control regions, as designated by the EPA (1972). Currently nearly all of these regions are designated as "better than national standards" or "cannot be classified" for total suspended particulates (TSP). Portions of Tulsa and Mayes counties in Oklahoma and parts of Pulaski and Sebastian counties in Arkansas are the only regions that at present do not meet the National Air Quality Standards for TSP.

The air quality along the proposed route was assessed from ambient air quality monitoring data available from various agencies in the states through which the pipeline route is proposed to pass. Because of the rural setting of the proposed route, little information is available. Measurements taken in the project region, and considered representative of the proposed route, indicate that TSP concentrations are occasionally in violation of state and federal standards. Annual TSP concentrations range from about 53.1 $\mu g/m^3$ at Gillette to 73.6 $\mu g/m^3$ at Tulsa. It should be noted that these measurements may have been influenced by some isolated industrial sources and may indicate greater concentrations than would be expected along the pipeline route. However, occasional violations of the 24-hour TSP standard may occur as a result of natural windblown dust.

3.A.9 RECREATION RESOURCES

Recreation resources are defined as formally designated areas that are managed to preserve and further their use for play, amusement, or relaxation. Attention here focuses on managed areas where the recreation experience could be directly affected by the proposed action. Included in those areas judged most significant are managed recreation lands actually traversed by the proposed pipeline route and areas where construction activities would be highly visible from the recreation site or access road, thereby affecting the natural scenic qualities of the landscape (an important element in the recreation experience, in many instances). Because of the importance of water-related activities, rivers, lakes, and reservoirs within close proximity to pipeline activities were also considered significant recreation resources.

The recreation areas under the management of various federal, state, county, and city agencies have been inventoried. Particular attention has been given to the following recreation resource concerns: (1) state-proposed or existing natural and scenic rivers; (2) rivers that have been inventoried by the Mid-Continent and South Central Regional offices of the Heritage Conservation and Recreation Service (HCRS) in the Nationwide Rivers Inventory, Phase I (1980a); (3) major trails that are either proposed, under study, or existing under a state or federal system; (4) proposed or designated National Natural Landmarks; and (5) other recreation resource concerns (e.g., hunting, state parks and recreation areas, county and city recreation facilities, etc.).

<u>Coal Slurry Preparation Plants and Water Supply System</u>

The area that would be affected by the preparation plants is principally in Campbell County, Wyoming. Outdoor natural recreation facilities in and near the county include state parks, lakes, and streams (Table 3-23). With the exception of hunting, opportunities for these outdoor natural activities within the county are limited. The county is particularly deficient in public access to streams and reservoirs that can be used for recreation. Only 7 percent of the total stream miles and 26 percent of the total acres used for recreation are public. Consequently, many Campbell County residents travel to neighboring counties for natural outdoor recreational experiences (BLM 1978).

Popular recreation areas outside the county include Big Horn National Forest in Sheridan and Johnson counties, the Devil's Tower National Monument, Black Hills National Forest, and Keyhole State Park in Crook County. These recreation areas account for more than a million visitor days per year (Table 3-24). Generally, between 60 and 75 percent of all visits to the recreation areas are made by Wyoming residents. In the future, fuel uncertainties and increased costs of travel may limit the distance people would be willing to travel for recreation. If residents of the Campbell County area made fewer trips to Yellowstone and Teton national parks in northwest Wyoming, for example, the effect might be an increase in visits to nearby recreation areas (Table 3-24).

Hunting for pronghorn antelope is a major recreational activity in Campbell County. In 1978 about 16 percent (over 9000 antelope) of the state's antelope harvest occurred in this county. During the same year, about 10,000 people hunted antelope in this county; this represented about 20,000 hunter days. Approximately 45 percent of the antelope hunters were county residents. Between 1976 and 1978, the number of hunting permits available decreased by 8 percent, from about 12,000 to 11,000 (Wyoming Fish and Game Commission 1979). During the same period, population in the county increased by 31 percent, resulting in increased hunting demand, greater competition for a limited number of permits, and reduced hunting opportunities for residents (BLM 1978).

<u>Slurry Pipeline System, Dewatering Plants, and Ancillary Facilities</u>

Pipeline-related activities would cross or be near 16 managed federal, state, and county recreation areas (Table 3-25).

Seventeen rivers having scenic or recreational value would be crossed by the proposed pipeline route (Table 3-26). Of these, 8 rivers were identified in HCRS's Nationwide Rivers Inventory, Phase I (HCRS 1980a), by the Mid-Continent and South Central Regional Offices. Draft reports were published on July 22, 1980, for the Mid-Continent Region and in March 1980 for the South Central Region identifying those inventoried rivers that could meet the criteria for a national wild and scenic river. The additional 10 rivers are those identified as having the potential for inclusion into a State Rivers system, or those rivers designated and under protection by state (Louisiana) law.

In addition, 15 major trails that would be crossed by the proposed slurry pipeline (Table 3-27) have historic, scenic, or recreation value. Many of these trails are included in state proposed plans. Since no significant impacts which would impair the recreation experience are expected, a complete listing of state trails is not presented here but is available in the

TABLE 3-23

OUTDOOR NATURAL RECREATION FACILITIES
IN OR NEAR CAMPBELL COUNTY, WYOMING

	Campbell County	Neighboring Counties[a]
Recreation Areas (acres)		
U.S. Forest Service	158,042	1,124,275
National Park Service	0	1,347
Bureau of Land Management	236,067	792,524
State Parks	0	4
Private	1,131,737	1,966,380
Total	1,525,846	3,900,644
Surface Water (acres)		
Alpine Lakes and Reservoirs	0	2,969
Lowland Lakes and Reservoirs	338	12,317
Farm Ponds	68	469
Total	406	15,755
Streams (miles)		
Public	10	649
Private	134	919
Total	144	1,568
Camping		
Family Sites	80	1,133
Capacity	400	5,665
Picnicking		
Family Sites	0	174
Capacity	0	870
Group Sites	0	50
Capacity	0	250
Swimming Sites	NA	1
Boating Sites	NA	3
Historic Areas	1	18

Source: Oblinger-McCaleb 1980.

NA = data not available.

[a]Includes Crook, Johnson, Sheridan, and Weston counties.

TABLE 3-24

CURRENT AND PROJECTED VISITOR USE OF PUBLIC RECREATION AREAS NEAR CAMPBELL COUNTY, WYOMING

		Visitor Days[a]			
Recreation Area	County	Current	1980	1985[b]	1990[b]
Big Horn National Forest	Sheridan, Johnson	845,800[c]	909,000	1,030,000	1,150,000
Black Hills National Forest	Crook	136,000[c]	146,000	165,000	185,000
Devil's Tower National Monument	Crook	43,302[d]	51,000	75,000	99,000
Keyhole State Park	Crook	120,231[d]	-	-	-

Source: Fisher 1980; Oblinger-McCaleb 1980; Wyoming Recreation Commission 1980.

[a]A common unit of measurement for recreation, representing 12 hours in activity (e.g., 3 people visiting a historic area for 4 hours equals 1 visitor day).

[b]Linear extrapolation based on recent five-year trends.

[c]1978 data.

[d]1979 data.

TABLE 3-25

MANAGED RECREATION AREAS CROSSED BY OR WITHIN 5 MILES OF THE PROPOSED PIPELINE ROUTE

State	Milepost[c]	Recreation Area
Nebraska	PMB-248	Ash Hollow Historic Park[a]
Kansas	P-394	Oberlin-Sappa State Park[a]
	P-512	Walnut Creek Proposed Recreation Area[b]
	P-591	Kingman County State Lake[a]
Oklahoma	P-825—P-830	Fort Gibson Lake, Sequoyah State Park[a]
	P-850—P-866	Tenkiller State Park and Reservoir[a]
	P-860—P-865	Spaniard Creek Public Use Area at Webber's Falls Reservoir[a]
Arkansas	P-870—PMB-997	Ozark National Forest[a]
	PMB-1015	Petit Jean State Park, Point Remove Park[a]
	PMB-1021—PMB-1040	Ouachita National Forest[a]
	PM-1288	Kisatchie National Forest, Catahoula Lake[a]
Louisiana	PM-1312—PM-1320	Alexander State Forest[a]
	PM-1400	Sam Houston State Park[a]

[a] Not crossed by but within 5 miles of the right-of-way.

[b] Crossed by the right-of-way.

[c] Refer to Appendix A for location of recreation areas.

TABLE 3-26

SCENIC AND RECREATIONAL WATERWAYS CROSSED: PROPOSED ACTION

State	Milepost[e]	River/Creek
Nebraska	PMB-91	Niobrara River[b]
	PMB-316	Stinking Water Creek[b]
Kansas	P-436	S. Fork Solomon River[b]
	P-532	Arkansas River[b,c,d]
	P-565	N. Fork Ninnescah River[b,c]
	P-610	Chikaskia River[b,c]
Oklahoma	P-904	Lee Creek[b]
Arkansas	PMB-929	Mulberry River[c]
	PM-964	Spadra Creek[c]
	PMB-970	Piney Creek[b]
	PMB-985	Illinois Bayou[c]
	PM-1161	Saline River[c]
	PMB-(I)-30	Cadron Creek[c]
	PC-1092	Bayou Bartholomew[c]
Louisiana	PM-1199	Bayou Bartholomew[d]
	PM-1288	Little River[d]
	PM-1330	Spring Creek[d]

[a]Scenic and recreational waterways as defined by Heritage Conservation and Recreation Service or a state agency.

[b]Heritage Conservation and Recreation Service, Department of Interior, Phase I Natural Rivers Inventory (1980a).

[c]State river identified for study.

[d]State-protected river.

[e]Refer to Appendix A for locations of protected waterways.

TABLE 3-27

MAJOR TRAIL CROSSINGS: PROPOSED ACTION

State	Name of Trail
Nebraska	Pioneer Mormon[a]
	Oregon Trail[a]
	Sidney-Deadwood Trail[b]
	Overland Stage-Denver Road[b]
Kansas	Santa Fe[b,c,d]
	Mormon Battalion[c]
	Old Cattle Trails[b,c,d]
	Parallel Road[b]
	Leavenworth Pikes Peak Express[b]
	Smoky Hill Trail[b]
Oklahoma	Old Cattle Trails (Western National Historical Trail)[c,d]
	Indian Nations[e]
	Texas Road (East Shawnee)[b]
	McClellan-Kerr Navigation System[f]
	Camp Grubber-Greenleaf Lake Trail[f]
	Tenkiller/Illinois/Barren Fork Rec. Trail[f]

[a] Existing Historic Trail, National Trails System Act (NTSA).

[b] Existing state trail.

[c] Studies complete, not recommended for designation (NTSA).

[d] House of Representatives Proposed Bill (HR80-87) trails legislation introduced for NTSA inclusio

[e] Trail under study (NTSA).

[f] Proposed state trail.

project files at Woodward- Clyde Consultants, San Francisco. Those trails having potential or existing national protection status are identified for informational purposes only. Further information concerning these trails is available from HCRS's Mid- Continent and South Central Regional offices in Denver, Colorado, and Albuquerque, New Mexico, respectively.

Three National Natural Landmarks (NNL), either under proposed status or designated, would be crossed by the proposed slurry pipeline. Three additional proposed NNL's would be within 5 miles of the slurry pipeline. These NNL's are listed in Table 3-28.

No dewatering plants would be located in formally designated recreation areas.

The only ancillary facilities that could affect the recreation experience are proposed microwave communication towers along the southern ridges of Carter Mountain next to the Ozark National Forest in Arkansas and next to the Alexander State Forest in Louisiana. Additional microwave communication towers are proposed adjacent to recreational waterways (Niobrara River, Arkansas River, Oologah Lake, and Saline River).

3.A.10 TRANSPORTATION NETWORKS

All paved roads and railroads in the project vicinity were inventoried to identify transportation segments that would be affected by construction, operation, maintenance, and abandonment of the proposed action. The status of the roads (whether interstate or state highway, and whether they are scenic or provide limited access to towns or recreation areas) was determined. In addition, railroad rights-of-way that would be crossed by the proposed pipeline were inventoried. The only segments of the transportation system that would be significantly affected by project-related activities are in the vicinity of the preparation plants and are described below.

Coal Slurry Preparation Plants

The principal means of access to all three preparation plants would be Wyoming State Highway 59. The North Rawhide preparation plant would be reached by Highway 59 north from Gillette, and both the Jacobs Ranch and North Antelope preparation plants would be reached by Highway 59 south of Gillette (see Maps A-1 through A-3 in Appendix A). The two southern plants are approximately 15 miles from the main highway, with immediate access provided by local county roads.

Highway 59, also known as Douglas Highway, is an element of the Federal Aid Primary system and is the main route connecting Douglas and Gillette. This road is currently under heavy use because of railroad construction in the area (the Burlington Northern and the Chicago and North Western railroads) as well as traffic related to the several coal mines between the two cities.

Highway 59 is a two-lane road, except for a five-mile portion immediately south of Gillette that has four lanes. Nearly 80 percent of the road has been rebuilt or is presently under contract. The remaining 20 percent of the road is planned for reconstruction within the next three to five years. This portion represents three segments of road: around the community of Bill, near the Reno Junction, and just south of Gillette. Currently the road is used for movement of heavy equipment used in oil and mining activities, and there have been no problems with degradation of the surface.

Highway 450 extends westward from Newcastle through Weston County toward the Jacobs Ranch and North Antelope preparation plant sites. Highway 450 is a two-lane road that would provide access to these two sites from Newcastle.

3.A.11 VISUAL RESOURCES

Visual resources are the physical characteristics of a landscape that determine its scenic quality and relevant value to the viewing public. These characteristics are frequently described according to the line, form, color, and texture of the natural features in the environment (landform, vegetation, water, soils) that make up a specific landscape scene.

TABLE 3-28

NATIONAL NATURAL LANDMARKS CROSSED BY
OR WITHIN 5 MILES OF PROPOSED PIPELINE ROUTE

Milepost [e]	State/County	Name
PMB-40 to PMB-60	Wyoming/Niobrara	Lance Creek Fossil Area [a,b]
PM-70	Wyoming/Niobrara	Hat Creek Break [a,c]
PMB-190 to PMB-210	Nebraska/Garden and Morrill	Oshkosh Prairie [a,c]
PMB-990	Arkansas/Pope	Cagle Rock [c,d]
PMB(I)-80	Arkansas/Independence	Salado Creek [c,d]
PMB-1015	Arkansas/Conway	Cedar Creek Canyon [c,d]

[a] Crossed by proposed route.

[b] Designated National Natural Landmark.

[c] Potential National Natural Landmark.

[d] Within 5 miles of proposed route.

[d] Refer to Appendix A for locations of National Natural Landmarks.

Since the term "scenic" implies exposure to human sensory experience, the visual resources for this project will include only those landscapes within the "seen area" of human use (highways, rivers, trails, recreation areas, and human developments). This section will focus on identifying and describing particularly sensitive visual resources, such as mountainous regions, steep slopes, waterways, valleys, heavily forested areas, and landscapes with fragile vegetation. Special attention is also given to areas already identified as having high scenic quality, such as wilderness areas, parks, scenic roadways, natural and scenic creeks and rivers, natural and historic landmarks and trails identified by the Heritage Conservation and Recreation Service (HCRS) or state agencies (Tables 3-25 through 3-28), and the public lands under the jurisdiction of BLM and rated a protected status under the agency's visual resource management (VRM) program. Ratings are derived by assessing (1) the inherent quality of the landscape, (2) the sensitivity of visual resources to modification, and (3) the distance from areas of human use. Ratings imply the level of management required for maintaining visual quality (BLM Manual 8400-VRM).

Most of the land that would be used for the proposed project is private rather than public; standard BLM inventory information (VRM classifications) was available only for the BLM-managed land in Wyoming. However, the basic procedure used by BLM for identifying visual resources is applied throughout. Resource material for this portion of the assessment included U.S. Geological Survey topographic maps, state roadway maps, national and state natural river listings, the ETSI pipeline right-of-way log, and input from other technical disciplines (particularly biology, recreation, transportation, and cultural resources).

The existing visual resources within the affected environment along the proposed route were examined for the following facilities: coal preparation plants, water supply system, slurry pipeline system, and pump stations (by milepost) and dewatering facilities and ancillary facilities (e.g., microwave towers). Existing visual resources are described in detail below only for those landscapes where pipeline facilities would cause significant or long-term visual impacts. Areas where pipeline facilities were determined to have visual impacts but landscapes were not considered of particular scenic value (either because they had already been degraded by human activity or they did not exhibit any pronounced visual characteristics) included: the preparation plants; portions of the pipeline right-of-way, including the New Roads, Baton Rouge, and Wilton laterals; pump stations; the Ponca City, Pryor, Muskogee, White Bluff, Baton Rouge, and Lake Charles dewatering plants; and the Cypress Bend barge site.

Water Supply System

The water well field site is located in rolling rangeland with few visual features of special note. U.S. Highway 85 (5 miles away) and several scattered ranch dwellings are the nearest areas of human use in the vicinity of the proposed well field.

Slurry Pipeline System

The following discussion of the affected environment is by pipeline milepost designation for the proposed action.

MP PMB-91 and Pump Station P-3 (MP PMB-91.5). This section of the proposed pipeline and this pump station intersect three human use areas--U.S. 20 from Lusk, Wyoming, to Crawford, Nebraska; the Niobrara River (a prime rainbow trout spawning ground and sport fishing stream); and the Chicago Northwestern railroad.

The Niobrara River at this point is sluggish and clear. The surrounding landscape is made up of short-grass range with some agriculture and is slightly rolling terrain. The area is primarily natural, with a few ranches scattered nearby. The town of Lusk is about 15 miles to the northwest. The overall visual image is one of openness, with little variation in texture, form, and color, except for that introduced by the understory and low brush along the river.

MP PMB-265. This pipeline segment intersects U.S. 30, the South Platte River, and I-80 5 miles from the town of Ogallala and 3 miles from Brule, Nebraska. The river is a recreation resource for fishing, boating, and other activities.

The riparian zone, or riverbank, has cottonwoods and a dense understory, providing interesting texture, color, and form along the scenic riverscape.

MP PMB-360. This segment intersects U.S. 6/34 midway between the towns of Culbertson and McCook, Nebraska, and crosses the Republican River (a Class II water--of high value as a fishery resource). The riparian zone is densely vegetated with cottonwood, willow, elm, locust timber, and understory. The river is clear, with a sand bottom and good flow providing color and texture. The landscape characteristics have high scenic quality, with diversity in color, texture, and line.

Pump Station P-8, MP PMB-373.9. This site is adjacent to U.S. 83 south of McCook. The surrounding terrain is rolling farmland. Visual features are high ridges to the west and east, creating a definitive visual border and enclosed view of the landscape.

MP P-434 to P-436. This segment crosses U.S. 24 (scenic highway), Union Pacific railroad, and the South Fork of Solomon River 6 miles west of Hill City, Kansas. The riparian vegetation includes large cottonwoods with dense understory. The river is sluggish and somewhat turbid. The surrounding terrain is hilly with a variety of vegetation; it is considered of high scenic quality because of the interesting color, textures, and form of the landscape.

MP P-445, P-486, P-496, P-508, P-515, P-530. These segments would intersect several major roadways: U.S. 283, I-70, U.S. 183, State Highways 4 and 96, and U.S. 56 (scenic). Nearby towns are LaCross, Great Bend, and Ellis, Kansas. The Walnut Creek area is a proposed state recreation area. These segments of the proposed pipeline would also cross several rivers and creeks with dense vegetation (willow bush, cottonwood, and understory). Since surrounding landscapes are primarily dryland farms and open, rolling range, the colorful and richly textured riverbeds offer scenic diversity and constitute focal points on the landscape and are therefore high-quality visual resources.

Pump Station P-10, MP P-560. This site is adjacent to U.S. 83 near Stafford, Kansas. The surrounding terrain is rolling farmland. High ridges to the west and east create a visual border and enclosed view of the landscape.

MP P-591. The proposed pipeline would cross U.S. 54 six miles west of Kingman, Kansas, very close to the Kingman County State Lake camping and recreation area. This site is about 40 miles from the metropolitan area of Wichita. The Kingman State Lake and the Ninnescah River landscapes are well vegetated and of high scenic quality (as evidenced by the presence of a state recreation area). The diversity in color offered by the presence of water and the rich textures of a variety of vegetation provide interesting landscape features for human enjoyment.

MP P-610. The proposed pipeline would cross the Chickaskia River near State Highway 14. The Chickaskia has been inventoried for study by the state and the HCRS for protection as a natural and scenic river. It has good flow and a sand bottom and is densely vegetated, providing a rich variety of color, texture, and form.

MP P-761. This portion, located on the Osage Indian Reservation, would intersect State Highway 11 four miles north of Skiatook, Oklahoma. Rolling hills, forested with nonmerchantable oak and brush, and rock outcroppings characterize this landscape. The composition is one of interesting texture and pattern. Oil wells are scattered throughout, reducing the visual quality of the otherwise natural setting by breaking the continuity in line and form of the horizon.

MP P-770 to P-779. This proposed segment would pass 1 mile below Oologah Lake, 3.5 miles from State Highway 88, and along the southern border of Will Rogers State Park. The nearby Verdigris River is approximately 300 feet of open water with a well-vegetated riparian zone. The surrounding landscape is woodlots and farmland to the west and scenic Oologah Lake to the north. This is a high-quality landscape offering a picturesque composition of interesting colors, textures, and forms.

MP P-808. This segment would intersect State 33 just south of the Grand River crossing 3 miles south of Chouteau and 9 miles from Pryor, Oklahoma. The Grand River is a commercial and sport-boating water. The Grand (Neosho) River is a river drainage of Lake Hudson. The river crossing is 500 to 600 feet of open water with steep-ledge rock banks. The riparian zone is heavily timbered on both sides of the river.

MP P-838. The pipeline would cross the Neosho River approximately 1 mile from Highway 2 and 4 miles north of Muskogee, Oklahoma. This is a densely vegetated scenic area with abundant waterways and recreation sites.

MP P-850 to P-866. This segment would pass 8 miles south of Muskogee and 4 miles east of U.S. 64 along the Arkansas River. It would be visible primarily from the Muskogee Turnpike, which the pipeline would parallel along this segment. Tenkiller State Park and reservoir are on the other side of the river, adding significantly to the value of the landscape features. The high-quality scenic river landscape characterizes this segment of the proposed pipeline route. There is dense vegetation in the riparian zone. Spaniard Creek and the Webbers Falls Lock and Dam provide additional scenic attributes.

MP PMB-929. The pipeline would pass less than 1 mile from Pleasant Hill, U.S. 64, and Interstate 40 (scenic). The riparian zone of the Mulberry River is well vegetated; the terrain is flat to rolling. The river has been identified for study as a state scenic river. Ozark National Forest is directly to the north.

MP PMB-960 to PMB-999. This segment would parallel I-40 and cross several state roadways and paved county roads. There is scattered residential development in the surrounding landscape, which is south of Ozark National Forest and Recreation Area. The segment would pass just north of Clarksville, Dardanelle Lake, and Russellville, Arkansas. The right-of-way would cross the Spadra Creek, which has been identified for study as a state scenic river.

Piney Creek and the Illinois Bayou have both been inventoried as candidates for the status of scenic rivers by the Heritage Conservation and Recreation Service. Coniferous forests are noticeable in the landscape; the scenic Ozark National Forest is in the background to the north, and Dardanelle Lake is to the south. The combination of the forested mountains in the background and the scenic rivers in the foreground makes this landscape rich in color, texture, and form.

Independence Lateral: PMB-(I)-36 to PMB(I)-60. This segment of the pipeline runs through the foothills south of the Boston Mountain range and Ozark National Forest to the southern tip of Greers Ferry reservoir. The right-of-way crosses Cadron Creek and the Little Red River, both environmentally sensitive waterways with high scenic qualities. The Greers Ferry reservoir is a popular recreation area in Arkansas. The landscape is characterized by rich color and texture from lush vegetation surrounding each of the above-mentioned waterways.

MP PMB-1013. This segment of pipeline would cross the Arkansas River between Point Remove Park and Petit Jean State Park, southwest of Morrilton and 1 to 2 miles north of State 154. This is a high-quality scenic landscape situated between two parks and along the Arkansas River. It is a heavily vegetated and rolling terrain offering a scenic backdrop to the river landscape.

MP PMB-1021 to PMB-1030. This segment would parallel State 9 and cross State 10 leading to Ouachita National Forest and campgrounds (a recreation area used by residents and visitors in the Little Rock metropolitan area).

The proposed pipeline would cross the Fourche LaFave River (MP PM-1022), where vegetation is abundant. The terrain in this area is heavily forested, with rolling to mountainous topography in the background. The visual quality is high, with primarily undisturbed natural features.

MP PM-1199. The pipeline would cross Bayou Bartholomew approximately 2 miles north of U.S. 165 and the town of Perryville, Louisiana, and 12 miles north of the city of Monroe, Louisiana. Bayou Bartholomew has been identified as a state scenic river and is characterized by a large variety of lush vegetation and by diversity in color and texture.

MP PM-1288. This segment would cross the Louisiana scenic Little River at State 127, east of Kisatchie National Forest and northeast of Pineville, and the access road to Catahoula Lake and recreation area. This is a high-quality visual resource landscape, with the scenic Little River and Lake Catahoula as primary natural attributes. Vegetation is abundant, offering a variety of color, texture, and form to the visual setting.

MP PM-1316 to PM-1320. This portion of the pipeline would be near the border of the Kisatchie National Forest and the Alexander State Forest. The pipeline would also cross U.S. 165 south of Alexandria. In addition to its proximity to the national forest, this portion of the pipeline would cross Spring Creek, Bayou Boeuf, and Cocodrie Diversion Channel. This is a high-quality natural setting with diverse vegetation and natural waterways.

Dewatering Plants

All dewatering plants would be located in proximity to existing coal-fired power plants. The descriptions below are of the areas surrounding each site.

Oologah. This proposed plant site is immediately to the south of Oologah Lake and Will Rogers State Park along U.S. 169. It is within 9 miles of the city of Claremore, Oklahoma, and is in a prime recreation area. The scenic quality of the bordering recreation area (Oologah Lake, the Verdigris River, and the state park) is high. Abundant vegetation provides high-quality color and texture in this rolling landscape.

Independence. The proposed plant site is 8 miles outside Newport, Arkansas, along State 69 and the White River. The river landscape has interesting textures, colors, and form provided by dense understory and timber growth. Since the surrounding landscape is flat agricultural terrain, the richly varied river landscape is of increased significance.

Wilton. This proposed plant site is located off State 44 near the town of Romeville; the nearest cities are Donaldsonville and Reserve, Louisiana. The area includes riverside development surrounded by marsh floodplains and vegetation.

Boyce. The proposed plant site is 4 miles outside the town of Boyce along State 8 north of Alexandria, Louisiana. This is a high-quality natural setting surrounded by national forests, lakes, and scenic resources.

Ancillary Facilities

The following listing identifies areas of visual sensitivity where microwave towers would be located along the pipeline routes. Milepost indicators are the closest pipeline reference point.

MP PMB-93. This microwave tower would be adjacent to the HCRS- inventoried environmentally sensitive natural landscape of the Niobrara River, Nebraska, and visible from State 20.

MP P-677. The proposed microwave site is next to State 11 outside of Blackwell, Kansas.

MP P-700. The proposed microwave site is near the Ponca City terminal in Oklahoma.

MP P-726. This tower would be visible from State 20 and is near the Arkansas River.

MP P-263. The site is next to the Osage reservation.

MP PMB-780. The site is at the southern tip of Oologah Lake and recreation area near State 88. It would be visible by recreation visitors using the lake.

MP PMB-946. The site is located adjacent to Ozark National Forest.

MP PMB(I)-30. The proposed site is along the Republican River near State 25.

MP PM-118. The proposed site is located along the Saline River (a natural river inventoried for protection by HCRS) and State 35 south of the town of Rison.

MP PM-1275. The site is located near the town of Jana and U.S. 84.

MP PM-1301. The site is located northeast of the city of Alexandria near State 28.

MP PM(NW)-1. The site is located near Summerville and Chambers, north of Alexander State Forest.

3.B MARKET ALTERNATIVE

For the following project components, the affected area for the market alternative is the same as the affected area for the proposed action:

- Coal slurry preparation plants
- Water supply system
- Slurry gathering pipelines
- Main slurry pipeline from milepost (MP) PMB-0 to MP PMB-378 and from MP PMB-922 to the seven dewatering plants in common
- Dewatering plants at Pryor, White Bluff, Independence, Boyce, Lake Charles, New Roads, and Wilton

Only the affected areas for the following market alternative components, which are different from the proposed action, are discussed in this section:

- Main slurry pipeline from MP PMB-378 (=MB-0) to MP PMB-922 (=MB-492) and the short pipeline to the Baton Rouge terminal
- Dewatering plants at Oologah and Baton Rouge

3.B.1 WATER RESOURCES

Surface Water

Under this alternative, 17 more intermittent creeks, 25 more minor streams, and 8 fewer major rivers would be crossed compared with the proposed action (WCC 1980c, Table 2-1). Surface facilities located within potential 100-year floodplains are listed in Table 3-6.

3.B.2 SOCIOECONOMIC CONSIDERATIONS

Slurry Pipeline System

The counties not discussed under the proposed action that would potentially be affected by pipeline and pump station construction and operation under the market alternative are listed in Table 3-29.

Dewatering Plants

Since the Oologah and Pryor dewatering plants would be constructed within 30 miles of each other a single affected area was defined. Table 3-30 lists those potentially affected areas not discussed before and for each gives population and construction employment data. Summaries of the Oologah/Pryor and Baton Rouge areas follow.

Oologah/Pryor. The Oologah and Pryor dewatering sites are in Rogers and Mayes counties, respectively. Both counties are in the Tulsa Standard Metropolitan Statistical Area (SMSA) and the sites are approximately 35 miles from Tulsa proper. The area labor pool includes about 12,000 construction workers.

Baton Rouge. The site of the proposed Baton Rouge dewatering plant is in East Baton Rouge Parish. In 1978, the city of Baton Rouge had a population of 332,000 and the Baton Rouge SMSA had approximately 25,000 workers employed in construction.

TABLE 3-29

COUNTIES IN AREAS POTENTIALLY AFFECTED BY ONLY MAIN SLURRY PIPELINE AND PUMP STATIONS: MARKET ALTERNATIVE

County/Parish	Pump Station	1975 Population	Fiscal Year 1976-77 Tax Revenues ($1000s)
Kansas			
Phillips		7,900	3,108
Rooks		7,300	2,854
Osborne		6,200	1,730
Russell		9,000	4,456
Ellsworth	MB-6	6,200	2,962
Rice		12,000	4,515
McPherson		25,900	8,720
Harvey		29,500	9,556
Sedgwick		351,000	90,077
Butler	MB-7	41,800	11,866
Cowley		34,700	8,986
Chatauqua		4,700	1,366

Sources: U.S. Bureau of the Census 1978, 1979b.

TABLE 3-30

AREAS POTENTIALLY AFFECTED BY CONSTRUCTION AND OPERATION OF DEWATERING PLANTS: MARKET ALTERNATIVE

Dewatering Plant Site	Counties/Parishes in Potentially Affected Area	July 1975 County Population	Area Construction Labor Pool
Oologah/Pryor	Osage	31,390	
	Washington	41,967	
	Rogers	33,671	
	Mayes	27,213	11,985
	(Tulsa)	416,892	
	(Wagoner)	27,225	
	Cherokee	25,143	
	Adair	16,615	
Baton Rouge	W. Baton Rouge	17,522	
	E. Baton Rouge	310,922	24,675

Sources: U.S. Bureau of the Census 1978. Source of state employment agency figures varies by state. For individual state figures, see the Socioeconomics Technical Report (WCC 1980d).

Note: Counties in parentheses would not have project components but would potentially be affected by the project.

3.B.3 VEGETATION

The market alternative would traverse or have permanent facilities located on the same vegetation types as listed for the proposed action in Section 3.A.3. Acreages and mileages for each vegetation type that would be affected are identified in Table 4-2 in Section 4.A.4.

Each of these vegetation types is described in detail in Appendix B of the Terrestrial Biology Technical Report (WCC 1980e). These areas are used mainly for agriculture, livestock grazing, wildlife habitat, and recreation.

3.B.4 WILDLIFE

The primary wildlife habitat types which would be affected by the market alternative and wildlife species of special concern occurring within these types are listed in Table 3-19. Since the market alternative would traverse the same vegetative habitats as the proposed action, wildlife species encountered would be essentially the same as those described for the proposed action in Section 3.A.4.

Threatened and Endangered Wildlife Species

Federal protected wildlife species which could occur in areas that would be affected by the market alternative include the black-footed ferret, bald eagle, peregrine falcon, red-cockaded woodpecker, and American alligator. In addition, two state protected species, the northern swift fox (Nebraska) and interior least tern (Kansas), could also be encountered. Each of these species is described in greater detail in the discussion of the affected environment for the proposed action (Section 3.A.4). Additional information is available in the Threatened and Endangered Species Technical Report (WCC 1980f).

The range of the greater prairie chicken in Oklahoma would be traversed by the market alternative between milepost (MP) MB-324 and MB-337 (Short 1980).

3.B.5 AQUATIC BIOLOGY

Coal Slurry Pipelines and Pump Stations

In Kansas, approximately 26 more perennial streams and 41 intermittent streams would be crossed by the market alternative slurry pipeline than by the proposed action slurry pipeline. Most of the rivers and streams that would be crossed sustain populations of rough fishes (including chubs, minnows, suckers, shiners, and darters) and sport fishes (including catfishes, bass, crappies, and sunfishes).

In Oklahoma, approximately 23 permanent streams and 26 intermittent or ephemeral streams would be crossed by the slurry pipeline. The U.S. Fish and Wildlife Service and the Oklahoma Department of Wildlife Conservation (1978) list 8 streams that would be crossed by the market alternative pipeline as Class 1 (highest-value fishery resource), including Buck Creek, Verdigris River, Neosho River, Fourteenmile Creek, Illinois River, Barren Fork Creek, Sallisaw Creek, and Lee Creek.

Dewatering Plants

Dewatering plants would be located adjacent to the Verdigris River in Oklahoma and the Mississippi River in Louisiana.

3.B.6 CULTURAL RESOURCES

Except for prehistoric site densities in Kansas and Oklahoma, the discussion for the proposed action (Section 3.A.6) applies to this alternative. Within Kansas, 170 sites are recorded as a result of over 100 previous cultural resource inventories within the 3245-square-mile study area. Approximate numbers of sites that may be encountered are 0.05 site per square mile or 1 site per 19 square miles. Within Oklahoma, 99 sites are recorded as a result of over 100 previous cultural resource inventories within the 900-square-mile study area. Approximate numbers of sites that may be encountered are 0.1 site per square mile or 1 site per 9 square miles. Sites in the vicinity of this alternative in the National Register of Historic Places are given in Table F-2, Appendix F.

3.B.7 AGRICULTURE

The market alternative would include eight slurry pump stations located differently from those associated with the main slurry pipeline for the proposed action. Five of these eight slurry pump stations would be located on potential prime agricultural land in Wyoming, Kansas, and Oklahoma. One of the five sites is on urban and built-up land and thus is not prime (Table 3-31). Refer to Table 4-16, Section 4.A.4, for acreages and mileages of cropland affected.

The market alternative would include two dewatering plants that are not associated with the proposed action. These two dewatering plants, in Oklahoma and Louisiana, would be located on potential prime agricultural land; however, both sites are on urban and built-up land and thus are not prime (Table 3-32).

3.B.8 RECREATION RESOURCES

The following discussion is for the portion of the market alternative slurry pipeline route (and associated dewatering and ancillary facilities) that does not follow the same right-of-way route or facility siting as the proposed action.

Five managed recreation areas are within 5 miles of the market alternative pipeline route. One of these, Prairie Dog State Park in Kansas, would be approximately 3 miles from the alternative slurry pipeline route at MP MB-36. Additionally, Rooks County State Park in Kansas at MP MB-81 is also within 3 miles of the route (Table 3-33).

Eight waterways having scenic and recreation value would be crossed by the alternative pipeline route in Kansas and Oklahoma (Table 3-34). Of these, four rivers have been identified by the Heritage Conservation and Recreation Service (HCRS) South Central Regional Office in the Nationwide Rivers Inventory, Phase I (1980a). These four rivers have the potential through future study to be added to the National Wild and Scenic Rivers System. Of the remaining four rivers, three, Barren Fork River, Illinois River, and Big Lee Creek are under protection by the Oklahoma Scenic Rivers Act. The Oklahoma Scenic Rivers Commission has jurisdiction for Barren Fork Creek and Illinois River. The last of the four state rivers, the Caney River in Kansas, is considered to be the most important state recreation river in Kansas (BLM Kansas Governor's Office of Policy and Research 1980).

The market alternative pipeline route would cross eleven major recreation trails (Table 3-35). Two of these, the Santa Fe Trail and the Western National Historic Trail, have as of September 8, 1980, been recommended for inclusion in the National Trails System.

No market alternative dewatering plants would be located in formally designated recreation areas. It should be noted, however, that the Oologah dewatering site would be immediately adjacent to the Will Rogers State Park in Oklahoma. For a discussion of the possible effects to the quality of the recreation experience in this vicinity, see Section 3.B.9 (Visual Resources).

The only ancillary facilities that could affect the quality of the recreation experience are microwave communication towers, which are discussed under the proposed action. The presence of microwave communication towers could alter the visitor's perception of the natural setting. Of particular concern to this alternative route is the tower located next to the Ozark National Forest at MP MB-10. (See Visual Resources, Section 3.B.9, for a listing of locations of towers near recreation waterways and park areas.)

3.B.9 VISUAL RESOURCES

MP MB-36 to MB-42. The market alternative right-of-way would intersect U.S. 36 approximately 2 miles west of Norton, Kansas. The route would continue south, crossing Prairie Dog Creek just above the Norton Reservoir and adjacent to Prairie Dog State Park. Riparian vegetation along the creek is thick, with low brush trees. The surrounding landscape is rolling terrain, with equal portions of dryland farming and range.

TABLE 3-31

PUMP STATIONS ON PRIME AGRICULTURAL LAND: MARKET ALTERNATIVE

Pump Station Designation[a]	Milepost[a]	Soil Association or Series	Land Use	Potential Prime Agricultural Land	Notes
MB-2	PMB-60.0	Samsil-Gaynor-Limon	Grazing/Wildlife Habitat	No	
MB-3	PMB-98.0	Trelona-Vetal-Hargreave	Nonirrigated Cropland/Grazing/ Wildlife Habitat	Yes	Vetal portion only. Must have an adequate irrigation system to qualify as prime.
MB-4	PMB-247.0	Colby	Grazing/Nonirrigated Cropland	No	
MB-5	MB-30.0	Holdrege-Uly	Nonirrigated Cropland/Irrigated Cropland/Grazing	Yes	Must have an adequate irrigation system to qualify as prime.
MB-6	MB-172.0	Crete-Hastings-Kipson	Nonirrigated Cropland/Grazing	Yes	Crete-Hastings portion only. Must have an adequate irrigation system to qualify as prime.
MB-7	MB-252.0	Goessel	Nonirrigated Cropland/Grazing	Yes	Must have an adequate irrigation system to qualify as prime.
MB-8	MB-378.0	Parsons-Dennis-Bates/ Sogn-Summit	Urban Land	Yes	Parsons-Dennis-Bates/ Summit portion only. This area is on urban and built-up land, thus not prime.
MB-10	MB-482.5	Mountainburg-Enders	Wildlife Habitat/ Recreation/Grazing	No	

Land use for each pump station site was determined from Soil Conservation Service (SCS) surveys, maps, publications, and 1:40,000 scale aerial photographs (where available). The potential for prime agricultural land was determined from lists and/or publications (SCS), which list on a state-wide or county basis those soil series or associations which meet the criteria to be considered potential prime agricultural land. Some areas that qualify as potential prime agricultural land are not actually prime, due to factors such as present land use, lack of an adequate irrigation system, or high frequency of flooding.

[a]Refer to strip maps in Appendix A for explanation of pump stations and locations.

Sources: Kansas Agricultural Experiment Station 1973; Oklahoma Agricultural Experiment Station 1959; SCS 1967d, 1975b, 1977a, 1978b, c, e, 1979a, b, U.S. Bureau of Chemistry and Soils 1924.

TABLE 3-32

DEWATERING PLANTS ON PRIME AGRICULTURAL LAND: MARKET ALTERNATIVE

Dewatering Plant Designation	Milepost	Soil Association or Series[a]	Land Use	Prime Agricultural Land Potential[a]	Notes
Oologah	MB-378.0	Parsons-Dennis-Bates/ Sogn-Summit	Urban Land	Yes	Parson-Dennis-Bates/ Summit portion only. This area is on urban and built-up land, thus not prime.
Baton Rouge	M-24.6	Olivier-Calhoun-Loring	Urban Land	Yes	Does not qualify as prime if frequently flooded. This area is on urban and built-up land, thus not prime.

Note: Land use for the dewatering plant sites was determined from Soil Conservation Service (SCS) surveys, maps, publications, and 1:40,000 scale aerial photographs (where available). The potential prime agricultural land was determined from lists and/or publications (SCS), which list on a state-wide or county basis those soil series or associations which meet the criteria to be considered potential prime agricultural land. Some areas that qualify as potential prime agricultural land are not actually prime, due to factors such as present land use, lack of an adequate irrigation system, or high frequency of flooding.

Sources:

[a] Oklahoma Agricultural Experiment Station 1959; SCS 1972b, 1978e, 1979c.

TABLE 3-33

MANAGED RECREATION AREAS WITHIN
5 MILES OF THE MARKET ALTERNATIVE ROUTE

State	Milepost	Recreation Area
Kansas	MB-36	Prairie Dog State Park
	MB-81	Rooks County State Park & Webster Reservoir
	MB-120	Wilson State Park & Reservoir
Oklahoma	MB-330 to MB-335	Keystone State Park
	MB-347 to MB-366	Osage Hill State Park
	MB-378	Will Rogers State Park (Oologah)
Arkansas	MB-452 to MB-492	Ozark National Forest

TABLE 3-34

SCENIC AND RECREATIONAL WATERWAYS TO BE CROSSED:
MARKET ALTERNATIVE ROUTE[a]

State	Milepost	River/Creek
Kansas	MB-55	S. Fork Solomon River[b]
	MB-65	Bow Creek[b]
	MB-127	Saline River[b]
	MB-354, 373	Caney River[c]
Oklahoma	MB-430	Barren Fork River[d]
	MB-437	Illinois River[d]
	MB-472	Lee Creek (Big and Little)[b,d]

Note: See Table 3-26 for waterways crossed by the parts of the Market alternative that are the same as that for the proposed action route.

[a] Scenic and recreational waterways as defined by Heritage Conservation and Recreation Service or a state agency.

[b] Heritage Conservation and Recreation Service 1980a,b.

[c] State River Identified for Study (Arkansas, Kansas).

[d] State-protected river (Louisiana, Oklahoma).

TABLE 3-35

MAJOR TRAIL CROSSINGS: MARKET ALTERNATIVE

State	Name of Trail
Kansas	Santa Fe[a,b]
	Mormon Battalion[a]
	Old Cattle Trails[a,b]
	Parallel Road[c]
	Leavenworth Pikes Peak Express[c]
	Smoky Hill Trail[c]
Oklahoma	Old Cattle Trails[a,b]
	Indian Nations[d]
	Texas Road (East Shawnee)[c]
	Camp Grabber-Greenleaf Lake Trail[e]
	Oologah Reservoir Trail[e]

[a] Studies complete, not recommended for National Trail System Act designation.

[b] House of Representatives proposed bill (HR80-87) trails legislation introduced for NTSA inclusion.

[c] Existing state trail.

[d] Trail under study (NTSA).

[e] Proposed state trail.

MP MB-60 to MB-83. The market alternative route would intersect U.S. 24 and U.S. 183 approximately 4 miles west of Stockton, Kansas. It would cross the South Fork of the Solomon River 7 miles downstream from Webster Reservoir and Webster State Park, and immediately adjacent to Rooks County State Park. This landscape has high-quality visual resources, as evidenced by two state parks. The landscape is rolling hills, and the riparian zone of the Solomon River is densely vegetated. The river is clear, with a sand bottom. Color, texture, and line create interesting visual features.

MP MB-115 to MB-137. This segment would be approximately 10 miles northwest of Russell, Kansas, adjacent to Wilson Lake and recreation area. The pipeline would intersect roadways leading to these recreation areas. This area has rolling to hilly terrain and is well vegetated. There is a scenic area surrounding Wilson Reservoir and the Saline River, which has been inventoried by HCRS for potential consideration as a national wild and scenic river.

MP MB-324 to MB-330. This segment would pass south of Cedar Vale and cross the Osage Indian Reservation; it would pass close to a wilderness trail used for hiking and riding. This area is considered one of the more picturesque areas in Kansas. Dense riparian growth along Rock Creek (mostly scattered timber) adds high-quality texture and color to the setting.

MP MB-347 to MB-366. This portion of the pipeline would pass within 2 miles of Bartlesville, Oklahoma, and cross U.S. 60, State 123, and U.S. 75. Osage State Park is 4 to 5 miles west of the proposed pipeline. Scrub oak and cultivated fields provide visual color and texture on the rolling terrain. The Caney River banks are heavily vegetated and steep.

MP MB-417 to MB-427. This pipeline segment would parallel State 82 through a mountainous area used for hiking and camping. This is a high-quality scenic area, abundant with streams from the Neosho River and Lake Hudson drainage. The terrain is hilly to mountainous, with rock outcroppings and a variety of colorful vegetation.

MP MB-440 to MB-446. This pipeline segment would pass near the town of Welling along a county road, about 4 to 5 miles south of Tahlequah. It would pass northeast of Tenkiller Ferry Reservoir and recreation area by 6 to 8 miles. The terrain in this area is mountainous, densely vegetated, and has many streams. The Barren Fork and Illinois rivers are both protected state scenic rivers.

MP MB-482.5 (Pump Station MA-10). The pipeline would cross State 59 midway between Cedarville and Figure Five, as well as an access road into the Ozark National Forest. The background to the north is the Ozark National Forest and mountain range, providing high-quality form, line, color, and texture to this natural setting.

3.C CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

The affected area for this alternative is the same as for the market alternative at the coal slurry preparation plants, water supply system, slurry gathering pipelines, and main slurry pipeline from MP PMB-0 to PMB-1092. The dewatering plants for this pipeline-barge alternative are also served by the market alternative.

Only the affected areas for the following components of the pipeline-barge alternative, which are different from affected areas previously presented, are discussed in this section:

- Main slurry pipeline from MP PMB-1092 to MP B-81
- Cypress Bend dewatering plant and barge loading facility

The affected areas along this pipeline-barge alternative for the wildlife and air quality resource topics are similar in type and description to the areas in Arkansas already discussed for the proposed action and are therefore not discussed in this section.

3.C.1 WATER RESOURCES

This alternative system would cross 75 fewer intermittent creeks, 50 fewer minor and 34 fewer major perennial streams and rivers, and 61 fewer bayous, compared with the proposed action (WCC 1980c, Table 2-1). Surface facilities located within potential 100-year floodplains are listed in Table 3-6.

3.C.2 SOCIOECONOMIC CONSIDERATIONS

Slurry Pipeline System

The counties that make up the socioeconomic environment that would be potentially affected solely by pipeline and pump stations under the pipeline/barge alternative are the same as those listed for the market alternative, except that none of the parishes in Louisiana would be affected.

Dewatering Plants

The site of the proposed Cypress Bend dewatering plant, steam plant, and barge loading facility is in Desha County, Arkansas. This is a large agricultural area where in 1974, employment in agriculture was 34 percent of total county employment. The potentially affected area includes Desha, Drew, Chicot, Ashley, and Lincoln counties.

Population and Employment. The communities nearest to the site are Arkansas City 8 miles away and McGehee, Arkansas, 14 miles away. The nearest cities are Greenville, Mississippi, 57 miles away, and Pine Bluff, Arkansas, 77 miles away.

Popluations of the five counties in the local study area are shown in Table 3-36. In the 1960s and 1970s Desha County did not experience the growth of other Arkansas counties, and in fact lost population as a result of a decline in agriculture and forest products production.

Desha County, like much of southeastern Arkansas, has been primarily rural and agricultural. Neither the five-county area nor Desha County has a large labor force or a large pool of contract construction workers (Table 3-37). In 1977 the five-county study area had 964 persons and Desha County had 117 persons employed in contract construction. The ten-county southeastern Arkansas labor area, however, had 2,724 employed in contract construction.

The late 1970s saw some changes and there are continuing efforts to develop the local ecomony. In particular, the Potlatch Corporation completed a $15 million paper mill in the area in 1977. The mill is 7 to 8 miles due north of Arkansas City and 8 miles east of McGehee.

Housing. At present, housing of any kind in the area is scarce. Some of the 300 people Potlatch Corporation presently employs at the paper mill near the Cypress Bend site commute from as far away as Monticello (about 42 miles). The estimated available housing in four communities in the area is shown on Table 3-38. While vacancy rates in the four communities are low, there are differing opinions as to how tight the market is and how responsive it might be to additional demand in the area.

Several local mobile home parks constructed new spaces from 1975 to 1977 during the Potlatch paper mill construction. There are some mobile home spaces available now.

There has been some new construction of single-family homes in the area. In Dumas, 32 miles from the Cypress Bend site, some 25 to 30 new homes are under construction. Voters in Dumas recently passed a $10 million bond issue, of which $5.5 million has been made available for home loans at 8.5 percent interest (Peterson 1980).

Arkansas City has no hotel or motel accommodations and the other three communities, McGehee, Dermott, and Dumas, have 200 to 225 hotel or motel rooms between them (Table 3-38).

Public Services. Public services were inventoried for the four communities: Arkansas City, McGehee, Dermott, and Dumas, which are where the bulk of the non-locals will move to during construction, and where impacts would be concentrated. Other communities such as

TABLE 3-36

POPULATIONS OF COUNTIES AND CITIES
IN THE CYPRESS BEND LOCAL STUDY AREA

County	City	Census 1970 Population	1970 Percent Urban	1975 Population[a]	Population Change 1970-75	Distance to Site (miles)
Lincoln		13,310	0			NA
Desha		18,761	50.1	18,005	-2.7	NA
	Arkansas City			784[b]		8
	McGehee	4,683		4,275	-8.7	14
	Dumas	4,600		5,399	17.4	32
Chicot		18,164	63.1	17,953	-1.1	NA
	Dermott	4,250		4,368	2.8	25
	Lake Village	3,310		3,328	.5	36
	Eudora	3,687		3,538	-4.0	52
Drew		15,157	33.5	17,190	2.5	NA
	Monticello	5,809		6,698	15.3	42
Ashley		24,976	48.8	25,206	.5	NA
	Crossett	6,191		6,290	1.6	78
	Hamburg	3,102		3,146	1.4	63
5-County Total		90,368		78,354	1.6	

[a]Source: U.S. Bureau of the Census 1978.

[b]1979 population; source: Arkansas State Highway and Transportation Department 1979.

TABLE 3-37

EMPLOYMENT BY MAJOR INDUSTRY (1977)
SOUTHEASTERN ARKANSAS LABOR AREA

	10-County Labor Area	Arkansas County	Ashley County	Bradley County	Chicot County	Cleveland County	Desha County	Drew County	Grant County	Jefferson County	Lincoln County	5-County Local Study Area*
Total Employment	48,457	6,450	6,401	3,168	1,918	333	3,403	4,228	1,683	19,817	1,056	17,006
Manufacturing	20,646	2,708	3,969	1,886	570	194	1,307	2,383	1,002	6,240	387	8,616
Mining		a	NA	NA	NA	NA	NA	NA	a	b	NA	NA
Contract Construction	2,724	425	462	197	102	14	117	154	61	1,053	139	974
Transportation and Other Public Utilities	2,543	387	112	51	86	17	206	96	37	1,475	76	576
Wholesale Trade	2,927	702	225	94	172	a	254	119	47	1,235	79	849
Retail Trade	9,817	1,303	796	485	532	53	862	803	324	4,464	195	3,188
Finance, Insurance, and Real Estate Services	2,173	256	167	120	108	a	142	142	47	1,155	36	595
Agricultural Services, Forestry, Fisheries	519	57	39	b	b	a	75	261	a	87	a	375

Source: U.S. Bureau of the Census 1979c.

Notes: Figures indicate number of employees for week including March 12, 1977. NA = Information not available.
Employment-size class 0-19
Employment-size class 20-99

* Five-county local study area consists of Ashley, Chicot, Desha, Drew, and Lincoln counties.

TABLE 3-38

TEMPORARY HOUSING AVAILABLE IN 1980 AT CYPRESS BEND AREA

Town	Dwelling Units: Single-Family	Dwelling Units: Multiple Units	Mobile Homes	Total	Vacancy Rate	Motel Units
Arkansas City	200	230	35	465	1-2%	0
McGehee	1600	200	150	1950	0	125
Dermott	1000	20	250	1270	0 single-family 2-3% mobile homes	50
Dumas	2000	45	40	2085	low	48
Total	4800	495	475	5770		223

Sources: Bixler 1980; Fields 1980; McMahon 1980; Franks 1980; and Peterson 1980.

Monticello may host some immigrants but not to the extent of these four.

Water and sewer systems in these four communities are generally adequate. The Dermott water system could use an additional 300,000 gallon water tank. Dumas' sewer system is overloaded with 2,000 users for a system designed to serve 1,500. A $2.0 million overhaul of the system is planned for the next two years.

The school districts in all four communities have plans for expanding or upgrading facilities. The Arkansas City School District, which includes the Cypress Bend site, receives $600,000 per year in property tax revenues from the new Potlatch paper mill and plans to construct a new high school. Dermott plans to build a new junior high school. McGehee has built a new elementary school and four new high school classrooms and plans to build a new junior high school. Dumas built a new high school four years ago.

3.C.3 VEGETATION

The Cypress Bend pipeline-barge alternative, where different from the proposed action, would traverse or have permanent facilities located on agricultural lands, forested wetlands, cross timbers, oak-hickory forest, southern pine-hardwood forest, and barren land (Table 4-16 in Section 4.A.4). These areas are used mainly for agriculture, livestock grazing, wildlife habitat, and recreation. Refer to Table 4-2 in Section 4.A.4 for acreages and mileages of vegetation types affected.

3.C.4 AQUATIC BIOLOGY

The Cypress Bend coal slurry pipeline from the White Bluff site to the dewatering and barge loading facility would cross approximately 14 permanent and 12 intermittent streams.

All of the potentially affected streams lie within the Mississippi alluvial plain, characterized as bottomlands with sluggish, meandering rivers. Common fishes of the region include minnows, shiners, chubs, shad, gar, suckers, sunfish, and bass (EPA 1978a). The aquatic macroinvertebrate fauna of those drainages would be numerically dominated by flies and aquatic worms, with fewer mayflies, caddisflies, beetles, and mussels (EPA 1978a). Macroinvertebrate populations of the lower Mississippi River include various mayfly, caddisfly, midge, beetle, worm, crustacean, and clam species (Ragland 1974).

3.C.5 CULTURAL RESOURCES

The discussion for the proposed action (Section 3.A.6) applies to this alternative. One hundred twenty eight sites are recorded within the 588-square mile study area that differs from the Proposed Action. Approximate numbers of sites that may be encountered are .2 site per square mile or 1 site per 5 square miles. Sites in the vicinity of the lateral that are in the National Register of Historic Places are listed in Table F-3, Appendix F.

3.C.6 AGRICULTURE

The Cypress Bend pipeline-barge alternative would not include any slurry pump stations that are not associated with the market alternative.

The pipeline-barge alternative would include one dewatering plant that is not associated with the proposed action or the market alternative. The Cypress Bend dewatering plant and barge loading facility in Desha County, Arkansas, would be located on potential prime agricultural land (Table 3-39). The portions of the barge loading facility near the Mississippi River are frequently flooded and thus may not qualify as prime agricultural land.

3.C.7 AIR QUALITY

Data on total suspended particulates along the proposed slurry pipeline route (Section 3.A.8) would be applicable to the Cypress Bend region. Measurements of gaseous pollutants are scarce for the project vicinity; however, data

TABLE 3-39

DEWATERING PLANTS ON PRIME AGRICULTURAL LAND: CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

Dewatering Plant	Milepost[a]	Soil Association or Series	Land Use	Prime Agricultural Land Potential	Notes
Cypress Bend	B-80.6	Sharkey-Desha-Commerce-Coushatta	Cropland/Woodland/ Wildlife Habitat	Yes	Sharkey-Desha portion only. Portions of this area are frequently flooded.

Note: Land use for this site was determined from Soil Conservation Service (SCS) surveys, maps, publications, and 1:40,000 scale aerial photographs (where available). The potential for prime agricultural land was determined from lists and/or publications (SCS), which list on a state-wide or county basis those soil series or associations which meet the criteria to be considered potential prime agricultural land. Some areas that qualify as potential prime agricultural land are not actually prime, due to factors such as present land use, lack of an adequate irrigation system, or high frequency of flooding.

[a]Refer to strip maps in Appendix A for location of dewatering plants.

Sources: SCS 1972c, 1977g.

collected by the states of Arkansas (1979), Oklahoma (1979), and Louisiana (1979) indicate that concentrations are generally low. Annual average measurements of sulfur dioxide (SO_2) ranged from about 2 micrograms per cubic meter ($\mu g/m^3$) to about 11 $\mu g/m^3$. The highest 24-hour SO_2 concentration reported in the area during 1978 was about 44 $\mu g/m^3$. Annual average concentrations of nitrogen dioxide ranged from about 27 $\mu g/m^3$ to about 48 $\mu g/m^3$. Measurements of other gaseous pollutants are not available in the project area.

3.C.8 RECREATION RESOURCES

At milepost B-24 of the Cypress Bend lateral the pipeline would cross Bayou Bartholomew, which has been inventoried for potential designation as a National Wild and Scenic River by the South Central Region of the Heritage Conservation and Recreation Service (HCRS 1980a). In addition, Bayou Bartholomew is of importance to the state of Arkansas and a possible candidate for inclusion in a potential Arkansas State Rivers System program.

3.D COLORADO ALTERNATIVE

The Colorado alternative is an alternative northern main slurry pipeline segment that could connect with the proposed action, market alternative, or Cypress Bend pipeline-barge alternative. It would replace the proposed action pipeline segment between mileposts PMB-0 and P-485 or the segment between mileposts PMB-0 and MB-181 of the market and Cypress Bend pipeline barge alternatives. Only the affected environment for this different northern route is described below.

3.D.1 WATER RESOURCES

This system would cross 57 more intermittent creeks, 11 more minor and 2 fewer major perennial streams and rivers compared with the proposed action (WCC 1980c, Table 2-1).

3.D.2 SOCIOECONOMIC CONSIDERATIONS

Slurry Pipeline System

The counties that would be potentially affected by pipeline and pump stations under the Colorado alternative are listed in Table 3-40.

3.D.3 VEGETATION

The Colorado alternative would traverse or have permanent facilities on agricultural lands, short-grass prairie, midgrass prairie, tall-grass prairie, shrub and brush rangeland, ponderosa pine forest, forested wetlands, and barren lands. These areas are used mainly for agriculture, livestock grazing, wildlife habitat, and recreation. See Table 4-16 in Section 4.A.4 for acreages and mileages of the vegetation types affected.

The Colorado butterfly-weed (Gaura neomexicana coloradensis) has been proposed for the federal list of threatened and endangered species. This will be published in the Federal Register by December 1980. Location of this plant is unknown at present but it is thought to be in the vicinity of Cheyenne, Wyoming, near the Colorado alternative route.

3.D.4 WILDLIFE

The primary wildlife habitat types that would be affected by the Colorado alternative and wildlife species of special concern occurring within these types are listed in Table 3-19. Game and nongame species that would occur in areas that would be affected by the Colorado alternative are essentially the same as those listed for the proposed action in Section 3.A.4.

Threatened and Endangered Wildlife Species

Federally protected wildlife species that could occur in the area that would be affected by the Colorado alternative include the black-footed ferret, bald eagle, peregrine falcon, and whooping crane. In addition, the greater prairie chicken, listed as endangered by Colorado legislation, could be present along the alignment

TABLE 3-40

COUNTIES IN AREAS POTENTIALLY AFFECTED BY ONLY MAIN LINE AND PUMP STATIONS: COLORADO ALTERNATIVE

County	Pump Station	1975 Population	Fiscal Year 1976-77 Tax Revenues ($1000s)
Wyoming			
Goshen		12,000	2,628
Laramie		63,000	14,620
Colorado			
Weld	C-4	107,400	35,950
Logan		19,500	7,074
Washington		5,500	2,686
Yuma	C-5	8,900	3,467
Kansas			
Cheyenne		4,100	1,112
Sherman		8,200	3,118
Thomas		8,100	4,472
Sheridan		4,000	1,710
Gove		4,000	2,947
Trego		4,500	1,608
Ellis	C-6	25,500	6,002
Rush		5,000	2,500
Barton		30,900	9,368
Ellsworth		6,200	2,062
Rice		12,000	4,515

Sources: U.S. Bureau of the Census 1978, 1979b.

through Colorado. The distribution of federally protected wildlife in Wyoming, Kansas, Oklahoma, Arkansas, and Louisiana is described in Section 3.A.4 of this report and in the Threatened and Endangered Species Technical Report (WCC 1980f).

In Colorado, no confirmed sightings of the black-footed ferret have been made recently. A single skull of a ferret estimated to be from the 1960s was found in northeastern Colorado (Kit Carson County, about 30 miles south of Colorado alternative MP C-340) (Bissel et al. 1978). Since black-tailed prairie dog colonies are numerous in eastern Colorado, potential ferret habitat is abundant along the Colorado alternative corridor (Bissell et al. 1978, 1979).

Before the 1950s, few peregrine falcon eyries were known in Colorado, but in 1978, 31 active eyries were recorded (Colorado Division of Wildlife 1978). Most of the sites presently occupied are situated in mountainous locations. All 31 sites recorded by the Colorado Division of Wildlife were located in the central and western portions of the state. These eastern range limit of the peregrine's hunting and nesting areas in Colorado includes portions of Larimer, Boulder, Jefferson, and El Paso counties (Colorado Division of Wildlife 1978). Peregrines may occur infrequently over construction sites in eastern Colorado.

Since 1974, two active bald eagle nests have been located in Colorado; neither is in an area that would be affected by the Colorado alternative. Wintering bald eagles could be encountered at the South Platte River crossing.

Whooping cranes have historically visited eastern Colorado as accidental migrants (Colorado Division of Wildlife 1978). However, in Kansas the Colorado alternative would pass approximately 7 miles north of Cheyenne Bottoms State Waterfowl Refuge, which is critical habitat for the whooping crane.

Between MP C-315 and MP C-325 (northwest of Wray, Colorado), there is a remnent population of greater prairie chickens. The greater prairie chicken is listed as endangered by state-level endangered species legislation in Colorado.

3.D.5 AQUATIC BIOLOGY

Coal Slurry Pipelines and Pump Stations

Fish. In Wyoming, approximately 8 permanent and 78 intermittent streams would be crossed by the Colorado alternative coal slurry pipeline system. The Wyoming Game and Fish Commission (1971) considers the North Platte River (at the crossing location) to be a Class III river: "important trout water, fishery of regional importance." All other Wyoming river crossing locations are classified as "low-production waters" (Wyoming Game and Fish Commission 1971). The fish faunas of these eastern Wyoming drainages are described in Section 3.A.5.

In Colorado, approximately 6 permanent and 27 intermittent or ephemeral streams and rivers would be crossed by the Colorado alternative coal slurry pipeline system. The major perennial rivers that would be crossed include the South Platte, North Fork Republican, and Arikaree rivers. The fishes of these drainages are similar to the fauna of eastern Wyoming stream systems, as described in Section 3.A.5.

In Kansas, approximately 15 permanent and 121 intermittent or ephemeral streams would be crossed by the Colorado alternative pipeline system. The fish fauna of the potentially affected drainages are described in Section 3.A.5.

Aquatic Invertebrates. The general discussions of aquatic invertebrates in Section 3.A.5 adequately describe the west-central fauna that would be expected to occur in the Wyoming, Colorado, and Kansas drainages to be crossed by the Colorado alternative coal slurry pipelines.

Threatened and Endangered Species. The plains orangethroat darter is considered threatened by the Colorado Division of Wildlife (1978) and is known to occur in Chief Creek (MP C-328.5), in the North Fork Republican River near the Colorado alternative pipeline crossing location (MP C-331.5), and in the Arikaree River near the crossing location (MP C-347).

The Topeka shiner is considered threatened by the state of Kansas and was reported as occurring in Cherry Creek in Cheyenne County, Kansas, near the Colorado alternative slurry pipeline crossing location (MP 364.5) (Minckley and Cross 1959).

3.D.6 CULTURAL RESOURCES

This alternative route lies within the Plains Culture Area. The discussion for Wyoming and Kansas in the proposed action section (3.A.6) also applies to this alternative. In Colorado, all drainages and alluvial valleys, especially the South Platte, the Republican, the Arikaree rivers and their tributaries, are sensitive. The numerous springs that dot the area are also sensitive. Site types that can be expected in this area of Colorado are seasonal to semi-permanent camps (or small villages) with associated lithic and ceramic scatters and tipi rings. Permanent settlements may be encountered in alluvial valleys of larger drainages. Twenty eight sites are located within this 1424-square mile study area. Approximate numbers of sites that may be encountered are .02 site per square mile or 1 site per 51 square miles. This small number of sites reflects the relative lack of previous cultural resource inventories. The area has a great potential for Paleoindian sites, especially in Yuma County. No prehistoric sites are listed in the National Register of Historic Places.

In Wyoming an open cattle ranch and the site of Jireh College are located near MP C-117. At MP C-114 the route passes near Fort Laramie National Historic Site and other associated sites. Several variants of the Oregon Trail are crossed by the route at MP C-112.9, C-113.3, and C-114.1. The Cheyenne-Deadwood Trail is crossed near MP C-115.

3.D.7 AGRICULTURE

The Colorado alternative would include six pump stations that are not associated with the proposed action or the market alternative. One of these six pump stations would be located on potential prime agricultural land in Kansas (Table 3-41). Refer to Table 4-16 in Section 4.A.4 for acreages and mileages of cropland affected.

3.D.8 RECREATION RESOURCES

The slurry pipeline route for this alternative would pass Fort Laramie National Historic Site in Wyoming near MP C-115 and C-116. In addition, at MP C-347 in Colorado it would cross the Arikaree River, which has been inventoried for consideration by the Heritage Conservation and Recreation Service (HCRS) as a possible National Wild and Scenic River.

The pipeline would also cross the Pawnee Butte potential National Natural Landmark site at MP C-220 through C-228 in Weld County, Colorado. The U.S. Forest Service has tentative plans to develop Pawnee Buttes as a high-intensity recreational area (HCRS 1980b).

Additionally, the Colorado alternative pipeline route would cross two existing historic trails under the National Trails System Act in southeastern Wyoming: The Mormon Pioneer and Oregon National Historic trails.

A microwave communication tower along the alternative pipeline route would be located at MP C-506. This communication tower site is adjacent to the Cedar Bluff State Park.

3.E COAL CLEANING OPERATION ALTERNATIVE

This alternative would be located at the preparation plants and would affect the same environmental resources discussed for these sites for the proposed action.

3.F CROOK COUNTY ALTERNATIVE WATER SUPPLY SYSTEM

The water gathering line from the North Rawhide preparation plant to the Jacobs Ranch and North Antelope preparation plants would have the same affected area as discussed for the proposed action water supply system. Only the affected area for the Crook County well field and pump station and the water gathering line to the North Rawhide preparation plant is described in this section.

TABLE 3-41

PUMP STATIONS ON PRIME AGRICULTURAL LAND: COLORADO ALTERNATIVE

Pump Station Designation	Milepost	Soil Association or Series	Land Use	Potential Prime Agricultural Land	Notes
C-2*	C-60.0	Mitchell-Keota-Epping[a]	Grazing/Wildlife Habitat	No[b]	
C-3	C-80.0	Wendover-Lambman-Rock Outcrop[a]	Grazing/Wildlife Habitat/ Nonirrigated Cropland	No[b]	
C-4	C-228.0	Epping-Thedlund-Keota[c]	Grazing	No[c]	
C-5	C-345.0	Colby-Ulysses-Keith[d]	Grazing	No[d]	
C-6	C-519.0	Harney[e]	Nonirrigated Cropland/Grazing/ Irrigated Cropland	Yes[f]	Must have an adequate irrigation system to qualify as prime agricultural land.

Note: Land use for each pump station was determined from Soil Conservation Service (SCS) surveys, maps, publications, and 1:40,000 scale aerial photographs (where available). The potential for prime agricultural land was determined from soil surveys (SCS) or lists and/or publications (SCS), which list on a state-wide or county basis those soil series or associations that meet the criteria to be considered potential prime agricultural land. Some areas that qualify as potential prime agricultural land are not actually prime, due to factors such as present land use, lack of an adequate irrigation system, or high frequency of flooding.

*The first pump station is PMBC-1 which is also part of the proposed action (See Table 3-21)

Sources:

[a] SCS 1978c.
[b] SCS 1978b.
[c] SCS 1979d.
[d] SCS 1976.
[e] SCS 1975c.
[f] SCS 1979b.

The affected area for air quality and recreation is essentially the same or similar to that already discussed for the Niobrara County well field and is not discussed further in this section.

3.F.1 WATER RESOURCES

Crook County Well Field

The affected environment for ground water in the vicinity of the proposed Crook County well field is the same or similar to that discussed for the proposed Niobrara county well field and is not discussed further in this section.

3.F.2 SOCIOECONOMIC CONSIDERATIONS

In addition to the Wyoming counties and communities identified as potentially affected by the proposed action, Crook County and the communities of Moorcroft, Sundance, and Hulett would be affected by this alternative. Population data for the county and these communities are given in Table 3-42. As shown in Table 3-43, rental housing units are relatively unavailable, and planned new housing construction will do little to change this situation.

3.F.3 VEGETATION

The Crook County alternative water supply line would traverse or have permanent surface facilities located on agricultural lands, midgrass prairie, and ponderosa pine forest (Table 4-2 in Section 4.A.4). This area is used primarily for grazing and wildlife habitat.

3.F.4 WILDLIFE

Primary concerns exist for the potential occurrence of the black-footed ferret at surface facilities and along the delivery pipeline corridor. The bald eagle and peregrine falcon could occur over the affected area; however, no nests or roosts are known in the area that would be affected.

3.F.5 AQUATIC BIOLOGY

The delivery pipeline would cross 1 perennial and 19 intermittent or ephemeral streams in the Little Missouri and Powder River basins in Wyoming. The fishes of the region are described in Section 3.A.5.

3.F.6 CULTURAL RESOURCES

This alternative water supply system lies in the Plains Culture Area. Twenty prehistoric sites have been recorded within the well-field boundary. Sites are primarily large camps located along the North Fork Little Missouri and the Little Missouri rivers and their tributaries. One of the sites, the Bush/Bunger Site, is a prehistoric antelope trap and has been nominated for the National Register of Historic Places (NRHP). All drainages and alluvial valleys, particularly the Little Missouri and its tributaries, are sensitive. Upland areas and ridges may contain evidence of camps or small temporary villages. Eighteen sites are located within the 460-square mile delivery pipeline study area. Approximate numbers of sites that may be encountered are 0.002 site per square mile or one site per 26 square miles.

No historic sites are recorded.

3.F.7 AGRICULTURE

The Crook County alternative water supply system would not be located on prime agricultural land. The entire water supply system would be located on soils that are used primarily for grazing and wildlife habitat. See Table 4-2 in Section 4.A.4 for acreages and mileages of cropland affected.

3.F.8 TRANSPORTATION NETWORKS

Access to the Crook County well field would be via U.S. 14/16, Interstate 90, and state or county roads from Gillette. All major roads are paved and capable of carrying heavy traffic and equipment. State and county roads are limited to 40 tons, and approximately 10 percent are

TABLE 3-42

SUMMARY OF POPULATION PROJECTIONS, CROOK COUNTY, WYOMING

Community	1978	1979	1980	1981	1982	1983	1984	1985
Hulett	340	345	355	360	370	375	386	390
Moorcroft	1,400	1,475	1,550	1,650	1,750	1,900	2,025	2,175
Sundance	1,400	1,450	1,475	1,525	1,575	1,650	1,725	1,800
Rural	2,260	2,280	2,370	2,415	2,455	2,475	2,540	2,585
Crook County	5,400	5,550	5,750	5,950	6,150	6,400	6,676	6,950

Source: Stuart/Nichols Associates 1978c.

TABLE 3-43

TEMPORARY HOUSING AVAILABLE IN 1980
AT MOORCROFT, SUNDANCE, AND HULETT, WYOMING

Community	Existing Hotel/Motel Rooms	Hotel/Motel Construction (rooms)	Existing Rental Units (Apts. & Homes)	Rental Vacancy Rate	Rental Units Planned or Under Construction	Existing Mobile Home Parks	Existing R.V. Parks	Mobile Home Spaces Planned or Under Construction
Moorcroft	63	0	425	5%	12	12	0	0
Sundance	120	0	25	1-2%	2	4	4	80
Hulett	30-40	0	NA	NA	NA	3	NA	NA

Sources: Schroder 1980b; Westover 1980.

NA = Information not available.

hard-surfaced. Despite the fact that many of the roads are carrying loads beyond their capacity, they have withstood the use because of the stabilization material in the asphalt. Unpaved roads are less able to withstand the abuse of heavy equipment and regular traffic.

3.G OAHE ALTERNATIVE WATER SUPPLY SYSTEM

The affected environment for this alternative, from the Oahe Reservoir in South Dakota to the North Rawhide preparation plant, is discussed below. From North Rawhide, the water lines described for the proposed action would transport water to the other two preparation plants.

The wildlife resources along the Oahe route are similar in type to those already discussed for the proposed action in Wyoming and are not repeated in this section.

3.G.1 WATER RESOURCES

This alternative would cross 106 more intermittent creeks, 10 more minor and 2 more major perennial streams and rivers compared with the proposed water supply system (WCC 1980c, Table 2-1).

3.G.2 SOCIOECONOMIC CONSIDERATIONS

The Oahe alternative water supply system would require a 276-mile water pipeline from the Oahe Reservoir, near Pierre, South Dakota, to Gillette, Wyoming. It would pass through five counties in South Dakota (Stanley, Haakon, Pennington, Meade, Lawrence) and two counties in Wyoming (Crook, Campbell). Since Pierre, the principal city near Oahe Reservoir, is situated in Hughes County, data are also provided for that county. There are several small communities along the 280-mile route and three principal service towns: Pierre, Rapid City, and Gillette.

The population of each of the counties and selected communities is shown in Table 3-44.

Employment in six South Dakota counties shows the Rapid City area (Pennington County) to be the largest source of construction workers for construction of the water pipeline in South Dakota (Table 3-45). In 1977, some 1,953 persons were employed in construction in Pennington County and another 165 in Meade County, the two counties that make up the Rapid City Standard Metropolitan Statistical Area (SMSA).

The existing socioeconomic conditions in the Gillette area are described under the Proposed Action section.

For construction workers (perhaps three-quarters of those to be employed) who would move in from outside the area to construct the water pipeline, Pierre, Rapid City, and Gillette would be preferred for temporary housing. Availability of temporary housing in these communities is shown in Table 3-46.

No significant impacts on local public services and facilities are expected from construction of the Oahe alternative water supply system. Therefore, no data on existing conditions are presented.

3.G.3 VEGETATION

The Oahe alternative water supply system would traverse or have permanent facilities located on agricultural lands, midgrass prairie, shrub and brush rangeland, ponderosa pine forest, forested wetlands, and barren land (Table 4-2 in Section 4.A.4). These areas are used mainly for agriculture, livestock grazing, wildlife habitat, and recreation.

3.G.4 WILDLIFE

Wildlife species of special concern that could occur along the Oahe alternative in Wyoming and South Dakota include mule deer, black-footed ferret, northern swift fox, bald eagle, whooping crane, and interior least tern.

Mule Deer

Between approximately MP O-195 and O-220 in Wyoming, the Oahe alternative would

TABLE 3-44

POPULATIONS OF COUNTIES AND COMMUNITIES WITHIN COMMUTING DISTANCE OF PROJECT COMPONENTS: OAHE ALTERNATIVE WATER SUPPLY SYSTEM

County	Community	Census 1970 Population	1975 Population	Population Change 1970-1975 (percent)
South Dakota				
Hughes		11,632	13,268	16.3
	Pierre		11,444 ('75)	
Stanley		2,457	2,520	3.3
	Ft. Pierre		1,800 ('79)	
Haakon		2,802	2,809	.2
	Phillip		1,000 ('79)	
Pennington		59,349	65,918	13.5
	Wall		820 ('70)	
	Wasta		120 ('79)	
	New Underwood		519 ('79)	
	Box Elder		867 ('79)	
	Rapid City		43,875 ('79)	
Mead		17,020	18,291	7.6
	Sturgis			
Lawrence		17,453	17,005	-4.1
	Whitewood		875	
6-County Total			119,811	
Wyoming				
Crook		4,535	4,883	7.2
	Sundance		2,500	
	Moorcroft		1,150	1.0
Campbell		12,957	13,090	1.0
	Gillette		8,215	

Sources: U.S. Bureau of Census 1978. Community population estimates are from the South Dakota Department of Economic Development and Tourism 1980.

TABLE 3-45

EMPLOYMENT IN SOUTH DAKOTA COUNTIES

County	Total Employment 1979	Construction 1977
Hughes	8,344	394
Stanley	1,096	76
Haakon	1,524	21
Pennington	37,265	1,953
Meade	5,265	165
Lawrence	7,795	301

Source: U.S. Bureau of Economic Analysis 1979.

TABLE 3-46

TEMPORARY HOUSING AVAILABLE IN 1980 FOR LIKELY PIPELINE CONSTRUCTION SPREAD HEADQUARTERS: OAHE ALTERNATIVE WATER SUPPLY SYSTEM

Community	Existing Hotel/Motel Rooms	Hotel/Motel Construction (units)	Existing Rental Units Apts./Homes	Rental Vacancy Rate	Rental Units Planned or Under Construction	Existing Mobile Home Parks Spaces	Existing R.V. Parks Spaces	Number of Mobile Home Spaces, Planned or Under Construction
Gillette, Wyoming	560	60	815	5%	252	1391	NA	471
Pierre, South Dakota	711[a]	Hotel complex in Ft. Pierre in planning stages	NA	Low	31	300	0	0
Rapid City, South Dakota	3140[b]	290	NA	10-15%	A few small units	1161	NA	NA

Sources: Phone conversations with local chambers of commerce, building inspectors, and realtors, June 25, 1980.

[a]Pierre Area Chamber of Commerce 1979.

[b]Sixth District Council of Local Governments 1978.

NA = Data not available

traverse important winter range area for the mule deer (Nimick 1980).

Black-Footed Ferret

In South Dakota more sightings of black-footed ferrets have been made in historical times than any other state; more than 400 sightings have been reported since 1889 (Linder and Hillman 1973). Most of these occurred in the western half of the state, with the greatest number in Mellette and Washabaugh counties (Linder and Hillman 1973). From 1964 to 1973, black-footed ferrets were seen as follows: at 17 different prairie dog towns in Mellette County; at 2 different towns in Washabaugh County; and at 1 in Shannon County. The Oahe alternative in South Dakota would be located approximately 45 to 65 miles north of these sightings. The most recent confirmed sighting of a ferret was made on March 28, 1979, near Okreek in Mellette County, about 75 miles south of what would be the beginning of the Oahe alternative in South Dakota (Anderson 1980). In addition to the ferret sightings, the greatest concentration of black-tailed prairie dog towns in South Dakota occurs in counties south of the proposed Oahe alternative. From east to west, counties that would be traversed by the Oahe alternative have the following estimated acreages of dog towns (Henderson et al. 1974): Stanley County (south of the Cheyenne River), 500 acres; Haakon County (south of the Cheyenne River), 800 acres; Meade County, 2500 acres; and Lawrence County, 100 acres. The status of the black-footed ferret in Wyoming is described in Section 3.A.4.

Bald Eagle

Overwintering bald eagles could be encountered at the proposed Cheyenne River crossing (MP O-103) and at the Oahe Reservoir. The status of the bald eagle in Wyoming is described in Section 3.A.4.

Whooping Crane

The whooping crane is a regular spring and fall visitor in South Dakota. Observations of whooping cranes have been reported from the prairie edges of the Black Hills to near the eastern border of South Dakota (Anderson 1980). However, most sightings occur within a north-south corridor 100 miles east and 150 miles west of Pierre. Approximately 170 miles of the Oahe alternative water pipeline would cross the whooping crane's migrating corridor through South Dakota. Whooping cranes have been observed at the Oahe Reservoir.

According to Anderson (1980), whooping cranes are present in South Dakota from April 6 to 7 through May and from early September through the first 10 days of November. Some data suggest that the whooping crane may have used the Cheyenne River as a staging area about 15 years ago (Anderson 1980).

Presently, whooping cranes are not known to occur on rivers and streams that would be traversed by the Oahe alternative. Whooping cranes would occur primarily as migrants in the affected area.

Northern Swift Fox

The northern swift fox is a state-listed threatened species in South Dakota. The swift fox has recently been sighted near two locations of the proposed Oahe alternative in South Dakota, near MP 38 in Stanley County and south of MP 60 in Haakon County (Sharps 1980). Dens have not been located. According to Sharps (1980), the northern swift fox could occur wherever the Oahe alternative traverses prairie dog towns.

Interior Least Tern

The interior least tern is a state-listed endangered species in South Dakota. It nests on river sandbars, sandflats, and other similar habitat in June and July (South Dakota Ornithologists Union 1978). In South Dakota the interior least tern could be encountered where the Oahe alternative would cross the Cheyenne River at MPO-103.

3.G.5 AQUATIC BIOLOGY

Fish. Oahe Reservoir is a 375,000-acre mainstem impoundment of the Missouri River, which extends approximately 250 miles upstream from its dam at Pierre, South Dakota (Hassler 1970). Walleye, white bass, northern pike, channel catfish, and recently introduced lake trout provide good sport fishing opportunities, particularly in reservoir embayments and tributary streams. Recent investigations by Nelson and Beckman (1979) indicate that larval (newly hatched) yellow perch, buffalofish, and shiners are susceptible to entrainment by presently operating irrigation water intakes in Lake Oahe.

In South Dakota, approximately 4 perennial and 109 intermittent or ephemeral streams would be crossed by the Oahe alternative water supply pipeline. In Wyoming, approximately 8 permanent and 29 intermittent streams would be crossed.

The Oahe alternative water supply pipeline generally lies in the Cheyenne River basin. The physical and fisheries characteristics of the Cheyenne River and many of its tributaries are described in Section 3.A.5. In addition, many of the streams in west-central South Dakota and northeastern Wyoming are located in the Black Hills region, which is an area prized for its pristine streams and productive trout fisheries. Spearfish Creek in South Dakota and Sand Creek in Wyoming are considered two of the best trout fisheries in the region. In addition, many Black Hills streams have small instream impoundments with good walleye and panfish fishing.

Because of the presence of trout, general spawning activity extends intermittently from February through July.

Aquatic Invertebrates. Most of the streams located east of the Cheyenne River that would be crossed by the proposed Oahe water supply pipeline are intermittent plains (low-gradient) streams or shifting-substrate perennial streams with a limited macroinvertebrate fauna.

Many of the streams located west of the Cheyenne River are intermittent or perennial high-gradient streams with coarse substrates and dense, diverse, and productive macroinvertebrate communities dominated by mayflies, caddisflies, stoneflies, and flies that serve as important food sources for the highly valued trout fauna.

Threatened and Endangered Species. Four fishes listed as threatened by the South Dakota Department of Game, Fish and Parks (1980) may be affected by this alternative water supply pipeline. The finescale dace is known to occur in the Redwater Creek drainage (approximately MP O-193) (Baxter and Simon 1970; Bailey and Allum 1962). The longnose sucker is known to occur in the Redwater Creek drainage (MP O-193) and Spearfish Creek (MP O-188) (Baxter and Simon 1970). The sturgeon chub prefers large silty streams with moderate current and gravel substrates (Baxter and Simon 1970) and has been collected from the Cheyenne River in the general vicinity of the proposed crossing location (MP O-103). The northern redbelly dace has been reported in Spearfish Creek (MP O-188), Crow Creek (MP O-188.5), and tributaries to Redwater Creek (approximately MP O-193) (Scalet 1980). Spawning seasons for these species extend from March through July.

3.G.6 CULTURAL RESOURCES

This alternative lies within the Plains Culture Area. All drainages and alluvial valleys, particularly the Missouri River, are sensitive. Bluff tops and terraces associated with the Missouri River are also sensitive. Within South Dakota, 93 sites are located within the 1940-square-mile study area. Forty-eight of these sites have been inundated by the existing Oahe Reservoir. Within Wyoming, 20 sites are located within the 710-square-mile study area. Approximate numbers of sites that may be encountered are 0.04 site per square mile or 1 site per 24 square miles.

Native American groups recorded as having occupied this region are the Crow, Teton Dakota, Arikara, Mandar, Hidatsa, and Pawnee. Site types that may be encountered are bison kill and butchering sites, campsites, ceremonial areas, earthen lodges, and village remains with associated defense ditches and earthen walls.

Fort Pierre - Deadwood Road and stage stations are located in the vicinity of the Oahe alternative in South Dakota. Stage stations along this route are located approximately 2 miles south of MP 0-7 and 3 miles south of MP 0-38. The road-stage route is crossed by the Oahe alternative near MP 0-12 and MP 0-30. Between MP 0-163 and MP 0-166 the alternative lies within the Bear Butte Historic District. Historic sites in the vicinity of the Oahe alternative also have been recorded in Wyoming. They represent early ranching, milling, and westward expansion. Coal mining has been a part of Wyoming's history since the early 1900's as evidenced by the Wyodak Coal Mine near MP 0-274.

Sites in the vicinity of this alternative that are listed in the NRHP are listed in Table F-5, Appendix F.

3.G.7 AGRICULTURE

Two of the eight pump stations along the Oahe alternative water pipeline in South Dakota and Wyoming would be located on potential prime agricultural land (Table 3-47). Refer to Table 4-2 in Section 4.A.4 for acreages and mileages of cropland affected.

3.G.8 RECREATION RESOURCES

The proposed Oahe water pipeline route would begin at the Oahe Reservoir, where water-related recreation activities such as boating, fishing, and swimming take place. Other recreation areas along the water pipeline route include Bear Butte State Park (MP O-163) and Black Hills National Forest in Wyoming. In addition, the pipeline would cross the Cheyenne River in Meade County, South Dakota, which is on the Heritage Conservation and Recreation Service's list of Phase I inventoried rivers for national protection.

The alternative water pipeline route in Crook and Converse counties, Wyoming, traverses the Western Black Hills Volcanic Intrusion, which currently is in the designation process for inclusion into the National Natural Landmarks system. Also, the alternative water pipeline route passes near the Bear Butte in Meade County, South Dakota, which is a registered National Natural Landmark.

3.G.9 TRANSPORTATION NETWORK

The delivery pipeline from the Oahe Reservoir to the Gillette well field would cross the following transportation routes: U.S. 14, State 73 and 34, and U.S. 85 from east to west in South Dakota; and State 111/U.S. 14 in the Black Hills National Forest of Crook County, Wyoming. The pipeline would also cross a number of county and private roads.

3.H SLURRY PIPELINE WATER DISCHARGE ALTERNATIVE

Discharge locations would be in the vicinity of the proposed dewatering plants, whose affected areas have been previously discussed for the proposed action and market alternative, except for water resources as discussed below.

3.H.1 WATER RESOURCES

Discharge Facilities

Surface Water Quantity and Quality. The sites at which dewatering plant effluent would be discharged are shown in Table 3-48. All of these sites are freshwater streams or rivers.

Table 3-49 presents the estimated low flow occurring at these sites, based on USGS water resources data. The 7-day, 2-year flow is shown for the sites in Oklahoma, and the 7-day, 10-year low flow is shown for sites in Arkansas. The lowest recorded historical flows are shown for the sites in Louisiana. Table 3-49 also shows the estimated concentrations of total dissolved solids (TDS), chloride (Cl), and sulfate (SO_4) during these low-flow conditions, which are derived from water quality records at U.S. Geological Survey gaging stations nearest to the proposed discharge, during applicable low-flow periods.

3.I NO-ACTION ALTERNATIVE

The preliminary impact assessment for the no-action alternative indicated that the only environmental resources affected by this alternative would be air quality and socioeconomics.

TABLE 3-47

PUMP STATIONS ON PRIME AGRICULTURAL LAND:
OAHE ALTERNATIVE WATER SUPPLY SYSTEM

Pump Station Designation	Milepost	Soil Association or Series	Land Use	Potential Prime Agricultural Land
O-1	O-0.0	Sansarl-Opal	Grazing	No
O-2	O-45.0	Pierre-Samsil	Grazing	No
O-3	O-96.0	Samsil-Lismas-Pierre	Grazing/Nonirrigated Cropland	No
O-4	O-138.0	Kyle-Pierre-Hisle	Grazing/Nonirrigated Cropland	No
O-5	O-163.0	Canyon-Lakoa-Maitland	Grazing	No
O-6	O-174.00	Butche-Santanta-Boneek	Grazing	No
O-7	O-196.0	Nevee-Vale-Tilford	Nonirrigated Cropland/Grazing	Yes
O-8	O-214.0	Nevee-Vale-Tilford	Nonirrigated Cropland/Grazing	Yes

Note: Land use for each pump station location was determined from Soil Conservation Service (SCS) surveys, maps, and publications. The potential for prime agricultural land was determined from soil surveys (SCS) or lists and/or publications (SCS) which list on a state-wide or county basis those soil series or associations that meet the criteria to be considered potential prime agricultural land. Some areas that qualify as potential prime agricultural land are not actually prime, due to factors such as present land use, lack of an adequate irrigation system, or high frequency of flooding.

Sources: SCS 1974b, 1975d, 1978b,f,g, 1979e,f.

TABLE 3-48

LOCATIONS OF DEWATERING PLANT EFFLUENT DISCHARGES

Site	Discharge Location
Ponca City, OK[a]	Arkansas River, 29 miles downstream from Ponca City
Oologah, OK[b,c]	Verdigris River, below Oologah Dam
Pryor, OK[a,b,c]	Neosho River (Grand River) 40 miles upstream from confluence with Arkansas River
Muskogee, OK[a]	Arkansas River, 4 miles downstream from confluence with Neosho River (Grand River)
Independence, AR[a,b,c]	White River, 20 miles downstream from Lock 4, Dam 1, at Batesville
White Bluff, AR[a,b,c]	Arkansas River, 25 miles downstream of Little Rock, between Lock and Dam 5 and 6
Cypress Bend, AR[c]	Mississippi River, Louisiana state line, and Arkansas River, 25 miles upstream from Greenville
New Roads, LA[a,b]	Mississippi River, 35 miles upstream from Baton Rouge, Louisiana
Baton Rouge, LA[b]	Mississippi River at Baton Rouge, Louisiana.
Boyce, LA[a,b]	Red River, 3 miles upstream from Boyce, Louisiana
Wilton, LA[a,b]	Mississippi River, 13 miles downstream from Donaldsville, Louisiana
Lake Charles, LA[a,b]	Calcasieu River, Lake Charles, Louisiana

[a]Potential proposed action site.

[b]Potential market alternative site.

[c]Potential Cypress Bend pipeline-barge alternative site.

TABLE 3-49

ESTIMATED WATER QUALITY DURING LOW FLOW CONDITIONS AT ALTERNATIVE DISCHARGE LOCATIONS

Site	Background Low Flow (cfs)[a]	Water Quality During Low Flow (mg/l)[b]		
		TDS	Cl	SO_4
Ponca City[c]	604	906	347	113
Pryor[c]	136	154	18	34
Oologah[c]	1.26	225	35	35
Muskogee[c]	2,200	850	405	90
Independence[d]	1,054	179	6	7
White Bluff[d]	3,000	343	120	70
Cypress Bend[d]	115,000	239	25	66
New Roads[e]	100,000	259	26	63
Baton Rouge[e]	100,000	280	35	65
Lake Charles[e]	204	1798	642	101
Boyce[e]	1,650	716	210	136
Wilton[e]	100,000	286	30	60

Source: Alan Plummer and Associates 1980.

[a] Cubic feet per second.

[b] Milligrams per liter.

[c] Seven-day, 2-year low flow.

[d] Seven-day, 10-year low flow.

[e] Historical low flow.

The affected environments for these resource topics are described below for the all-rail route and the rail-barge route. More detailed information regarding the environmental assessment of the no-action alternative is found in the No-Action Alternative Technical Report (WCC, 1980i), which is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado 80228.

3.I.1 SOCIOECONOMIC CONSIDERATIONS

All Rail Alternative

The rail routes of the no-action rail alternative are shown on Map 1-1. Rail delivery of coal to these markets would cover 3626 unduplicated miles of track, all of which is category A or B mainline track (U.S. DOT 1977a). There is existing rail access to all six coal mines and all power plant sites.

The rail route passes through 118 counties in seven states and would affect a minimum of 2.9 million people in at least 500 communities. Table 3-50 lists the numbers of towns and people that would be affected for each route segment. Table 3-51 lists those towns where the train would stop either for a crew change or a maintenance inspection.

It should be noted that many of these towns owe their existence to the presence of the railroad, having developed around it for the transportation and freight services it provided. Precise figures on the number of people in each town employed by the railroad are difficult to obtain. At one extreme there are towns like Alliance, Nebraska, which can be characterized as a "railroad" town. Most of this town's population is employed by the railroad, and the town owes its recent population boom almost exclusively to the building of a large maintenance facility by Burlington Northern (BN). Other towns, like Kansas City, a large, diversified metropolitan area, are major centers for railroad activities, but the economy is less dependent upon railroad activities. Because of the number of communities traversed by the railroad, it is impossible to discuss each one. Instead, the following 13 are examined in detail as being representative of nearly all community types along both the northern and southern portions of the rail route.

Torrington, Wyoming. Torrington (population 4700) is bisected by the BN, with about 85 percent of the population located north of the BN tracks and 15 percent located south of the tracks. All services, including the schools, are north of the tracks. No satellite fire, police or ambulance facilities are located south of the tracks. Located within 500 feet of the center line are a church, the library, and one home for juveniles.

By 1986 it is estimated that annual vehicular delay for all Torrington grade crossings (exclusive of ETSI-related traffic) would be 2649 vehicle hours (Peat, Marwick, Mitchell, & Co. 1979).

Scottsbluff, Nebraska. Scottsbluff (population 12,700) is another city that is bisected by the BN. Approximately 20 percent of the population lives south of the tracks and 80 percent lives north of the tracks, where the major services are located.

Police, fire and ambulance services report that the risk of delay is greatest for ambulance services or health emergencies. Valley Ambulance Service crossed over the railroad tracks on 443 calls out of the 1400 runs made during 1977. Less than one-fourth of fire department responses within the city involve crossing any tracks although more than a third of rural station runs cross over tracks. The police department has a beat on the south side of the railroad so they experience fewer problems with blocked crossings.

Alliance, Nebraska. The BN skirts the west and south sides of Alliance (population 7000). Industrial development south of the tracks is primarily on BN property and the residential development west of the tracks can be served by the U.S. 385 overpass. According to the Alliance Chamber of Commerce, the impacts from increased coal traffic on the BN would not be considered a community problem (PMM 1979).

While increased railroad development is not likely to be opposed in Alliance as it is in other

TABLE 3-50

AFFECTED POPULATION BY ROUTE SEGMENT

Route Segment	Number of Counties/ Parishes	Number of Towns	Population
Wyoming Mines to Kansas City	25	104	813,451
Kansas City to Ponca City	6	15	102,855
Kansas City to Independence	15	74	208,090
Kansas City to Pryor	7	24	58,773
Kansas City to Muskogee	12	45	108,187
Muskogee to White Bluff	9	43	167,926
White Bluff to Alexandria	12	62	194,405
Alexandria to Boyce	1	2	50,744
Alexandria to New Roads	6	24	377,079
Kansas City to Shreveport	13	71	315,361
Shreveport to Lake Charles	6	33	294,273
Shreveport to Wilton	6	6	244,517

TABLE 3-51

CREW CHANGES AND MAINTENANCE STOPS FOR THE ROUTES OF THE PROPOSED ACTION

Railroad	State	County/Parish	Town	Population
BN	Wyoming	Platte	Guernsey (2)	838
	Nebraska	Box Butte	Alliance (1,2)	6,990
		Buffalo	Ravenna (2)	1,250
		Lancaster	Lincoln (1,2)	163,112
	Missouri	Buchanan	St. Joseph (2)	77,679
		Jackson	Kansas City (1,2)	472,529
MP	Kansas	Miami	Osawatomie (1,2)	4,156
			Dixon (1)	
		Montgomery	Coffeyville (1,2)	15,537
	Oklahoma	Rogers	Claremore (1)	9,897
			Cookson (1)	
			Upson (1)	
	Arkansas	Crawford	Van Buren (1,2)	9,452
		Franklin	Alix (1)	
		Conway	Morrilton (1)	6,814
		Pulaski	North Little Rock (1,2)	61,768
		Jefferson	Pine Bluff (1)	57,389
		Desha	McGehee (1,2)	5,413
			Sunshine (1)	
	Louisiana	Ouachita	Monroe (1,2)	61,016
		Caldwell	Grayson (1)	601
			Texmo Junction (1)	
			Alexandria (2)	
		Grant	Georgetown (1)	305
		Morehouse	Collinston (1)	428
		Rapides	Meeker (1)	
		Avoyelles	Bunkie (1)	5,129
	Missouri	Cass	Pleasant Hill (1)	3,475
		Cass	Ore (1)	
		Bates	Rich Hill (1)	1,590
		Vernon	Sheldon (1)	483
		Barton	Lamar (1)	3,791
		Jasper	Carthage (2)	10,928
		Stone	Crane (1)	1,108
		Taney	Branson (1)	2,642
		Boone	Bergman (1)	294
	Arkansas	Baxter	Cotter (1,2)	949
		Izard	Calico Rock (1)	928
		Independence	Batesville (1)	7,209
KCS	Kansas	Crawford	Pittsburg (2)	18,375
	Oklahoma	Adair	Watts (2)	346
		LeFlore	Heavener (1,2)	2,585
	Arkansas	Sevier	DeQueen (2)	4,083

TABLE 3-51 Concluded

Railroad	State	County/Parish	Town	Population
KCS	Louisiana	Caddo	Shreveport (1,2)	185,711
		Vernon	Leesville (2)	8,473
		Calcasieu	Lake Charles (1)	76,087
		Rapides	Alexandria (2)	49,481
		E. Baton Rouge	Baton Rouge (2)	444,600
ATSF	Kansas	Lyon	Emporia (2)	23,447
		Cowley	Arkansas City (1,2)	13,791
MKT	Kansas	LaBette	Parsons (1,2)	12,356

1 = Maintenance stop.
2 = Inspection stop.

BN = Burlington Northern
MP = Missouri Pacific
KCS = Kansas City Southern
ATSF = Atchinson, Topeka and Sante Fe
MKT = Missouri-Kansas-Texas

towns, Alliance is experiencing something of its own boomtown problems. For example, despite a dramatic increase in housing construction (only two houses were built in 1970 versus 92 apartment units and 129 houses in 1979) the town has not kept up in terms of any accompanying growth in private services. There are complaints that there is little to do in town except drink and shoot pool. First run films are offered in an inadequately equipped movie house. Police services are increasingly needed as problems have progressed from dealing with local drunks and teenage shoplifters to domestic fights, drug abuse and petty theft. Prices for goods are said to be high and the selection sufficiently limited that workers prefer to shop 60 miles away in Scottsbluff.

Broken Bow, Nebraska. The BN bisects Broken Bow (population 4000) about equally. According to one of the Broken Bow citizens, grade separations are a major issue with most citizens. All emergency services are south of the tracks, which means that about 50 percent of the population could be cut off from the services by the passage of a train because there are no grade-separated rail-highway crossings. Vehicle delay due to train traffic is currently about 3800 hours annually.

Ravenna, Nebraska. Ravenna (population 1300) is a major crew-change town for the BN. Many fast-food restaurants derive significant income from the 48 BN living units. No quiet facilities are within 1000 feet of the BN right-of-way and most are beyond 2000 feet. Services are not a major problem, except for the BN crew-change quarters, which are south of the tracks.

Grand Island, Nebraska. According to local officials, facilities in Grand Island (population 33,000) that would be affected by increased BN traffic include two schools, a veterans' home, a hospital, a church, and a recreation park/little league ball field. Most of the city is south of the tracks, with the older part of the city north of the tracks. The BN traffic is considered well scheduled, with particular attention paid to scheduling of traffic to avoid blocking grade crossings. It is estimated that the annual vehicle delay at the grade crossings in Grand Island for 1986 (not including ETSI-related traffic) would be 12,136 hours (Peat, Marwick, Mitchell, & Co. 1979).

Lincoln, Nebraska. The impacts of increased coal traffic in the Lincoln area (population 163,000) are likely to be perceived as a major problem, as evidenced by numerous newspaper articles on this subject and by at least one major environmental impact statement (U.S. DOT 1977b) and a more recent (U.S. DOT 1978) supplement to it. Particular concern has focused on the more than 400 at-grade rail crossings in the town and the relatively high accident rate at these crossings. While the town can trace much of its development to the presence of the railroads, some of which date from the late 1800s, current urban development has resulted in problems that the citizens of Lincoln are actively trying to have remedied.

Greenwood, Nebraska. Greenwood (population 500), in contrast with some other towns, may be more affected by increased rail traffic. Approximately 60 percent of the population lives northwest of the tracks, while the other 40 percent lives to the southeast. Since all highway crossings are at grade, this 40 percent of the population could be cut off from fire, ambulance, and police services by the passage of a train. Children from 60 percent of the population must cross the tracks to reach school. The nearest hospital is to the east, so 60 percent of the population could be cut off from the hospital as well.

The city's future plans will further diminish fire service accessibility because the city has purchased land for a new fire station to be located southeast of the tracks. Most of the fire volunteers, however, live northeast of the tracks, which could exacerbate the problem.

Exclusive of ETSI-related traffic, it is estimated that the citizens of Greenwood will experience about 709 hours of vehicular delay in 1986 due to existing merchandise traffic (Peat, Marwick, Mitchell, & Co. 1979).

Kansas City, Missouri. Kansas City (population 473,000) is served by 12 railroads that average 272 freight train trips daily. These railroads are: Chicago and North Western, St. Louis--San

Francisco, Illinois Central Gulf, Kansas City Southern, Milwaukee Road, Missouri-Kansas-Texas, Missouri Pacific, Rock Island, Santa Fe, Union Pacific, Norfolk and Western, and Burlington Northern.

Vehicle delay due to at-grade crossings should not be a problem in Kansas City. The city has a hilly topography so most of the crossings are grade-separated. There are, however, two crossings where problems with regard to emergency services could develop. One crossing is in the southern part of the city where State Highway 150 crosses the Kansas City Southern tracks. The second crossing is where Jackson County route 10S crosses the Missouri Pacific tracks. There is a fire station within one-half mile of the crossing and the alternate grade-separated crossings are more than a mile to the north (I-435) and south (Blue Ridge Blvd.), both of which are considerably out of the way.

Pryor, Oklahoma. Pryor (population 7800) has a population of 11,500 with 3000 people employed in 47 manufacturing companies, most of which are located just south of the city in a 10,000 acre industrial park. The MKT stops and picks up freight two hours per day. The railroad is located on the western fringes of the city, paralleling U.S. Highway 69. The majority of residential area and all of the city's services are located east of the railroad tracks. The police, fire and sheriff's offices are located within one block of the tracks.

Muskogee, Oklahoma. Muskogee (population 37,313) has 690 retail establishments employing 3,216 people and 150 wholesale establishments employing 625 people. The city's 15 largest manufacturing companies employ an additional 3,200 people.

Muskogee is served by three railroads: Missouri-Kansas-Texas Railroad, Missouri Pacific (Texas Pacific) Railroad Company, and St. Louis-San Francisco Railway Company. Each railroad has two trains per day which stop and pick up freight.

The MKT traverses the city in a general north-south direction and among the three railroads has the greatest affect on vehicular movement. Located on the east side of the railroad are the major residential and industrial areas. On the west side of the railroad are located the major commercial areas and public emergency facilities. The railroad has become a major physical barrier to traffic flows in an east-west direction. There are only five at-grade crossings and one grade-separated crossing (constructed in 1913) serving the major development.

Several major tracks through the city are owned by Missouri Pacific. One parallels the MKT through the major portion of the city and then branches off to the west. Another Missouri Pacific line runs through the eastern part of the city, and a third runs through the northern portion of Muskogee, bypassing much of the city.

Newport, Arkansas. Newport (population 7900) has 2650 people employed in manufacturing industries and 1350 people employed in agriculture. The city serves as a maintenance/crew change stop for the Missouri Pacific. The railroad passes through the northwestern parts of town and continues south along Front Street directly across from the White River. The police and fire department as well as the public library and a hospital are located one block from Front Street. These facilities would be affected by additional rail and coal trains.

Dumas, Arkansas. Dumas (population 5300) has about 2000 people employed in eight manufac turing industries, including wood products and small appliances. Dumas is passed through by the Missouri Pacific. The Missouri Pacific tracks parallel Main Street and divide the town into east and west portions. Most of the residential areas along with the health facilities are located on the west side of town. All other services are located on the east side of town. Directly affected facilities within four blocks of the Missouri Pacific tracks include schools, three churches, the public library, and the Desha County Hospital.

Rail-Barge Alternative

The area uniquely affected by this alternative is defined as those counties and towns along the rail route from Lincoln, Nebraska east to St. Louis, Missouri, and from Kansas City to Pryor and Oologah, Oklahoma. This includes 36 counties in Nebraska, Iowa, Missouri, and Oklahoma and at least 88 towns with a minimum population of 692,000. Towns between Lincoln and St. Louis have average rail traffic of approximately 30 trains per day.

The towns identified as those most likely to be affected by this alternative are Lincoln, Nebraska; St. Louis, Missouri; and Kansas City, Missouri.

St. Louis now has only one rail-to-barge transshipment facility. This is the Hall Street terminal owned by American Commercial Barge Line-Western. It is located on 45 acres of a 70-acre site adjacent to BN tracks. There are no current plans for expansion, though the remaining land could be used for expanding the existing facility (White 1980). Studies are underway for development of these and other sites in the St. Louis harbor (Mankus 1980). Land for other facilities is available, especially on the east side of the river.

The capacity of this terminal is 10 MMTA, of which 60 percent is contracted for with Cajun Electric Company in Baton Rouge, Louisiana, which at present is processing approximately 3 MMTA (Barker 1980). The remaining capacity is uncommitted.

The Corps of Engineers has proposed rebuilding Lock 26 north of St. Louis at Alton, Illinois. Rebuilding the lock would relieve the waiting times experienced at this facility, which now are as much as 72 hours. A lock is considered at capacity when average delay times reach 150 minutes (ICC 1979, p. 4-27). The average at lock 26 is said to be as little as 24 hours (Dutt 1980) and as much as 3.5 days (Mankus 1980). To the extent that this project is delayed and the demand for coal in the south continues to increase, there will be increased pressure for the development of transshipment facilities in St. Louis.

3.I.2 AIR QUALITY AND NOISE

The railroad alternative routes would cross about 19 different air quality control regions, as designated by the U.S. Environmental Protection Agency (1972). Currently, nearly all of these regions are designated as being "better than national standards" or "cannot be classified" for total suspended particulates (TSP). Portions of Wyandotte County, Kansas, Tulsa and Mayes counties in Oklahoma, and parts of Pulaski and Ashley counties in Arkansas are the only regions that are presently not in attainment of the National Air Quality Standards for TSP. Air quality monitoring data representative of the railroad alternative routes should be similar to those discussed for the proposed slurry pipeline route (Section 3.A.8).

Existing noise levels along the railroad alternative route are dependent upon train speed, the number of trains passing a given site, topography, and the type of track. Maximum sound levels may range from 50 to 100 decibels, A-weighted scale, at a distance of 50 feet (OTA 1977).

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES, MITIGATION MEASURES, AND MONITORING PROGRAMS

ENVIRONMENTAL CONSEQUENCES

This section discusses the environmental consequences (commonly referred to as impacts) of implementing the proposed action or alternatives. The affected environment is described in Chapter 3. The impacts are discussed to a level commensurate with the degree or severity of impact. Thus significant impacts are discussed in detail and insignificant impacts are merely summarized.

The following criteria were used to determine the significance of impacts on each resource.

- Water resources. Impacts on the hydrology of the Madison aquifer system would be considered potentially significant if drawdowns in the potentiometric surface exceeded 25 feet, if stream flow was reduced by more than 0.5 cfs, or if measurable water quality changes occurred as a result of ETSI's ground-water withdrawals.

- Socioeconomics. Impacts were considered significant if they would exceed the following criteria:

  - Population. A permanent change in the local population greater than 5 percent as a result of combined direct and indirect employment, or a temporary change in the local population greater than 15 percent in the area where the construction work force would reside.

  - Housing. A demand for permanent housing greater than 10 percent of the local permanent housing market or a demand for temporary housing which would exhaust the local market.

  - Other infrastructure. The creation of a permanent demand in infrastructure greater than 10 percent, or the temporary creation of a demand which would exhaust the excess capacity of infrastructures in the areas where the crews would live, or a change in local tax revenues greater than 10 percent.

  - Economics. An employment demand on the local work force greater than 15 percent or a permanent shift in any local industry greater than 5 percent.

  In addition, the impacts were considered significant if the work force would be a considerably different social group than the residents of the area in which the crew would reside, or if the work force would present a conflict in social mores and attitudes.

- Wildlife. Impacts on wildlife would be significant if any crucial habitats were affected during the season of use or if the habitat disturbance were expected to be greater than 1 percent of the habitat within a geographic region. Impacts to wetlands would be significant. Impacts to threatened or endangered species would be considered significant if the Fish and Wildlife Service finds that the project would jeopardize the species. If a significant amount of crucial habitat is destroyed, the dependent species would be significantly affected whether it is present at the time of construction or not. Different parts of an animal's habitat have different values or levels of importance. Habitat disturbances which comprise less than 1 percent of an animal's habitat may be significant if the disturbance is located in an area of high value (e.g., denning or nesting sites, brooding habitat, crucial winter range).

- Aquatics. Impacts on aquatic biological resources would be significant if numerous fishes or macroinvertebrates would be killed or displaced as a direct or result of permanent or temporary habitat loss due to project construction or operation.

- Cultural resources. Impacts would be considered significant if there is a reasonable possibility that a scientifically or culturally important site could be damaged or destroyed as a result of the proposed action or alternatives.

- Vegetation. Impacts on vegetation resulting from removal of cover and from surface disturbance would be considered significant if, following construction, there would be a low probability of establishing adequate vegetative cover to minimize soil erosion with the implementation of the revegetation and erosion control plan. Any impacts to threatened or endangered plant species would be considered significant.

- Agriculture. Impacts on agricultural lands would be considered significant if these lands were irreversibly converted to other uses or if the viability of the lands were significantly diminished as a result of the proposed action or alternatives.

- Air quality. Impacts to air quality would be considered significant if one of the following criteria could be met by the proposed action and alternatives.

  1. Temporary or localized impacts from construction would affect regional and/or long-term air quality.
  2. Estimated emission rates at the pump stations would exceed the following:
     - Carbon monoxide, 100 tons/year
     - Nitrogen dioxide, 10 tons/year
     - Sulfur dioxide, 10 tons/year
     - Total suspended particulates, 10 tons/year
     - Ozone, 10 tons/year of volatile organic compounds
  3. Estimated concentration increases of pollutants which exceeded the rates expressed in item 2 above would exceed the following:
     - Carbon monoxide, 500 $\mu g/m^3$, 8-hour average
     - Nitrogen dioxide, 1 $\mu g/m^3$, annual average
     - Sulfur dioxide, 5 $\mu g/m^3$, 24-hour average
     - Total suspended particulates, 5 $\mu g/m^3$, 24-hour average
  4. Predicted ambient concentration (pollutant increases exceeding the criteria in item 3 plus existing levels of pollutants) would exceed one-fourth of applicable federal standards.

- Recreation. A recreation impact is considered significant if it permanently removes part of the recreation area from its prior use or if it alters the extent or quality of recreational experiences possible at a particular area. Temporary (1 or 2 visitor seasons) disturbance of an area is not usually considered a significant impact, nor is disturbance in an area that is considered inaccessible and thus not regularly used, even though it is in the managed area (e.g., the back acres of a managed forest).

- Transportation. Transportation impacts are judged to be significant if the traffic is at a level where a further increase, particularly over the long term, would cause an instability of traffic flow, noticeable congestion, and/or a substantial increase in average travel time. Impacts would be considered significant if there would be any permanent impact on road or rail networks, or if the local traffic would increase more than 30 percent, or if annual traffic accident rates would increase more than 3 percent.

- Wilderness. Impacts would be considered significant if the proposed action crossed a boundary of a Wilderness Study Area or Forest Service Second Roadless Area Review and Evaluation Program (RARE II) or come closer to a boundary than an existing road or trail.

- Visual resources. Impacts would be considered significant if long-term (greater than 5 years) changes would occur in the form, line, texture, or color of the existing visual resources near human use areas or areas having high scenic quality. Changes that would be temporary due to successful revegetation would be considered insignificant.

Not all resources would be affected. No impacts on wilderness would result from construction or operation of the proposed action or alternatives, since no designated Wilderness Study Areas, RARE II areas, or state wilderness/natural areas would be affected.

The construction, operation, maintenance, and abandonment of the coal slurry pipeline project would not affect any federal or state threatened or endangered plant species (FWS 1980a), except for the Colorado alternative. The Colorado butterfly-weed, which may occur on the Colorado alternative route, will be addressed in the Memorandum of Understanding between the Bureau of Land Management and the Fish and Wildlife Service (Appendix D-4). Once the exact location of this plant is identified, the possible impacts and mitigation measures can be determined.

Noise levels generated by the proposed action and alternatives were found to be insufficient to produce impacts, except for the no-action alternative.

The geology and topography of the project area would not be affected. Soils would be affected during the construction period until implementation of the reclamation program, establishment of vegetative cover in native range and woodland areas, and restoration of production in cropland areas.

Impacts discussed for the proposed action (or specific components) also apply to portions of all of one or more of the alternatives. For the topics mentioned below, the impact discussion is not repeated for the alternatives:

- Ruptures and spills. The magnitude and type of impacts discussed for the proposed action would also apply to the market alternative, Cypress Bend pipeline-barge alternative, and Colorado alternative.

- Vegetation. Reclamation discussions presented for the proposed action also apply to disturbed areas for all of the alternatives.

- Wildlife. Impacts to wildlife for the Cypress Bend pipeline-barge alternative are similar to those discussed for the pipeline route in Arkansas for the proposed action.

- Agriculture. Discussions regarding concerns, impacts, and restoration of cropland production and grazing on native rangeland for the proposed action will also apply to disturbed areas for all tne alternatives.

- Aquatics. Impacts to aquatic biota for the market alternative and Cypress Bend pipeline-barge alternative are similar to those described for the proposed action, except at the Cypress Bend site. The impacts associated with the Oahe alternative water supply system are similar to those discussed for the Crook County alternative, except for the intake structure at the Oahe Reservoir. The water treatment facilities for the water discharge alternative would not result in any additional impacts to the aquatic resources already discussed for the dewatering plants.

- Air quality. The impacts to air quality for the market alternative are not substantially different from those discussed for the proposed action.

- Cultural resources. The discussion of impacts to cultural resources for the proposed action would apply to any of the other alternatives where ground disturbances would occur as a result of construction.

The impacts discussed in this chapter for the proposed action and alternatives are summarized in Chapter 2 and compared by alternative (see Table 2-3).

4.A PROPOSED ACTION

4.A.1 WATER RESOURCES

Ground Water

The conceptual model used to describe the existing geologic and hydrologic characteristics of the Madison Formation (including present users of water from this formation) was the basis for the numerical model that was used to assess impacts of the ETSI project on the Madison. Four pumping scenarios (or plans) are discussed in this chapter. Two of these refer to the proposed action and are discussed in this section. The other two refer to the Crook

County alternative water supply system and are discussed in Section 4.F.1. For the proposed action, the impacts associated with obtaining up to 20,500 acre-feet of water (Table 4-1) from the Niobrara County well field (Plan 1) and from a combination of pumping (Plan 2) from the Niobrara well field and the Gillette well field (now under construction by the city of Gillette) were predicted based on calculated drawdowns in the potentiometric surface of the Madison aquifer. The hydrogeology of the Madison aquifer system is discussed in more detail in the Well-Field Hydrology Technical Report (WCC 1980b).

The amount of water available to ETSI from the Gillette well field is based upon projected water demands and supplies developed by James M. Montgomery, Consulting Engineers (1979), for the city of Gillette (Figure 4-5 in the Montgomery report). The difference between the projected maximum amount of water that can be pumped from the well field and the amount of water that is expected to be used by the city of Gillette was used to calculate the amount of water that can be supplied to ETSI from the Gillette well field (Table 5-3). This amount was used to represent the worst-case analysis.

Since the calculated declines in the Madison potentiometric surface during the period 1985-2035 as a result of continued water production at existing rates from water wells in use in 1980 are small relative to the calculated drawdowns caused by the proposed pumping by ETSI, only those impacts caused by ETSI and existing users are considered here. These expected impacts include declines in water levels and reductions in spring and stream flow. These impacts are listed in Tables 4-2 and 4-3.

Niobrara County Well Field.

Water Levels. Pumping approximately 1 million acre-feet of water from the Madison aquifer at the Niobrara well field over the ETSI project's 50-year design life (1985-2035) would result in large declines in the potentiometric surface of the Madison aquifer system (Map 4-1 and Table 4-2). Drawdowns greater than 25 feet in the Madison potentiometric surface would occur within a region of about 5300 square miles extending north, south, and east from the Niobrara County well field. The region over which drawdowns of greater than 25 feet would occur due to pumping encompasses the western half of Fall River and Custer counties, South Dakota; the northern portion of Sioux and Dawes counties, Nebraska; and the eastern half of Niobrara County, the extreme southeastern half of Weston County, and the northern half of Goshen County, Wyoming. Drawdowns of greater than 100 feet would occur in a region of more than 3800 square miles in Niobrara, Goshen, Sioux, and Fall River counties. Drawdowns greater than 200 feet would occur in a region of more than 2000 square miles in Sioux, Niobrara, and Fall River counties; and drawdowns greater than 400 feet would occur only within a radius of 15 miles north, south, and east of the Niobrara well field, encompassing an area of 500 square miles.

The cone of depression is asymmetrical due to variations in the hydrogeologic properties within the Madison aquifer system (Map 4-1). The extent of the cone of depression is limited to the west by the low-transmissivity zones associated with the Black Hills monocline, the Fanny Peak monocline, and the Rawhide fault. The Precambrian core of the Black Hills uplift and the surrounding Madison aquifer outcrop areas form the northern boundary of the cone of depression, while the Cascade anticline and the erosional limit of the Madison Group act as the northeastern and southeastern boundaries to the spread of drawdown from pumping.

Several existing Madison and Minnelusa water users would be likely to have increased pumping lifts as a result of the declines in the potentiometric surface (Table 4-2). Only at the Madison wells located near Edgemont, South Dakota, would drawdowns in the potentiometric surface exceed 25 feet. Water levels at the seven Madison wells used for municipal water supply at Edgemont would decline after 50 years by 303 feet, from their current level of 200 feet above land surface to 103 feet below land surface at the end of 50 years (Figures 4-1 and 4-2). This would result in the gradual lessening of flow from these wells, with cessation of flow in approximately 2005

TABLE 4-1

PUMPING SCHEDULES FOR THE VARIOUS WELL-FIELD COMBINATIONS: PLANS 1, 2, 3, AND 4

Plan Number and Name		Time Period (years)	Pumping Rate in cfs (acre-feet per year)
Plan 1:	Niobrara Well Field Only	1985-2035	28.31 (20,500)
Plan 2:*	Niobrara Well Field	1985-1995	16.90 (12,240)
		1995-2005	18.62 (13,480)
		2005-2015	19.48 (14,100)
		2015-2025	19.94 (14,440)
		2025-2035	20.17 (14,610)
	City of Gillette Well Field	1985-1995	11.41 (8,260)
		1995-2005	9.69 (7,020)
		2005-2015	8.83 (6,390)
		2015-2025	8.37 (6,060)
		2025-2035	8.14 (5,890)
Plan 3:	Crook Well Field Only	1985-2035	28.31 (20,500)
Plan 4:*	Crook Well Field	1985-1995	16.90 (12,240)
		1995-2005	18.62 (13,480)
		2005-2015	19.48 (14,100)
		2015-2025	19.94 (14,440)
		2025-2035	20.17 (14,610)
	City of Gillette Well Field	1985-1995	11.41 (8,260)
		1995-2005	9.69 (7,020)
		2005-2015	8.83 (6,390)
		2015-2025	8.37 (6,060)
		2025-2035	8.14 (5,890)

Note: The 10-year pumping intervals listed above were used to calculate drawdowns for each well-field pumping plan. The maximum rate of withdrawal by ETSI is 28.3 cfs (20,500 acre-feet per year) when the coal cleaning operations are being conducted. Since the greatest impacts are expected to occur with the largest pumping rate, the maximum rate (28.3 cfs) was used, and not a smaller rate.

*Average annual rates for 50 years (acre-feet):

Niobrara - 13,700, Gillette - 6800
Crook - 13,700, Gillette - 6800

TABLE 4-2

DRAWDOWNS IN THE MADISON POTENTIOMETRIC SURFACE DURING THE PERIOD 1985-2035[a]

Approximate Location	Location[b] No. (See Map 3-9)	Current Use Only: 1900-1980 Time Period	Current Use Only: (Column A) 1985-2035 Time Period	Plan 1: Niobrara W.F. Only: ETSI only	Plan 1: Niobrara W.F. Only: ETSI Plus Col. A	Plan 2: Niobrara W.F. Plus Gillette W.F.: ETSI only	Plan 2: Niobrara W.F. Plus Gillette W.F.: ETSI Plus Col. A	Plan 3: Crook W.F. Only: ETSI only	Plan 3: Crook W.F. Only: ETSI Plus Col. A	Plan 4: Crook W.F. Plus Gillette W.F.: ETSI only	Plan 4: Crook W.F. Plus Gillette W.F.: ETSI Plus Col. A
				Calculated Drawdowns (feet)[c]							
Niobrara County Well Field, WY	1	18	9	666	675	464	473	-	9	-	9
Edgemont, SD	2	44	8	295	303	203	211	-	8	-	8
Provo, SD	3	31	8	335	343	230	237	-	8	-	8
Hot Springs, SD	4	1	1	7	8	5	6	-	1	-	1
Cascade Springs, SD	5	3	3	32	35	22	25	-	3	-	3
Lusk, WY	6	-	1	6	7	4	5	-	1	-	1
Newcastle, WY	7	128	18	2	21	1	20	4	23	7	26
Osage, WY	8	68	14	-	14	24	38	17	31	36	50
Upton, WY	9	32	13	-	13	56	69	38	51	82	95
Sundance, WY	10	5	8	-	8	34	42	47	55	66	74
Gillette Well Field, WY	11	11	10	-	10	191	202	91	101	254	264
Devils Tower, WY	12	8	10	-	10	77	87	134	144	169	179
Hulett, WY[d]	13	7	9	-	9	60	69	125	134	147	156
Crook County Well Field, WY	14	10	10	-	10	30	40	366	376	286	296
Bell Creek, MT	15	30	10	-	11	15	26	151	162	117	127
Belle Fourche, SD	16	2	4	-	4	11	15	49	53	44	48
Spearfish, SD	17	1	4	-	4	11	15	38	42	36	40

Note: Numbers in the columns above are rounded to the nearest whole number and may not add exactly. W.F. = well field.

[a]Calculated drawdowns

[b]Exact locations are shown on Map 3-9.

[c]Pumping schedules used for drawdown calculations are listed in Table 3-4.

[d]Drawdowns calculated for the Minnelusa aquifer unit only.

TABLE 4-3

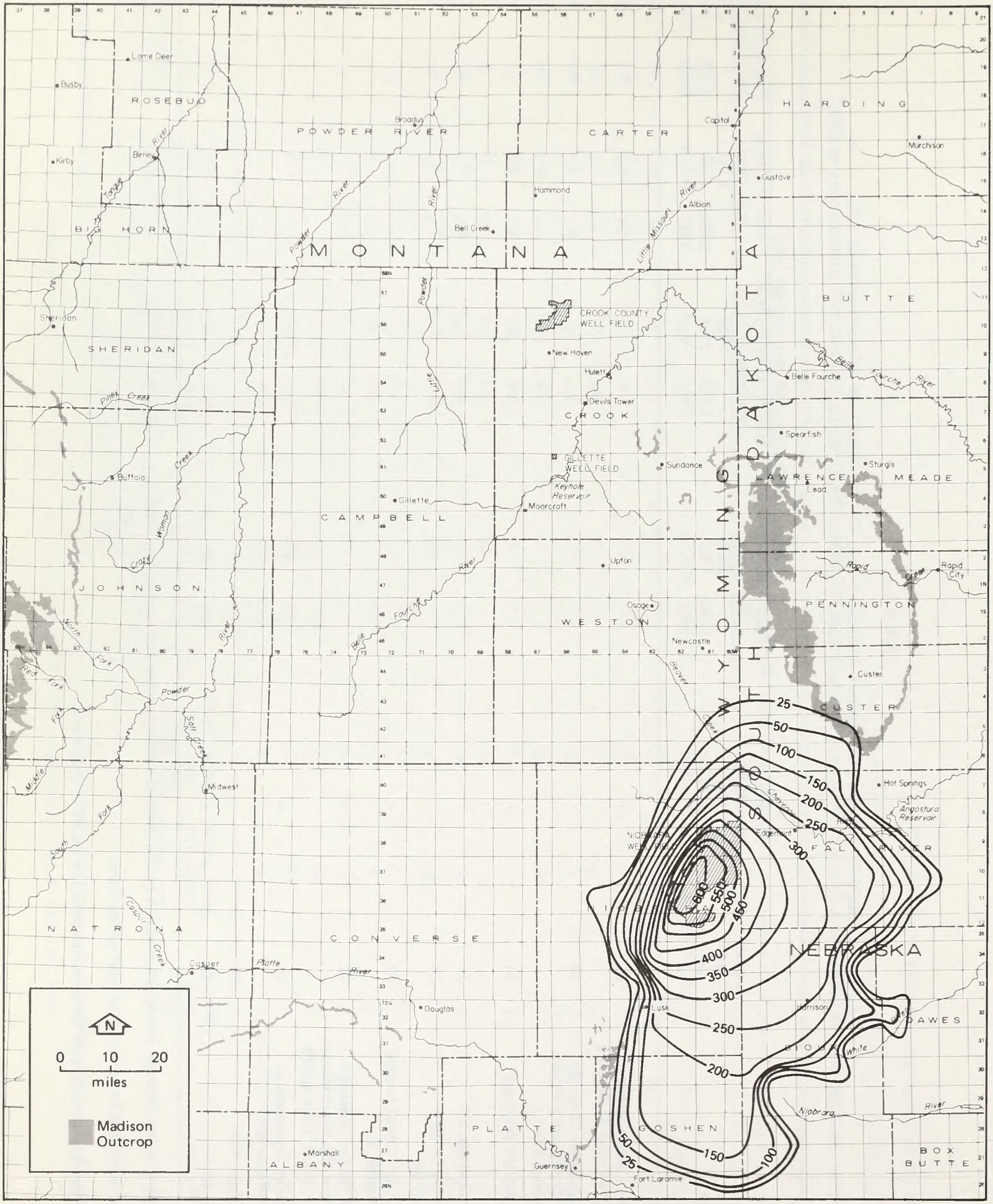
CHANGES IN GROUND-WATER DISCHARGE RATES TO THE MAJOR STREAMS AND SPRINGS IN THE BLACK HILLS REGION AS A RESULT OF WITHDRAWALS FROM THE MADISON AQUIFER DURING THE PERIOD 1985 to 2035[a]

Approximate Location	Location No. (see Map 3-9)	Column A: Current Use Only, 1985-2035 Time Period	Calculated Change in Discharge Rate (cfs)[b] Plan 1: Niobrara W.F. Only		Plan 2: Niobrara W.F. Plus Gillette W.F.		Plan 3: Crook W.F. Only		Plan 4: Crook W.F. Plus Gillette W.F.	
			ETSI Only	ETSI Plus Col. A	ETSI Only	ETSI Plus Col. A	ETSI Only	ETSI Plus Col. A	ETSI Only	ETSI Plus Col. A
Little Missouri River at the Montana-Wyoming State Line	18	-	-	-	-	-	1	1	1	1
Belle Fourche River (Keyhole Reservoir to Wyoming-South Dakota State Line	19	-	-	-	1	1	4	4	4	4
Sand Creek (entire drainage basin)	20	-	-	-	2	2	3	4	4	4
Crow Creek Springs, SD	21	-	-	-	1	1	2	2	2	2
Spearfish Creek (entire drainage basin)	22	-	-	-	1	1	1	1	1	1
Stockade-Beaver Creek (entire drainage basin)	23	-	-	-	-	-	-	-	1	1
Rapid Creek (entire drainage basin west of the Precambrian core of the Black Hills uplift)	24	-	-	-	-	-	-	-	-	-
Cheyenne River (upstream of Angostura Reservoir)	25	-	1	1	1	1	-	-	-	-
Cascade Springs, SD	26	-	4	4	3	3	-	-	-	-
Hot Springs, SD	27	-	2	2	1	1	-	-	-	-

Note: Numbers in the columns above are rounded to the nearest whole number and may not add exactly. W.F. = well field.

[a]Calculated reductions in stream flow and spring flow.

[b]Pumping schedules used in drawdown calculations are listed in Table 3-4.



Map 4-1. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING FROM NIOBRARA COUNTY WELL FIELD ONLY (PLAN 1)

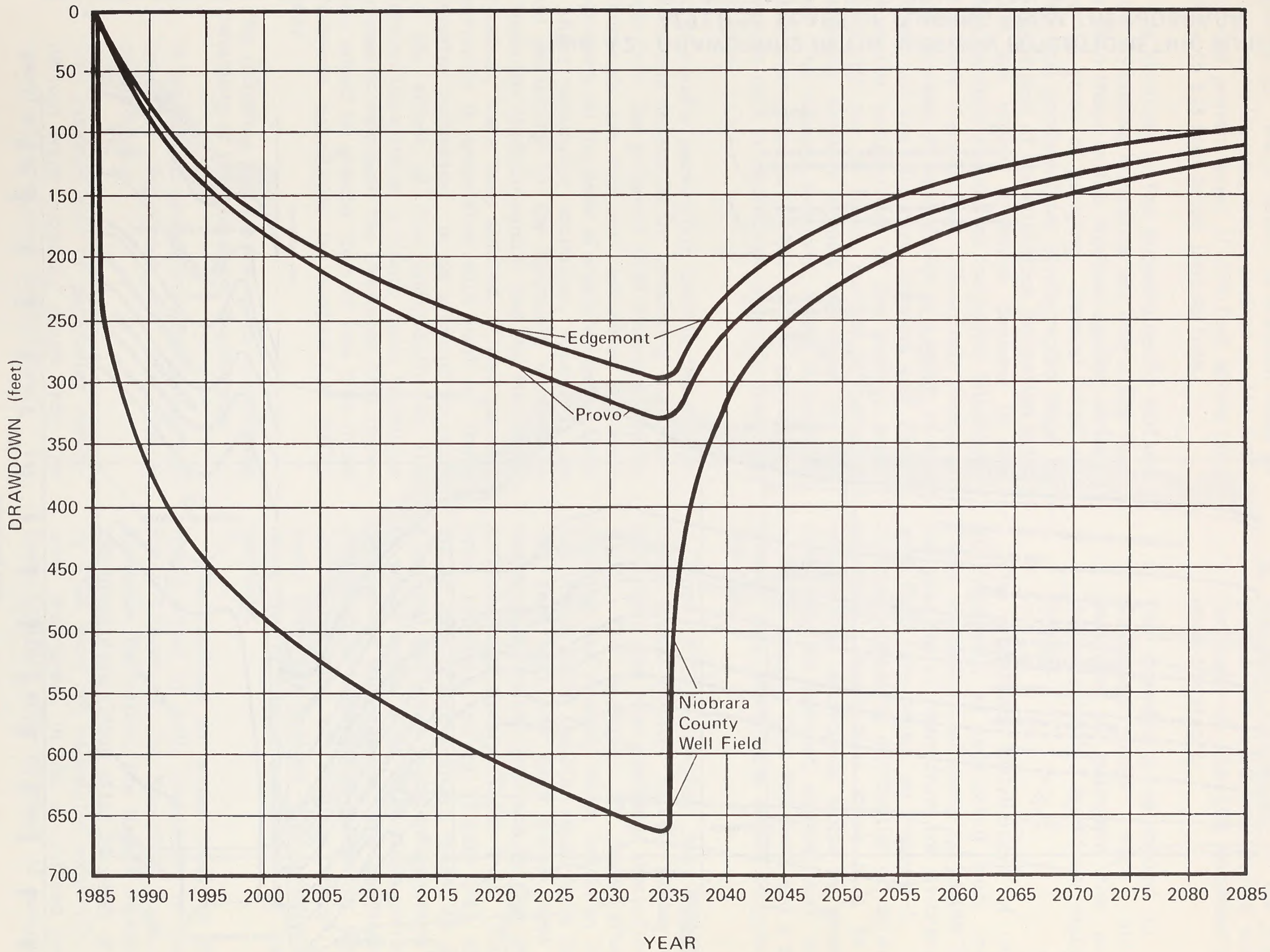
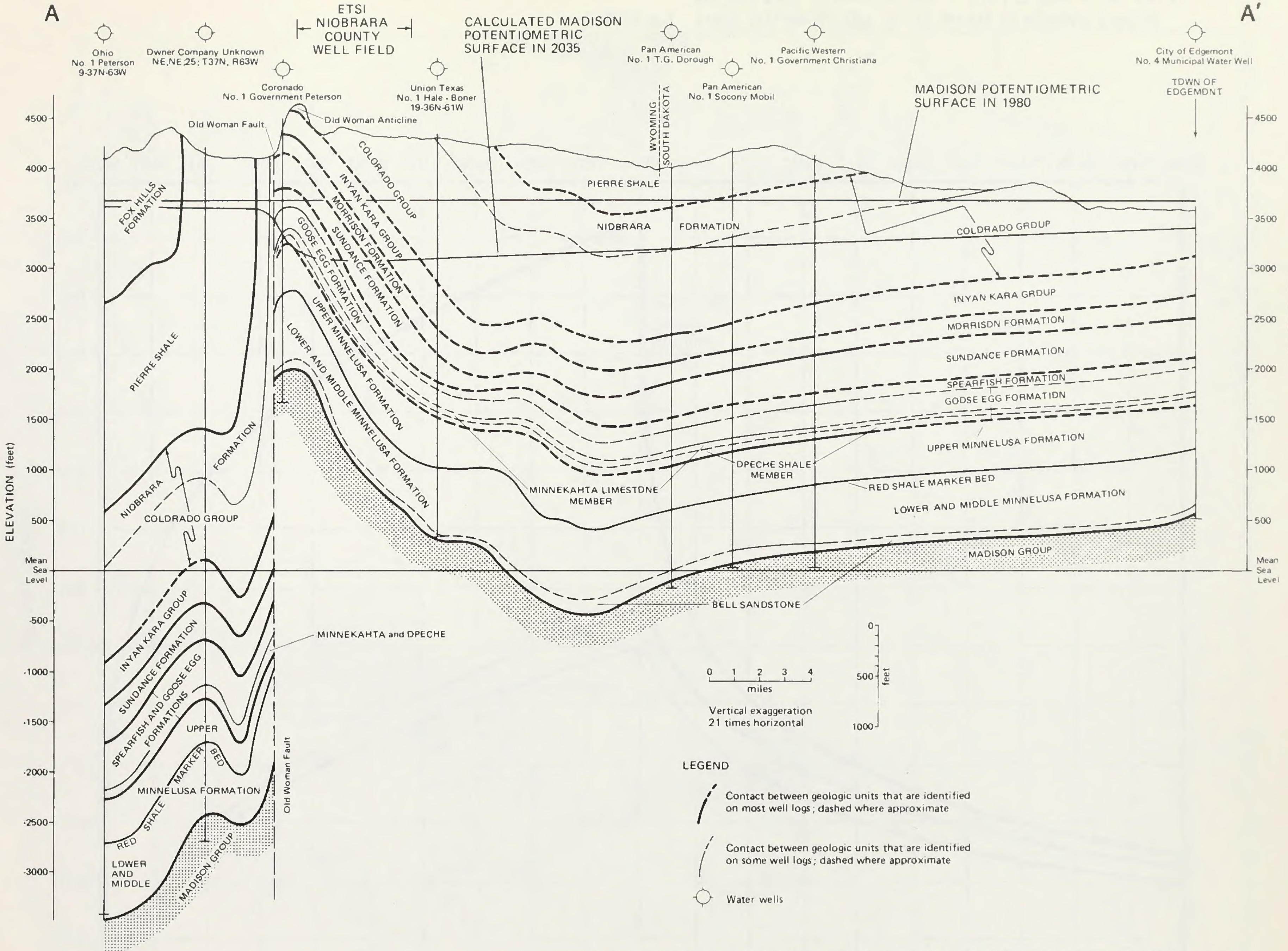


Figure 4-1. TIME-DRAWDOWN PLOT WITH PUMPING FROM NIOBRARA COUNTY WELL FIELD ONLY (PLAN 1)



Note: See Map 3-3 for location of cross section A-A′.

Figure 4-2. DRAWDOWNS IN THE MADISON POTENTIOMETRIC SURFACE AFTER 50 YEARS OF PUMPING FROM THE NIOBRARA COUNTY WELL FIELD ONLY (PLAN 1)

(Figure 4-2). Water levels at Madison wells at Provo, South Dakota, would decline by 343 feet, from the present level of 200 feet above land surface to 143 feet below land surface.

The declines in the potentiometric surface of the Minnelusa Formation are only a few feet less than those in the Madison aquifer surface after 50 years of pumping. Several small oil fields that produce from stratigraphic traps in the upper part of the Minnelusa Formation exist within the region in which declines in the potentiometric surface of the upper Minnelusa are greater than 25 feet. Reservoir pressures would decrease in these fields as a result of the pumping at the Niobrara County well field. Due to the complexities of the geology associated with the oil fields, further refinements concerning impacts cannot be made at this time. The impacts, however, would be equal to or less than those predicted for the corresponding rock unit at equivalent distances from the well field.

The aquifer parameters used in the numerical models developed for predicting the drawdowns from the proposed ETSI Niobrara County withdrawals are the best estimates of these parameters on the basis of available data. Data on these parameter estimates, especially on those pertaining to the hydraulic connection between the Madison aquifer and the Minnelusa Formation, were very limited. Consequently, uncertainty is associated with each of these parameter estimates. In an attempt to evaluate the effect of this uncertainty on the predicted drawdowns, a Monte Carlo technique was used to calculate the likelihood that drawdowns would be greater than or less than those drawdowns calculated in Section 4.A (WCC 1980b).

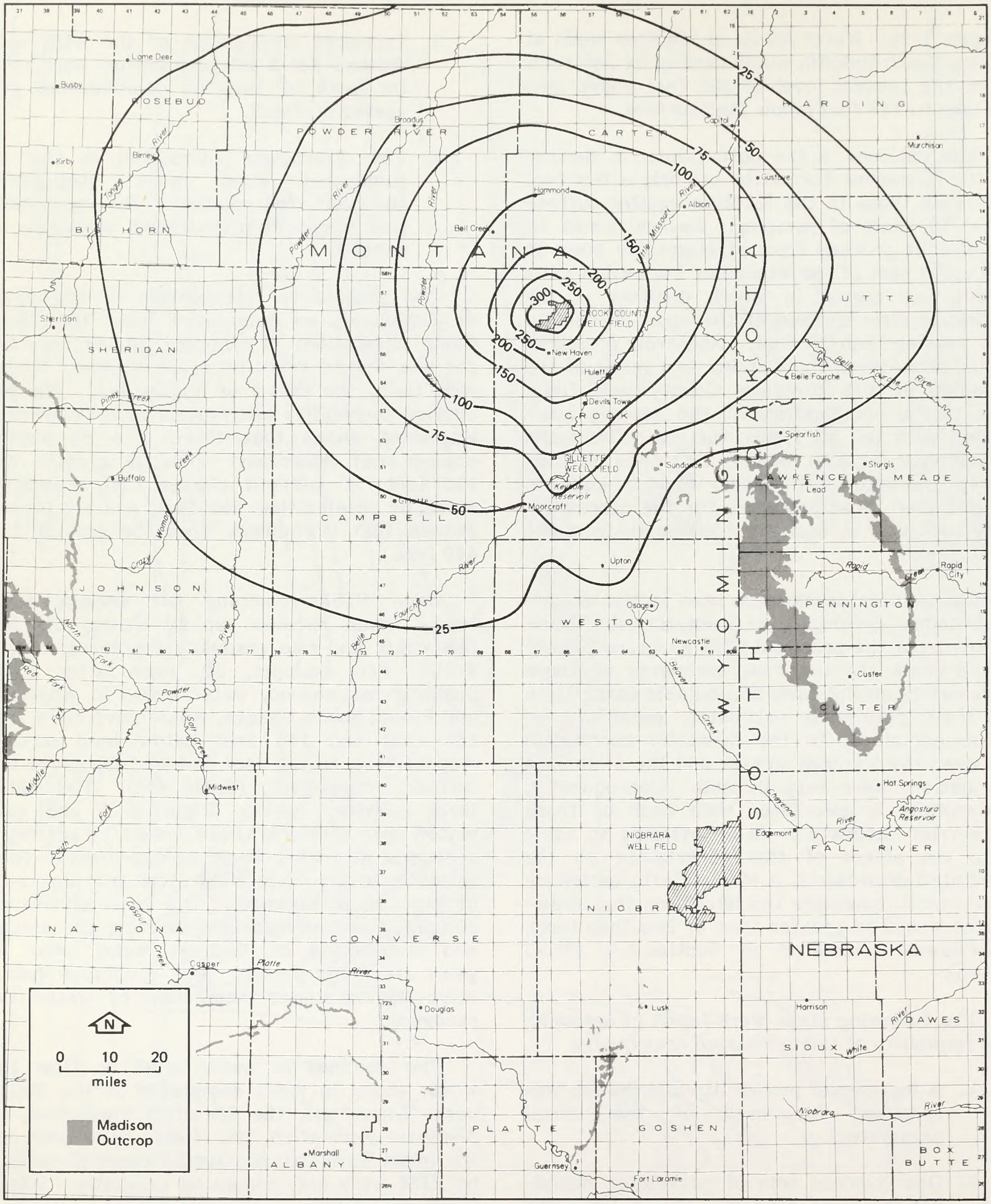
The following steps were taken in assessing the reliability of the calculated drawdowns:

1. A log-normal probability distribution was specified for each of the model parameters.
2. One hundred sets of parameter combinations were randomly drawn from the specified log-normal distributions.
3. Transient simulations of the ETSI withdrawals for a 50-year period were made for each of the 100 combinations generated in step 2.
4. The drawdowns calculated in the 100 simulation runs were statistically analyzed to calculate the probability that a specified drawdown would be exceeded.

The probability distributions of drawdowns at Edgemont, as calculated from the Monte Carlo simulations of pumping 20,500 acre-feet per year for 50 years from the Niobrara County well field, are shown on Figure 4-3. The calculated probability distribution of drawdowns at Edgemont shows that there is a 98 percent chance that drawdowns would be greater than 150 feet, 50 percent chance that drawdowns would be greater than 260 feet, and a 2 percent chance that drawdowns would be greater than 440 feet.

Once ETSI's pumping has ceased, water levels would recover rapidly during the first few years and rise gradually thereafter (Figure 4-1). For example, 50 years after ETSI's pumping has ceased, water levels at Edgemont and Provo, South Dakota, would have risen from 103 feet and 143 feet below land surface, respectively, to 102 feet and 90 feet above land surface, respectively (Table 4-4). The water-level recovery curves (Figure 4-1) and associated data (Table 4-4) are meant to portray in a general way what would be expected to occur to water-levels when ETSI stops pumping after 50 years of withdrawals. The uncertainties and complexities involved in predicting the amount and distribution of Madison water used 100 years from the present time precludes making more than a simple assessment of water-level recovery.

The declines in water level or flow that would occur in wells completed in the Minnekahta Limestone, the Spearfish Formation, the Sundance Formation, the Hulett Sandstone, and the Inyan Kara Group after 50 years of pumping by ETSI were not calculated explicitly. Water-level drawdowns in the unconfined portions of these aquifers after 50 years of pumping would



Map 4-3. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING FROM CROOK COUNTY WELL FIELD ONLY (PLAN 3)

TABLE 4-4

DRAWDOWNS IN THE MADISON POTENTIOMETRIC SURFACE FIFTY YEARS AFTER ETSI STOPS PUMPING (2035 to 2085)

Approximate Location[a]	Location No. (see Map 3-9)	Calculated Drawdown (feet): Plan 1: Niobrara County Well Field Only (ETSI pumping only)	Calculated Drawdown (feet): Plan 3: Crook County Well Field Only (ETSI pumping only)
Niobrara County Well Field, WY	1	122	—
Edgemont, SD	2	98	—
Provo, SD	3	110	—
Hot Springs, SD	4	7	—
Cascade Springs, SD	5	29	—
Lusk, WY	6	6	—
Newcastle, WY	7	5	4
Osage, WY	8	—	14
Upton, WY	9	—	27
Sundance, WY	10	—	37
Gillette Well Field, WY	11	—	40
Devils Tower, WY	12	—	15
Hulett, WY[b]	13	—	44
Crook County Well Field, WY	14	—	56
Bell Creek, WY	15	—	58
Belle Fourche, SD	16	—	32
Spearfish, SD	17	—	27

[a]Exact locations as shown on Map 3-9.

[b]Drawdown calculated in the Minnelusa aquifer unit.

be small, but declines in the potentiometric head in confined portions of these aquifers were estimated to be as large as 90 percent of those calculated for the Madison aquifer.

Water Quality. Total dissolved solids (TDS) concentrations in ground water pumped from the Niobrara well field would increase gradually from 500 milligrams per liter (mg/l) to 560 mg/l at the Niobrara County well field. Changes in TDS concentrations at current Madison water wells at Edgemont would be less than 1 percent.

Spring Flow and Stream Flow. Ground-water discharge to the streams and springs in the vicinity of the Niobrara County well field would decrease as a result of pumping from the Madison aquifer (Table 4-3). The base flow of the Cheyenne River upstream of Angostura Reservoir in Fall River County, South Dakota, would decrease by approximately 1 cubic foot per second (cfs) after 50 years of pumping. The average flow of Cascade Springs and of the springs in the Hot Springs area, in Fall River County, South Dakota, would decrease by 4 cfs and 2 cfs, respectively, from their present levels of 22 cfs and 25 cfs. These reductions in stream flow would result in impacts to the aquatic biota of these streams as discussed in Section 4.A.6. Additional data concerning the flow characteristics at these streams are contained in Appendix I of the Well-Field Hydrology Technical Report (WCC 1980b) and the Aquatic Biology Technical Report (WCC 1980g).

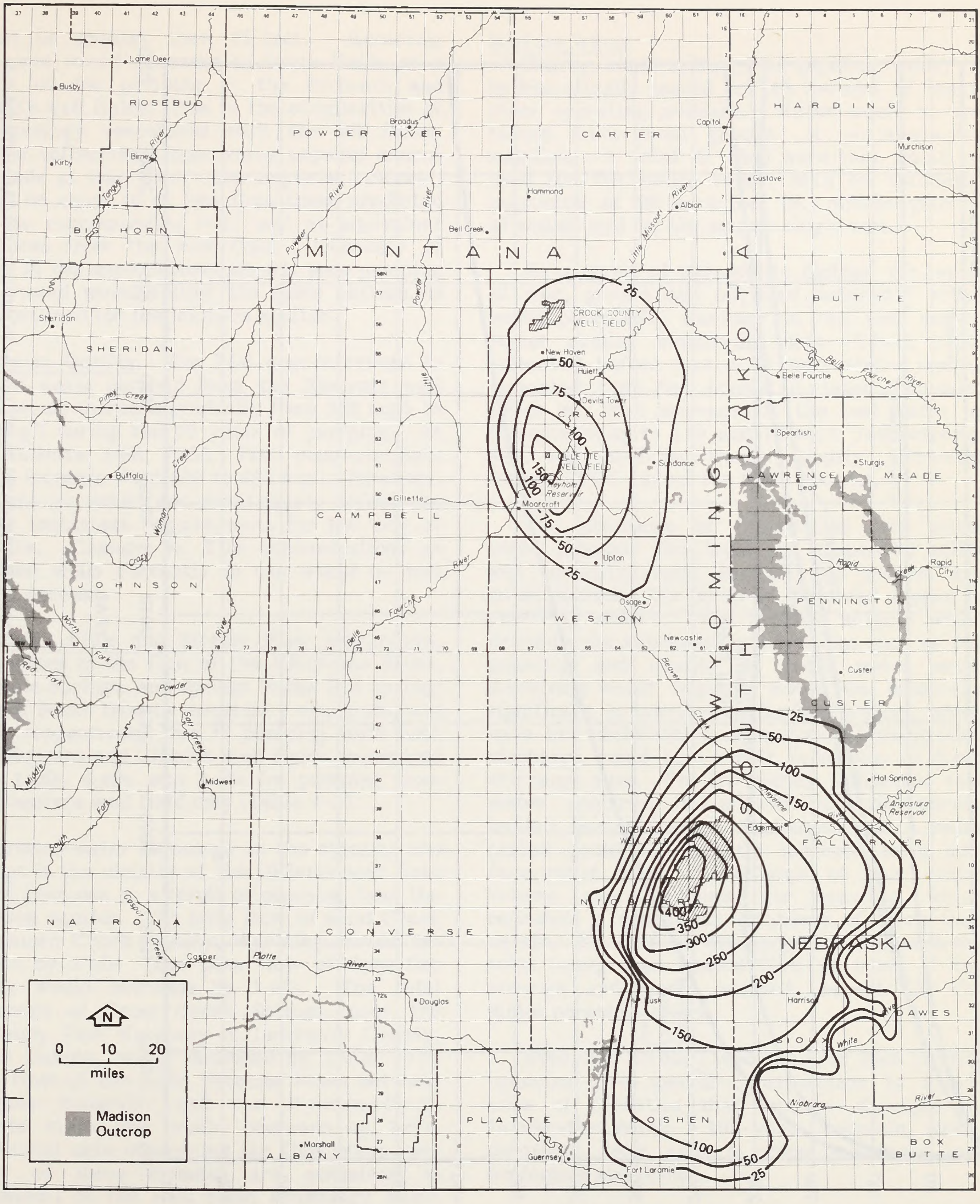
Niobrara County Well Field with Gillette Supplemental Water.

Water Levels. Pumping of approximately 1 million acre-feet of water from the Madison aquifer at the Niobrara and Gillette well fields over the ETSI project's 50-year design life (1985-2035) would result in large declines in the potentiometric surface of the Madison aquifer system (Map 4-2). These declines would immediately begin to lessen at most locations once pumping ceases.

The declines in the potentiometric surface in the Madison aquifer system would consist of two separate cones of depression, one centered over the Niobrara well field and the other over the Gillette well field. The cone of depression at the Niobrara well field would be very similar to that previously described for Plan 1, with drawdowns reduced in magnitude by approximately 30 percent (Table 4-2). Pumping from the Gillette well field would produce declines of over 25 feet in the Madison potentiometric surface in an area of approximately 1650 square miles around the Gillette well field after 50 years of pumping. Drawdowns greater than 100 feet would occur within a 10-mile radius of the Gillette well field, encompassing an area of about 200 square miles.

Many existing Madison and Minnelusa water users would have increased pumping lifts as a result of the declines in the potentiometric surface around the Gillette well field (Figure 4-4). Water levels at Madison wells used for water flooding at the Bell Creek oil field in Montana, which are currently 40 to 200 feet above land surface, would decline by 26 feet. The water level in the Madison water well at Devils Tower National Monument, which is now within 20 feet of land surface, would decline by 87 feet after 50 years of pumping from the Niobrara well field (Figure 4-4). Madison Group and Minnelusa Formation water levels in the Spearfish, South Dakota, area, where large quantities of Minnelusa ground water are currently produced for irrigation from artesian wells, would decline by approximately 15 feet. This would result in a flow reduction in many of the irrigation wells in western Butte and Lawrence counties, South Dakota. A drawdown of 42 feet would occur at the Madison wells near Sundance, Wyoming, where water levels are currently about 400 feet below land surface, and a drawdown of 69 feet would occur at the Upton wells. Drawdowns of less than 25 feet would occur in the Newcastle area, where most of the current Madison ground-water production occurs.

The declines in the potentiometric surface in the upper part of the Minnelusa Formation would be only a few feet less than those in the Madison aquifer after 50 years of pumping. Several small oil fields that produce from stratigraphic traps in the upper Minnelusa exist within the region in which declines in the potentiometric surface of the upper Minnelusa



Map 4-2. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING FROM NIOBRARA COUNTY AND GILLETTE WELL FIELDS (PLAN 2)

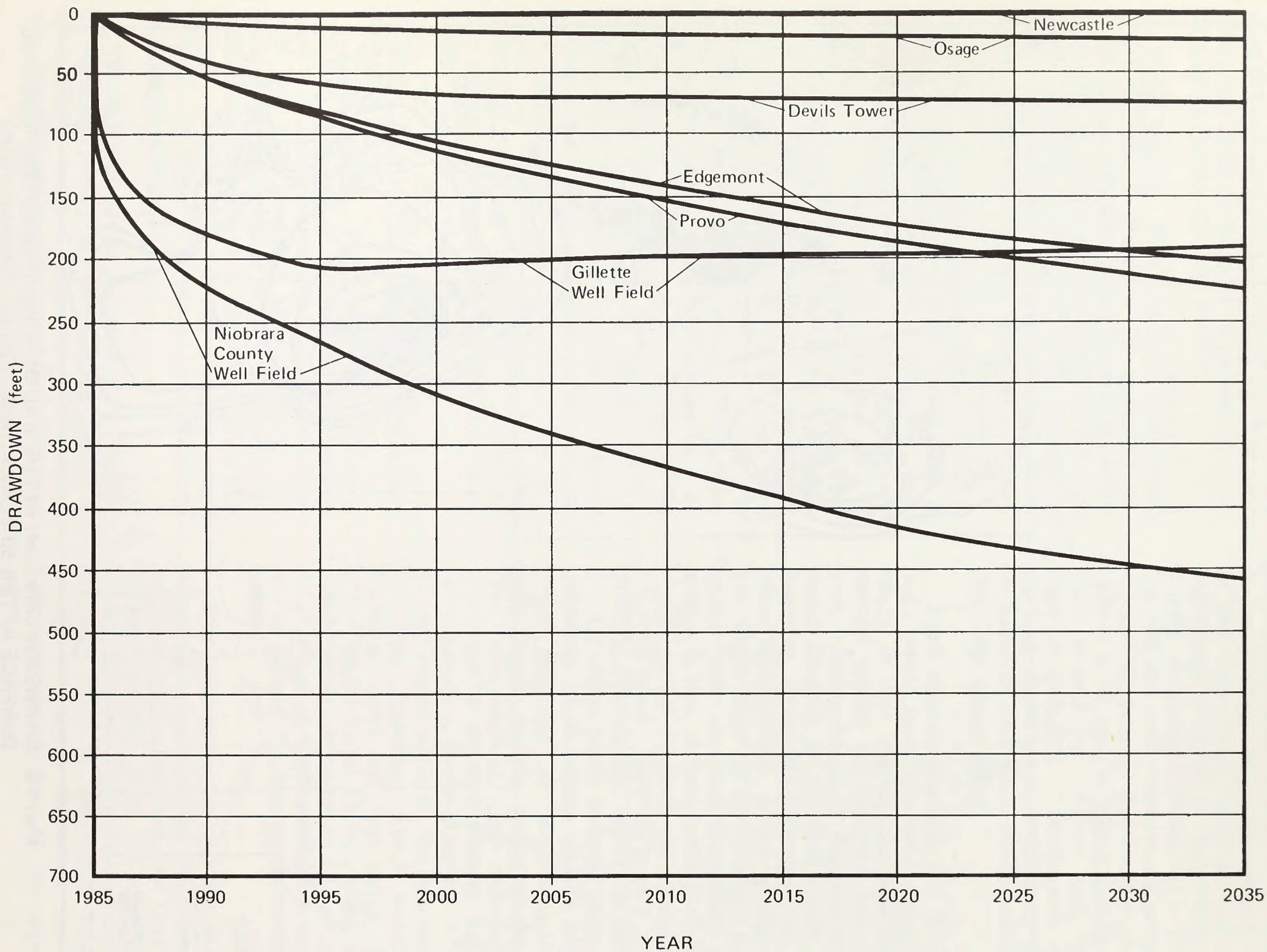


Figure 4-4. TIME-DRAWDOWN PLOT WITH PUMPING FROM NIOBRARA COUNTY AND GILLETTE WELL FIELDS (PLAN 2)

would be greater than 25 feet. Reservoir pressures would decrease in these fields as a result of the pumping at the Niobrara and Gillette well fields. Due to the complexities of the geology associated with the oil fields, further refinements concerning impacts cannot be made at this time. The impacts, however, would be equal to or less than those predicted for the corresponding rock unit at equivalent distances from the well field. Recovery of water in the upper Minnelusa unit once pumping has ceased would follow the same pattern as that outlined for the Madison aquifer.

Water Quality. The TDS concentrations in ground water pumped from the Niobrara well field would increase gradually from 500 mg/l to 540 mg/l during the 50 years of pumping. At the Gillette well field, TDS concentrations would increase from 600 to 620 mg/l. However, this change would not significantly affect the water treatment requirements for the city of Gillette. Changes in TDS concentrations at Madison wells currently in use would be less than 1 percent.

Spring Flow and Stream Flow Reductions. Reductions in the flow of the Cheyenne River, Cascade Springs, and springs in the Hot Springs area of South Dakota would be 1 cfs, 3 cfs, and 1 cfs, respectively, due to pumping from both the Niobrara and Gillette well fields, compared with 1 cfs, 4 cfs, and 2 cfs for pumping from the Niobrara well field only (Table 4-3).

Ground-water discharge to the streams and springs in the vicinity of the Gillette well field would decrease as a result of pumping from the Madison aquifer. The base flow of Sand Creek in eastern Crook County, Wyoming, would decrease by 2 cfs. The base flow of Spearfish Creek would decrease by 1 cfs. The total discharge of Crow Creek Springs, near the McNenny Fish Hatchery in Lawrence County, South Dakota, would decrease by 1 cfs. The base flow of the Belle Fourche River between Keyhole Reservoir and the Wyoming-South Dakota state line would decrease by 1 cfs. Additional data concerning the flow characteristics of these streams are contained in Appendix I of the Well Field Hydrology Technical Report (WCC 1980b) and the Aquatic Biology Technical Report (WCC 1980g).

Surface Water

During construction, the pipeline would be hydrostatically tested to 125 percent of maximum operating pressure. Water would be obtained from local ground- or surface-water supplies. A total of 1650 acre-feet would be used for the entire route, with an estimated maximum of 28 acre-feet (9.1 million gallons) of water used for the largest single test.

As a result of hydrostatic testing, the levels of iron, grease and oil, and suspended solids could potentially increase in the test water. Water quality monitoring data (Young 1980) collected before and after hydrostatic testing indicated that the levels of total suspended solids and iron increased in the test water by increments up to 110 and 14 mg/l, respectively. See the Surface Water Quality Technical Report (WCC 1980c) for these results).

The discharge of hydrostatic test water could increase the levels of suspended solids and turbidity, iron, and oil and grease, and could decrease the levels of dissolved oxygen in receiving waters. The specific effects would depend upon site-specific conditions such as the quantity and quality of local water used. Receiving-water impacts would be especially significant in low-flowing surface waters, which have low assimilative capacities. Uncontrolled discharge could also result in erosion at local discharge sites. For the highest volume of test water required (9.1 million gallons), uncontrolled (instantaneous) discharge over a short period could significantly increase local surface-water flow. Discharge of this entire volume over 24 hours, for example, would represent a continuous discharge of more than 14 cfs. This rate of discharge could exceed the total background stream flow at most of the streams and rivers crossed, except for the major perennial rivers.

Executive Order 11988 requires that federal agencies give special consideration to avoidance of facilities that can be damaged by floodwaters within a 100-year floodplain, where practical, from both a property damage and ecological standpoint.

The proposed action pipeline would cross the floodplains of numerous creeks, streams, and rivers. Stream crossing construction is scheduled to occur during periods of low flow, minimizing the likelihood of flooding during construction. If a major flood were to occur during construction, however, damage to or loss of equipment could occur. Construction debris of fuel could be added to downstream flood flows, and an increase in sediment load with downstream deposition could occur. In accordance with existing regulatory requirements, the pipeline would be buried beneath the maximum expected scour depth at all river crossings, minimizing potential flooding effects following construction.

Certain surface facilities, including pump stations and dewatering plants, could be located in potential 100-year floodplains (see Table 3-7). The location and elevation of proposed surface facilities, and specific design characteristics, have not yet been precisely determined (e.g., they are located within approximately 1 square-mile areas). Preparation plants and pump stations would be designed to provide protection from the 100-year flood by the siting of facilities at sufficient elevation, using elevated pads or dikes where necessary.

Dewatering plants would be located within the boundaries of existing or future power plants and would thus receive the same level of protection as the power plants. At dewatering plants located within power plant boundaries without 100-year-flood protection, conveyors, buildings, and process facilities could be damaged or destroyed. Overtopping of clariflocculator tanks could release coal slurry into floodwaters. Oil, fuel, or other process wastestreams could also reach floodwaters.

The construction of surface facilities in the 100-year floodplain would permanently remove several natural vegetation types, as described in Section 4.A.4 and further detailed in the Terrestrial Biology Technical Report (WCC 1980e). This could result in increased erosion at these sites. The surface facility flood protection measures (diking or pad elevation) could also result in potentially higher flood velocities or flood peaks at these sites. Potential upstream effects include increased stage heights and increased area of floodplains. The specific magnitude of these effects would depend upon final facility siting and design characteristics, as well as the level of flood protection provided at existing and future power plant sites. Because of the relatively small areas involved and the existing topography at most sites, upstream effects would likely be negligible.

Construction activities at perennial streams, wetlands, and bayous would result in a temporary increase in suspended sediments. Immediately downstream from construction, these levels could exceed 10,000 mg/l. However, increases in background levels are expected for up to an additional 1000 feet at most crossings.

During construction of the proposed well field, all drilling fluids would be discharged into a mud pit to evaporate, minimizing potential water quality effects in local surface waters. During construction activities at preparation and dewatering plant sites, sedimentation (detention) basins, and/or straw bale filters, would be constructed to prevent suspended sediments or other potential pollutants from reaching downstream receiving waters. At preparation and dewatering plants, all process (coal cleaning) water would be incorporated into the slurry makeup water, preventing discharge into local receiving waters. Drainage facilities (e.g., settling basins, pH control, etc.) would be designed to treat coal pile runoff so that resulting discharge would meet existing effluent limitation guidelines promulgated under the Clean Water Act for the steam electric power generating industry (EPA 1974a, 1980).

4.A.2 SOCIOECONOMIC CONSIDERATIONS

Socioeconomic impacts were evaluated in terms of added employment, population, and housing. A second, but equally critical, level of impacts evaluated was the additional burden placed on existing public facilities and the ability (financially and institutionally) of the local communities to provide the services demanded by the influx of population. The general approach used to estimate these impacts was as follows:

- Analyze the schedule of quarterly manpower needs by project component to estimate in-migration and residential distribution patterns as well as population and household characteristics.

- Evaluate the family structure and housing preferences of various elements of the work force (e.g., preference differences between more stable fixed-site construction workers against the more transient pipeline workers).

- Determine by county, and where appropriate by community, the settlement patterns of new-to-the-area workers, induced employment, population, housing, and demand for public services.

- Estimate the incremental impacts to the baseline.

- Identify potential problem areas such as limited carrying capacity of capital facilities (wastewater, water, and schools).

- Estimate the net fiscal impacts, where appropriate and feasible, of the combined developments in the region and the marginal impacts due to ETSI.

Project Components in Wyoming

Construction. The major construction activities would include the building of the three preparation plants, the water supply system, slurry gathering lines, and the first 100 miles of the main slurry pipeline. Preparation plant construction would take place from 1983 through 1989, with peak employment demand occurring in the second quarter of 1984. Construction of the slurry gathering lines from the preparation plants and the water supply system would require over two years to complete. Construction of the northernmost 100 miles of the main slurry pipeline is estimated to require a little over three months and is scheduled to take place during the fourth quarter of 1984. The combined fixed-site and pipeline construction work force would peak at 1015 workers in the fourth quarter of 1984 (Table 4-5).

Induced Employment. Expenditures by construction workers and contractors locally would generate additional income and employment in the area. Estimates of nonbasic or service-sector employment were based on the following assumptions:

- All the service workers would be newcomers. Reasons for this assumption are outlined in the Socioeconomics Technical Report (WCC 1980d).

- Fixed-site construction jobs would generate or induce new service-related jobs by a ratio of 5:2 (a multiplier of 0.6) (WCC 1980d). It is difficult to assess the induced effects of pipeline construction workers since there is little information regarding expenditure patterns, propensity to consume, or the ability of the service sector to respond. However, the same multiplier (0.6) was used in this case to determine the worst-case condition.

- Permanent nonlocal workers would generate or induce new service-related jobs in a ratio of 10:8.

Secondary employment generated by the construction project would be about 600 workers, at maximum.

Residential Location of Construction Work Force. Principal factors influencing residential location for fixed-site construction workers are community size, availability of adequate housing and services, distance from work site, transportation service, and recent experiences in the region. The estimated distribution of the construction work force to the principal communities by construction activity is given in Table 4-6.

Population. Estimates of the population increase associated with the combined construction and service activities are given in

TABLE 4-5
CONSTRUCTION WORK FORCE ESTIMATES FOR WYOMING, BY QUARTER

	1982		1983				1984				1985			
Project Component	3	4	1	2	3	4	1	2	3	4	1	2	3	4
North Rawhide Prep. Plant		5	19	29	43	63	72	80	68	38	5	9	20	14
Jacobs Ranch Prep. Plant		24	95	131	176	224	260	278	200	114	11	24	50	31
North Antelope Prep. Plant		5	15	29	40	55	70	82	70	50	60	50	25	12
Subtotal		34	129	189	259	342	402	440	338	202	76	83	95	57
Water Lines and Slurry Gathering Lines			60	360	360	60	90	260	260	30	15			
Well Field			41	41	41	41	41	41	41	41				
Water Pump Station				8	22	23	20	18	17	12				
Slurry Pump Station P-2				20	49	49	39	39	38	30				
Slurry Pump Station P-3		—	—	20	49	49	39	39	38	30	—	—	—	—
Subtotal		34	230	638	780	564	631	837	732	345	91	83	95	57
Main Pipeline Construction		—	—	—	—	—	—	—	—	670	—	—	—	—
Total		34	230	638	780	564	631	837	732	1015	91	83	95	57

TABLE 4-5 Concluded

Project Component	1986				1987				1988				1989			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
North Rawhide Prep. Plant	7	20	18	8	2	5	11	8								
Jacobs Ranch Prep. Plant	60	69	52	35	35	31	29	20	15	15						
North Antelope Prep Plant	14	18	21	49	56	25	18	5	5	11	21	49	56	25	18	5
Subtotal	81	107	91	92	93	61	58	33	20	26	21	49	56	25	18	5
Water Lines and Slurry Gathering Lines																
Well Field																
Water Pump Station																
Slurry Pump Station P-2																
Slurry Pump Station P-3																
Subtotal	81	107	91	92	93	61	58	33	20	26	21	49	56	25	18	5
Main Pipeline Construction	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	81	107	91	92	93	61	58	33	20	26	21	49	56	25	18	5

TABLE 4-6

ESTIMATED RESIDENTIAL LOCATION CHOICES OF CONSTRUCTION WORKERS
(Percent)

Project Component	Campbell County: Gillette Planning Area	Campbell County: Wright	Converse County	Weston County	Niobrara County
North Rawhide Prep. Plant	100	-	-	-	-
Jacobs Ranch Prep. Plant	40	40	-	20	-
North Antelope Prep. Plant	35	30	20	15	-
Water Pipelines	65	25	-	-	10
Well Field	-	-	20	-	80
Pump stations	15	15	-	-	70
Main Slurry Pipeline	100[a]	-	(50)[a]	-	(50)[a]

Note: Location pattern is based on (1) heuristic analysis of available transportation, housing by type, and services; (2) review of several permit applications to the Wyoming Industrial Siting Council; and (3) review of the Mineral Development Monitoring System maintained by Stuart-Nichols Associates for the Wyoming Department of Economic Planning and Development.

[a] Transient work force for the main slurry pipeline (spread crew I) would more than likely locate first in Niobrara and Converse counties and then relocate in the Gillette Planning Area.

Table 4-7. For each type of worker, the following assumptions were used to develop these estimates:

- Nonlocal fixed-site construction workers
  - 48.9 percent would be accompanied by their families; average household size would be 3.61 persons.
  - Total transient population would be 2.28 times the number of construction workers (Mountain West Research 1975).
- Nonlocal pipeline construction workers
  - 16.3 percent would be accompanied by their families; average household size would be 2.83 persons.
  - Total transient population would be 1.30 times the number of pipeline workers (Northern Tier Pipeline 1979).
- Nonbasic workers
  - There would be 1.6 service workers per service worker household; average household size would be 2.5 persons (RSWA-Denver 1980).

Housing. Peak housing requirements resulting from ETSI construction would likely occur in 1984, with the most significant of the demands taking place in the Gillette Planning Area (GPA) (Table 4-8). The spread crew building the main slurry pipeline would demand approximately 840 units, of which most would be temporary quarters such as motels. This group is anticipated to remain in southern Niobrara and Converse counties for about 6 to 8 weeks and then move to the Gillette vicinity.

While the incremental impact of this pipeline construction crew would be large, it would last for only 6 to 8 weeks per community. It is expected that through the use of travel trailers and campers and the sharing of rooms by construction workers, the influx of workers could be accommodated.

Housing for the fixed-site workers presents a different and longer-term problem. Residential distribution patterns (see Table 4-6) indicate that construction workers would tend to locate in a number of communities where housing is already limited, in terms of both the actual supply and the cost of housing. For the past year (late 1979 and 1980), new housing construction has been constrained by very high mortgage rates and the unavailability of mortgage financing in Wyoming, and in the Gillette region in particular.

The short-term remedy has been to add more mobile homes to relieve demands, but this action does not help to increase the permanent housing supply.

Summary of Construction Impacts. In summary, construction of the ETSI project components in Wyoming would generate over 1000 fixed-site and pipeline construction jobs (Table 4-5) and an additional 600 secondary (nonbasic) jobs during the peak period (fourth quarter 1984). It would cause an increase in population of about 2600 in the four-county region. This estimate, from Table 4-7, is arrived at by adding the increase in population from fixed-site components (1109 during fourth quarter 1984) to the total 1500 population from the main pipeline components (1500 people would locate first in Niobrara and Converse counties and relocate in the GPA). Aggregate increases in employment and population associated with construction of the proposed action would exert a positive but not a significant impact on the regional economy. The differential construction impacts of increased employment and population on the counties and major communities are summarized in Table 4-9 and discussed below.

- Campbell County, Gillette Planning Area, Gillette, and Wright. The projected GPA population base is 31,700 by 1984 (Table 3-12). ETSI would not cause significant impacts on Campbell County or the Gillette Planning area.

TABLE 4-7

PEAK ETSI-RELATED POPULATION FOR CONSTRUCTION AND SERVICE SECTORS (1984)

Area or Community and Project Component	Quarter 1	2	3	4
Gillette Planning Area				
• Fixed-Site	885	1297	1146	428
• Main Pipeline (100%)				1500[a]
Total				1928
Wright				
• Fixed-Site	521	692	579	254
Converse County				
• Fixed-Site	71	78	71	58
• Main Pipeline (50%)				750[a]
Total				808
Weston County				
• Fixed-Site	203	216	164	96
Niobrara County				
• Fixed-Site	351	405	399	273
• Main Pipeline (50%)				750[a]
Total				1023

Note: A more detailed explanation of these calculations is given in the Appendix H.

[a] Transient workers for the pipeline (and their families) would probably locate first in Niobrara and Converse counties and then relocate in the Gillette Planning Area.

TABLE 4-8

ETSI-RELATED HOUSING REQUIREMENTS DURING PEAK CONSTRUCTION PERIOD (1984)

Area or Community and Project Component	Quarter			
	1	2	3	4
Gillette Planning Area				
• Fixed-Site	378	554	490	183
• Main Pipeline (100%)				921
Total				1104
Wright				
• Fixed-Site	223	296	243	109
Converse County				
• Fixed-Site	30	33	30	25
• Main Pipeline (50%)				461
Total				486
Weston County				
• Fixed-Site	87	92	70	41
Niobrara County				
• Fixed-Site	150	173	170	116
• Main Pipeline (50%)				461
Total				577

Note: A more detailed explanation of these calculations is given in Appendix H.

TABLE 4-9

SUMMARY OF SOCIAL AND ECONOMIC EFFECTS OF CONSTRUCTION IN WYOMING DURING PEAK CONSTRUCTION PERIOD (1984): PROPOSED ACTION

County	Community	Project Component[a]	Baseline 1984 Total Employment	Total Peak Fixed-Site Employment[b,c] (2nd quarter 1984)	Total Peak Pipeline Employment[c,d] (4th quarter 1984)	Estimated Peak Population In-migration	
						Fixed-Site	Pipeline
Campbell	Gillette Planning Area	PP, WSL, PL, PS	14,000	645	1072	1297	1500
Converse	Douglas Glenrock	PL	7,600[e]	38	536	78	750[d]
Weston	Newcastle	PL	3,300[e]	107	0	216	0
Niobrara	Lusk	WSL, WF, PS, PL	1,450[e]	202	536	405	750[d]

TABLE 4-9 Concluded

County	Estimated Peak Housing Unit Demand		Hotel-Motel Units in Area Avail./Under Construction	Public Services		
	Fixed-Site	Pipeline		Wastewater	Water	Schools
Campbell	554	921	620/Gillette 51/Wright	Excess capacity	Excess capacity	Excess capacity
Converse	33	461	360/Douglas 54/Glenrock	Excess capacity	Excess capacity	Excess capacity
Weston	92	0	210/Newcastle	Adequate Adequate	Adequate Adequate	Adequate Inadequate
Niobrara	173	461	150/Lusk	Excess capacity	Excess capacity	Excess capacity

a PP = preparation plant
WSL = water supply line
PL = pipeline
WF = well field
PS = pump station

b Peak period ranging from 1983 to 1984.

c Includes construction and service sectors. Assumes all employees will be nonlocal.

d Transient work force for the pipeline and their families would probably first locate in Niobrara and Converse counties and then relocate in the Gillette Planning Area.

e Employment estimates are countywide figures.

  - The economic base and population will have grown large enough to absorb the increases due to ETSI.

  - The communities are anticipating the overall growth and have expanded or planned to expand community facilities and services to accommodate growth.

  - While no significant overburden on community facilities would be anticipated, the city of Gillette and the Campbell County School District would experience adverse fiscal impacts beyond 1984 due in part to ETSI, since it would contribute a lesser proportion of tax revenues to these entities because of the tax structure (discussed later in this section).

  - Substantial short-term housing shortages are anticipated in the GPA, especially during the peak construction period of late 1984.

- Niobrara County and Lusk. Socioeconomic effects of construction of the ETSI pipeline facilities in Niobrara County are mixed. Most of the revenues generated from ETSI components would go to the county. On the other hand, most of the in-migrating population would locate in Lusk, but since ETSI facilities would be located outside of the town, Lusk would not receive much of the increase in the tax base.

  - Location of ETSI facilities would increase the county's property tax base by 52 percent from a fiscal year 1980 base of $1.5 million.

  - Peak ETSI fixed-site construction population (405) would increase the county's 1984 population of 3200 by 13 percent.

  - Most of the new-to-the area people would locate in Lusk. Although the in-migrating population in absolute terms would be only 405 people and would be expected to remain in the area for more than 2 to 3 years, the net increase in the town population would be a substantial 21.3 percent.

  - Lusk is planning to upgrade its wastewater and water facilities and is also expanding the treatment capacity in anticipation of population growth. As a result, the town faces substantial increases in wastewater treatment costs.

  - However, since ETSI facilities would be located outside the town limits in northern Niobrara County, the town would not receive much of the increase in the tax base to offset cost increases.

- Weston County, Newcastle, and Upton. No significant impact from ETSI is anticipated. ETSI-related population would increase the population of the county by 2.3 percent and the population of Newcastle by 4.0 percent. Both communities are planning to expand public services.

- Converse County, Douglas, and Glenrock. No significant impacts are anticipated. At the most, temporary pipeline construction workers might add only 4.0 percent of the county's population base for a period of only 6 to 8 weeks. The increase in population due to fixed-site workers would be less than 1 percent. No significant problems are anticipated in the provision of water, waste water, or school facilities.

Operation and Maintenance. The western district operations office would be located at Jacobs Ranch. In addition, there would be preparation plant employees at North Rawhide and North Antelope. A total of approximately 243 operations personnel would commute to work from the five nearby counties in Wyoming (Campbell, Converse, Crook, Weston, and Niobrara) (Table 1-5).

Operation of the proposed project would begin in January 1985. At this point there would be a substantial labor pool available both from the completion of ETSI construction projects and from construction of other energy projects. A substantial drop-off in construction-related jobs after 1984 is expected, resulting in a substantial increase in the rate of unemployment (Tables 4-7 and 4-8, WCC 1980d). Although a large portion of the preparation plant jobs would be filled by in-migrants, many jobs would be filled by local residents.

Assuming all preparation plant personnel are nonlocal (a worst-case situation), the net effect on regional employment, population, housing, and services would be as discussed below.

Employment. No significant impact is anticipated. At the end of 1984, between 600 and 800 ETSI construction workers would be leaving the area, and an estimated 1000 workers from other construction jobs would also be leaving the area. The influx of 243 maintenance and operation personnel would fill only part of the void.

Population. No significant impact is anticipated. The departure of the ETSI construction workers would result in a population decrease of 900 to 1200 people. Operation of the preparation plants would result in an increase of 626 people.

Housing. No significant impact is anticipated, but operation could create a shift in the housing preference and a higher vacancy rate. Since permanent workers generally prefer detached, single-family units, an accelerated construction program would be necessary to satisfy the increased demand. Since departing workers would have lived in mobile homes and apartments, there would be a surplus of these units and higher vacancies if the increased construction program for permanent single-family units were realized.

Services. No significant impact is anticipated. Services such as sewers, water, and schools would have been expanded to meet the needs of the departing construction workers and their families. No new services would be required to serve the new residents.

Tax Revenues. A significant impact is anticipated. Increased assessed valuations and property tax revenues from the ETSI project would have positive significant impacts on Converse, Weston, and Niobrara counties (Table 4-9). The proposed project would have a negative net fiscal impact on Campbell County, the city of Gillette, and the Campbell County School District (Table 4-10). Projected deficits for Gillette and the school district would be significant.

Summary of Operation Impacts. Estimated and maintenance operation effects on each county and/or community are shown in Table 4-11 and are summarized below.

- Campbell County, Gillette Planning Area, Gillette, and Wright. Work crews associated with preparation plant operation would not significantly affect local communities. The total operating work crew would be 243 over all four counties, or one-fourth of the peak construction crew. Permanent workers would in effect replace construction crews; consequently, there would be no impact.

- Niobrara County and Lusk: In the long run, the impact of permanent workers on the county would not be significant. ETSI-associated population would be 1.7 percent of the county's total population.

- Converse County, Douglas, and Glenrock. No significant impacts from the permanent work force are anticipated.

- Weston County, Newcastle, and Upton. ETSI operating employment would be insignificant. The increase in the population of the county would be about 1.5 percent; the increase in the population of Newcastle would be about 3.0 percent.

TABLE 4-10

NET FISCAL IMPACT OF ETSI PROJECT

	Annual Projected Surplus/Deficit (x $1000)		
	With ETSI	Without ETSI	Net Fiscal Impact of ETSI
Campbell County			
1984	+3,477	+3,534	-57
1990	+5,877	+5,913	-36
Total Impact (1984 through 1990)			+69
Gillette (general fund account)			
1984	+552	+495	+54
1990	-2,058	-1,917	-141
Total Impact (1984 through 1990)			-258
Campbell County School District			
1984	+25,429	+27,184	-1755
1990	+57,708	+58,750	-1042
Total Impact (1984 through 1990)			-6360
Net Total Impact of ETSI			-6549

TABLE 4-11

SUMMARY OF SOCIAL AND ECONOMIC EFFECTS OF OPERATION IN WYOMING: PROPOSED ACTION

County	Community	Project Component[a]	Employment		Estimated Population In-Migration	Annual County Property Tax Revenues		
			Direct Employment	Estimated Secondary Employment		1976-77 Property Tax Revenues (x $1000)	Estimated ETSI Property Tax Revenues (1980 dollars) (x $1000)	Percentage of 1976-77 Property Tax Revenues
Campbell[b]	Gillette Planning Area	PP, WSL, PL, PS	106[d]	127	465	39,198	1,621	4.1
Converse[c]	Douglas	PL	12	14	53	14,353	100	0.7
Weston[c]	Newcastle	PL	39	47	170	3,606	256	7.1
Niobrara[c]	Lusk	WSL, WF, PL, PS	9	11	40	2,530	1,321	52.2

[a] PP = preparation plant
WSL = water supply line
PL = pipeline
WF = well field
PS = pump station

[b] Estimates for the Gillette Planning Area.

[c] Estimates are countywide figures.

[d] Does not include 77 jobs in Wright.

Abandonment. Socioeconomic impacts resulting from project abandonment are expected to be insignificant. Because of the mining activities in the area, it is anticipated that no long-term unemployment would be experienced by operating personnel when pipeline operations are discontinued. Wyoming counties, particularly Campbell, would have a reduction in property tax revenues as the property was depreciated, and revenues would approach zero upon abandonment. However, the property taxes accruing from the proposed project would be a relatively minor portion of the Campbell County budget.

Project Components Outside Wyoming

Slurry Pipeline System. This section discusses impacts to areas with pipeline and pump stations only, as shown on Table 4-12. Segments of pipeline and pump stations near dewatering plants are discussed in the Dewatering Plants section.

The potential impacts that the pipeline and pump station areas would be subjected to are as follows:

- Short-term impacts due to increased demand for incidental services, such as lodging, food, and fuel
- Short-term impacts through increasing sources of social interaction (annoyance may result from increases in noise and traffic congestion, or new sources for social interaction may result in a welcome sense of social excitement)
- Long-term impacts through increases in tax revenues from project-related property taxes

The counties, parishes, and selected communities in the affected area were examined for their capacities to provide needed services for the short term. They were also examined to determine the potential for beneficial effects over the period of project operation. Details of specific demands and capacities are provided in the Socioeconomics Technical Report (WCC 1980d).

Minor impacts due to temporary increased demand for transient housing, food, and fuel would be experienced to some extent in those counties included in the affected environment. In no instance was the level of anticipated adverse effect on the environment determined to be significant.

Construction. Potential effects from pipeline construction are quite different from those associated with long-term, fixed-site construction projects. Pipeline crews move rapidly through areas through which the right-of-way extends. The right-of-way clearing crew may work as much as 25 miles ahead of the trenching and pipe-laying crews and as much as 40 miles ahead of the cleanup crew. Associated effects are therefore spread along a series of communities in proximity to the right-of-way at any one time.

Typically, few crew members are accompanied by other persons because of the speed of project activities. The construction work week is typically six days, 10 to 12 hours per day. Under these circumstances, few crew members bring their families; this is especially true for those workers having school-age children. Work on the pipeline would potentially affect a given area for no more than 4 months, and in most cases, for 2 to 3 months. For those segments in which a pump station would also be located, a separate crew of about 50 persons would be required for about 24 months. Table 4-12 shows 1975 county population, components to be built in the area, peak employment for pump stations and pipeline, estimated in-migrant population, estimated housing demand, and availability of hotel and motel units in selected communities for comparison.

Given the dispersion, duration, and magnitude of expected effects from pipeline construction and the existing capacities in the host counties and selected communities, no system strain is anticipated to occur for any given community within the affected environment.

Given the small peak work force (49 workers) and the minor population and income increases associated with pump station construction, no effects were determined to be of a significant magnitude.

TABLE 4-12

EFFECTS OF CONSTRUCTION ON AREAS OUTSIDE WYOMING WITH PIPELINE AND PUMP STATIONS ONLY: PROPOSED ACTION

Area	County/ Parish	1975 Pop.	Project Component[a]	Peak Fixed-Site Employment[b] Qtr/Yr	Peak Fixed-Site Employment Total	Peak Fixed-Site Employment Non-local	Peak Pipeline Employment Qtr/Yr	Peak Pipeline Employment Total[c]	Peak Pipeline Employment Non-local[c]	Estimated Peak Pop. In-Migration Fixed-Site	Estimated Peak Pop. In-Migration Pipeline[c]	Estimated Peak Housing Unit Demand Fixed-Site	Estimated Peak Housing Unit Demand Pipeline[c]	Hotel/Motel Units in Selected Communities
Northwest Nebraska	Sioux	2,000	PL, PS	4/83	49	38	2/84	748	562	insignificant	731	insignificant	337	500/Scottsbluff
	Box Butte	12,400												
	Morrill	6,100												
	Garden	2,900												
	Deuel	2,400												
	Scotts Bluff	36,200												
Southwest Nebraska	Keith	10,100	PL, PS	4/83	49	38	2/84	748	562	insignificant	731	insignificant	337	280/Ogallala 217/McCook
	Perkins	3,500												
	Chase	4,800												
	Hayes	1,500												
	Hitchcock	4,000												
	Red Willow	12,800												
North Kansas	Decatur	5,100	PL, PS	4/83	49	25	3&4/83	748	374	insignificant	486	insignificant	226	741/Hays
	Norton	6,700												
	Graham	4,400												
	Trego	4,400												
	Ellis	27,400												
	Rush	4,800												
	Barton	31,600												
South Kansas	Stafford	6,200	PL, PS	4/83	49	25	1&2/84	748	374	insignificant	486	insignificant	226	83/Kingman 4975/Wichita
	Reno	63,700												
	Kingman	8,900												
	Harper	7,900												
	Sumner	24,500												
Northwest Arkansas	Sequoyah, OK	28,600	PL, PS	4/83	49	25	4/83 1/84	748	374	insignificant	486	insignificant	226	1111/Ft. Smith
	Crawford	33,400												
	Franklin	13,700												
	Sebastian	109,100												

TABLE 4-12 Concluded

Area	County/ Parish	1975 Pop.	Project Component[a]	Peak Fixed-Site Employment[b]			Pipeline Employment			Estimated Pop. In-Migration		Estimated Housing Unit Demand		Hotel/Motel Units in Selected Communities
				Qtr/Yr	Total[c]	Non-local	Qtr/Yr	Total[c]	Non-local[c]	Fixed-Site	Pipeline[c]	Fixed-Site	Pipeline[c]	
North-Central Arkansas	Johnson	17,100	PL, PS											
	Pope	36,100												
	Conway	18,600		4/83	49	25	2&3/84	688	344	insignificant	447	insignificant	206	420/Russellville
	Van Buren	11,800		4/83	42	21	3/83	260	130	insignificant	169	insignificant	80	250/Batesville
	Cleburne	15,800												
	Perry	7,400												
South Arkansas	Cleveland	6,900	PL, PS											
	Bradley	12,700												
	Ashley	26,400		4/83	49	25	1/84	615	307	insignificant	399	insignificant	184	450/Pine Bluff
	Drew	17,200												
	Union	44,600												
North Louisiana	Moorehouse	33,700	PL, PS											
	Ouachita	130,700		4/83	49	25	2&3/84	615	307	insignificant	399	insignificant	184	1500/Monroe
	Caldwell	10,200		4/83	49	25				insignificant		insignificant		
	La Salle	15,200												

Source: Population data are from U.S. Bureau of the Census 1978.

[a] PL = pipeline
PS = pump station

[b] Fixed-site employment includes construction and service sector employment.

[c] Assumes maximum (rough terrain) spread size as a worst case.

Operation, Maintenance, and Abandonment. The operation and maintenance manpower requirements for the pipeline segments are small and would be distributed throughout the project area. Pump stations would be automated. Consequently, no noticeable effects would be associated with work-force requirements (Table 4-13).

The pipeline system would add to local tax bases and would offer local taxing jurisdictions a new source of property tax revenues. In some jurisdictions the increased tax base and potential revenues would be a significant benefit (Table 4-13).

Upon abandonment, employment and population effects in "pipeline-only" counties would be nil and property tax revenues from the pipeline system (already reduced by depreciation) would decline.

Dewatering Plants. This section discusses impacts of dewatering plants and their associated pipelines and pump stations as shown on Table 4-15.

Construction. Construction of a dewatering plant typically would take eight quarters and have a peak manpower demand of 150 to 260 workers (Table 4-14). This requirement is relatively small compared with the work-force demands of the coal-fired power plants served by the dewatering plants. Some coal plants in the region, for example, have had a peak construction employment of 750 to 1500 workers. In general, the dewatering plants would be built adjacent to power plants and within easy commuting distance of cities or large metropolitan areas that have an available local construction labor pool (Table 4-14). Because of the moderate demand for construction labor and the availability of construction workers from local labor pools, construction of the dewatering plants is not expected to cause substantial in-migration of construction workers or to stimulate significant secondary employment. In no case would the construction cause structural changes in any local economy.

Pipeline construction in the dewatering plant areas is not expected to cause significant socioeconomic effects, either independently or in combination with the dewatering plants. The short-term influx of workers for 2 to 4 months would generate increased demand for temporary rental housing in the dewatering plant areas, but sufficient numbers of apartment units and motel rooms are available in those areas and no deficiencies in temporary housing are expected. Although pipeline construction workers prefer short-term apartment rentals, they will rent motel rooms if less expensive lodging is not available.

Operation, Maintenance, and Abandonment. Operation and maintenance of the dewatering plants and the associated pipeline system would create some new direct employment at the dewatering plant sites. Approximately 502 workers would be required to operate and maintain the dewatering plants (Table 4-15). This new direct employment would stimulate creation of some secondary employment, and the new in-migrant population would stimulate demand for housing and other private and public facilities and services. Even assuming all new direct permanent jobs were taken by nonlocals, the employment, population, and housing effects would be insignificant (Table 4-15).

The pipeline system and dewatering plants would add to local tax bases and would offer local taxing jurisdictions new sources of property tax revenues (Table 4-15). In some jurisdictions the increased tax base and potential revenues would be a significant benefit.

Upon abandonment, operation and maintenance positions at the dewatering plants and maintenance bases would be eliminated. Property tax revenues, already reduced due to depreciation of the capital facilities, would decline further.

Effect of Pipeline Operation on Railroads

Except for the Wilton site, all of the ETSI markets will be served by railroads prior to completion and operation of the pipeline. Thus, if a pipeline were constructed, there could be a loss of specific markets for the railroads. Due to the projections for continued overall increase in coal movement by the railroads, it is not expected that over the total rail system

TABLE 4-13

EFFECTS OF OPERATION ON AREAS OUTSIDE WYOMING WITH PIPELINE AND PUMP STATIONS ONLY: PROPOSED ACTION

			Annual County Property Tax Revenues		
Area	County/ Parish[a]	Project Component[b]	1976-77 Property Tax Revenues (x $1000)	Estimated[c] ETSI Property Tax Revenues (1980 dollars) (x $1000)	Percentage of 1976-77 Property Tax Revenues
Northwest Nebraska	Sioux	PL	611	880	144
	Box Butte	PL	3,557	300	8
	Morrill	PL	2,295	1,190	52
	Garden	PL,PS	1,571	970	62
	Deuel	PS	1,410	110	8
Southwest Nebraska	Keith	PL	4,134	400	10
	Perkins	PL	2,022	630	31
	Chase	PL	2,743	350	13
	Hayes	PL	648	580	90
	Hitchcock	PL	2,201	290	13
	Red Willow	PL,PS	4,607	640	14
North Kansas	Decatur	PL,PS	2,192	710	32
	Norton	PL	2,452	70	3
	Graham	PL	3,145	860	40
	Trego	PL	1,608	230	14
	Ellis	PL	6,902	390	6
	Rush	PL	2,566	360	14
	Barton	PL	9,368	370	4
South Kansas	Stafford	PL,PS	3,100	550	18
	Reno	PL	18,236	300	2
	Kingman	PL	3,834	450	12
	Harper	PL	3,382	360	7
	Sumner	PL	7,213	540	7
Northwest Arkansas	Sequoyah, OK	PL	1,290	610	47
	Crawford	PL,PS	2,277	460	20
	Franklin	PL	1,270	210	17
North-Central	Johnson	PL	1,220	300	25
	Pope	PL,PS	7,490	520	7
	Conway	PL	1,614	174	11
	Van Buren	PL,PS	692	130	19
	Cleburne	PL	1,462	90	6
	Perry	PL	556	120	22
South Arkansas	Cleveland	PL	476	190	40
	Bradley	PL,PS	1,089	420	39
	Ashley	PL	2,830	110	4
North Louisiana	Moorehouse	PL	3,496	150	4
	Ouachita	PL,PS	13,354	380	3
	Caldwell	PL	1,374	380	28
	La Salle	PL,PS	1,976	590	30

Note: There would be no direct or secondary permanent employment and no population in-migration.

[a] Only counties in which components are to be located are listed.

[b] PL = pipeline
PS = pump station

[c] Estimated property taxes by county were estimated by ETSI for the EIS by extrapolating previously developed unit cost estimates for components and should in no way be construed as representing the cost estimate for the components. Values shown on this table were derived by ETSI as follows:

Sum of estimated cost of components in county (1980 dollars) x Statewide ratio of assessed value to market value x Percentage tax rate assumed for county = Estimated ETSI property tax revenues in 1980 dollars

TABLE 4-14

EFFECTS OF CONSTRUCTION ON AREAS WITH DEWATERING PLANTS: PROPOSED ACTION

Area	County/ Parish	Project Component[a]	Existing Construction Labor Pool	Peak Fixed-Site Employment[b]			Peak Pipeline Employment			Estimated Peak Pop. In-Migration		Estimated Peak Housing Unit Demand		Hotel/Motel Units in Selected Communities
				Qtr/Yr	Total	Non-local	Qtr/Yr	Total[c]	Non-local[c]	Fixed-Site	Pipeline[c]	Fixed-Site	Pipeline[c]	
Ponca City, OK	Kay, Noble, Pawnee, Payne	PL, PS	3,800 in 1981	1/84	195	0	2/84	670	335	none	435	none	200	600 Ponca City
Pryor, OK	Osage, Washington, Rogers, Mayes, Creek, Tulsa	PL, DP, MB, PS	8,340 in 1981	1/85	195	0	3/83 4/84	670	335	none	435	none	200	100 Pryor 400 Bartlesville
Muskogee, OK	Wagoner, Muskogee, McIntosh, Cherokee, Okmulgee	PL, DP, PS	11,985 in 1981	1/84	262	0	4/83	670	335	none	435	none	200	745 Muskogee
Independence, AR	Independence, Jackson	PL, DP	565 in 2 counties in 1974	1/84	160	32	3/83	260	130	85	170	35	80	512/2 counties
White Bluff, AR	Saline, Pulaski, Jefferson	PL, DP, MB, PS	20,917 in 3 counties in 1970	1/84	260	0	4/83 1/84	550	275	0	358	0	105	450 Pine Bluff

TABLE 4-14 Concluded

Area	County/ Parish	Project Component[a]	Existing Construction Labor Pool	Peak Fixed-Site Employment[b]			Peak Pipeline Employment			Estimated Pop. In-Migration		Estimated Peak Housing Unit Demand		Hotel/Motel Units in Selected Communities
				Qtr/Yr	Total	Non-local	Qtr/Yr	Total[c]	Non-local[c]	Fixed-Site	Pipeline[c]	Fixed-Site	Pipeline[c]	
Boyce-Alexandria, LA	Rapides Grant Avoyelles	PL, DP, PS	3,250 in 3 counties in 1978	1/84	160	0	3/83 3/84	390 550	195 275	0	358	0	165	1425 Alexandria
Lake Charles, LA	Evangeline Allen Jefferson Davis Calcasieu	PL, DP	5,400 Calcasieu Parish in 1978	1/84	189	0	4/83	260	130	0	169	0	99	1000+ Lake Charles
New Roads, LA	St. Landry Pointe-Coupee W. Baton Rouge	PL, DP, MB, PS	24,675 in Baton Rouge labor mkt in 1978	1/84	150	0	2/84	390	195	0	254	0	115	3500 Baton Rouge
Wilton, LA	Iberville Ascension St. James	PL, DP	61,075 in Baton Rouge and New Orleans labor mkts in 1978	3/86	189	0	3/84	260	130	0	169	0	80	3500 Baton Rouge

Source: Labor pool data are from WCC 1980d.

[a]PL = pipeline
DP = dewatering plant
MB = maintenance base
PS = pump station

[b]Fixed-site employment includes construction and service sector employment.

[c]Assumes maximum (rough terrain) spread size as a worst case.

Table 4-15

EFFECTS OF OPERATION ON AREAS WITH DEWATERING PLANTS: PROPOSED ACTION

Area	County/ Parish[a]	Project Component[b]	Annual County Property Tax Revenues: 1976-77 Property Tax Revenues (x $1000)	Annual County Property Tax Revenues: Estimated[c,d] ETSI Property Tax Revenues (1980 dollars) (x $1000)	Annual County Property Tax Revenues: Percentage of 1976-77 Property Tax Revenues
Ponca City, OK	Grant	PL	1,953	180	9
	Kay	PL	7,486	420	6
	Noble	PL, DP, PS	1,785	470	26
	Pawnee	PL	1,160	320	28
Pryor, OK	Osage	PL	3,208	650	20
	Washington	PL	5,945	200	3
	Rogers	PL	4,362	439	10
	Mayes	PL, DP, MB, PS	2,126	757	36
Muskogee, OK	Wagoner	PL	1,427	290	20
	Muskogee	PL, DP, PS	2,126	757	9
Independence, AR	Independence	PL, DP	1,427	290	20
White Bluff, AR	Saline	PL	3,555	140	0.6
	Pulaski	PL	47,811	290	4
	Jefferson	PL, DP, MB, PS	10,013	768	8
Boyce-Alexandria, LA	Rapides	PL, DP, PS	108,546	1,163	11
	Grant	PL	1,031	27	3
	Avoyelles	PL	1,290	70	6
Lake Charles, LA	Evangeline	PL	1,753	4	0.2
	Allen	PL, PS	1,728	280	16
	Jefferson Davis	PL	2,810	20	0.7
	Calcasieu	PL, DP	22,722	492	2
New Roads, LA	St. Landry	PL	3,915	140	4
	Pointe Coupee	PL, DP, MB, PS	665	220	33
	W. Baton Rouge	PL	2,562	127	5
Wilton, LA	Iberville	PL, PS	3,212	40	1
	Ascension	PL	3,731	20	0.5
	St. James	PL, DP	3,876	433	11

Note: There would be no direct or secondary permanent employment and no population in-migration.

[a] Only counties in which components are to be located are listed.

[b] PL = pipeline
DP = dewatering plant
PS = pump station
MB = maintenance base

[c] Pipeline only, does not include value of dewatering plant, plus terminal facilities.

[d] Estimated property taxes by county were estimated by ETSI for the EIS by extrapolating previously developed unit cost estimates for components and should in no way be construed as representing the cost estimate for the components. Values shown on this table were derived by ETSI as follows:

Sum of estimated cost of components in county (1980 dollars)	x	Statewide ratio of assessed value to market value	x	Percentage tax rate assumed for county	=	Estimated ETSI property tax revenu in 1980 dollars

there would be a decline in traffic and hence decreased employment. Most likely the railroads would replace the lost markets with new markets. What would result would be a shift in the rail routes used and a possible shift in employment from one rail line to another. These shifts cannot be estimated, as they would be affected by railroad marketing decisions and competitive conditions within the rail industry.

4.A.3 SLURRY PIPELINE RUPTURES AND SPILLS

Environmental impacts of a slurry pipeline rupture and spill are addressed for the proposed action but apply to all the alternatives containing pipelines, since a spill could occur along any part of a pipeline route. The impact assessment is derived from a detailed impact analysis of eight worst-case spill sites, as described in the Ruptures and Spills Technical Report (WCC 1980j), which is available from the Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado 80228. The sites are representative of the major types of environments encountered along the proposed pipeline route and alternatives. Of the eight sites, five are at stream crossings, one is at a reservoir, and two are on land.

The physical and biological impacts were assessed by analyzing the effects of the modeled spill volumes and movements on the potentially affected environmental components (i.e., surface waters, ground water, and land). Based on the results of analyses for these eight locations, generalizations were made as to the anticipated impacts of a coal slurry spill for a given location. Most of these impacts were deemed insignificant, with the exception of a few isolated cases. Generalizations of the more significant impacts are discussed below.

In order to put this assessment into perspective, a spill probability analysis was conducted resulting in a predicted median frequency of 1.8 spills per year, with a total magnitude averaging 1130 barrels of coal slurry for the entire system. It should be noted, however, that the predicted frequency was based on all interstate liquid pipelines, regardless of age or methods employed (if any) to minimize spills. Because the ETSI pipeline would be new and would utilize state-of-the-art technology to reduce spills, it is expected to operate at less than this spill frequency. An example is the 273-mile, 18-inch Black Mesa coal slurry pipeline in Arizona, which is the only operating coal slurry line in the United States. It has experienced only one rupture event during its 10 years in operation, which resulted in spills in two places. If the formula used in predicting spill frequencies for the ETSI pipeline were applied to the Black Mesa line, it would be expected to have had 2.73 spills over the 10-year period.

The anticipated yearly spill magnitude should also be considered conservative, as it is based on the maximum throughput of the ETSI system. This throughput occurs only in the main section of the pipeline between the preparation plant and the first delivery point. As the pipeline throughput decreases with each successive delivery point, the expected spill magnitudes would also decrease.

Surface Waters

The impact of coal slurry spilled into surface waters depends on the energy environment of the receiving water. Therefore this discussion has been divided into two parts: rivers and streams, and lakes.

Rivers and Streams. Concentrations of coal particles would generally be highest for complete pipeline ruptures into streams under low-flow conditions. Under high stream flow conditions the concentrations decrease with distance downstream due to mixing and dilution. In either case, high concentrations of coal particles in any one location are expected to be short-lived (1 to 24 hours).

Due to the turbulence, the coal particles are expected to settle out in back eddies and areas of low current velocity. The deposition could fill the channel and create major changes in flow; however, these conditions are expected to be short-lived (1 to 24 hours).

Water quality investigations indicate that no detectable concentrations of toxic "priority pollutants" are anticipated in the slurry water and therefore none are expected to occur in the receiving waters. In situations where the spill volume is large relative to the ambient stream flow, significant changes in water temperature could occur in addition to decreased dissolved oxygen levels and increased concentrations of total dissolved solids (TDS) and sulfates. No significant impacts are expected for spills involving streams during periods of high flow, except in those cases where already low dissolved oxygen levels may prevail and would be decreased even further.

Biological impacts resulting from an aquatic coal slurry spill would depend on the spill location, time of year, and sensitivity of the affected biota. The significant aquatic biological impacts could include the following:

- Mortality of a significant percentage of fish eggs and larvae in the affected river area
- Smothering of bottom-dwelling organisms and substrate (lake, river, or stream bottom) habitat, or emigration from affected substrate areas
- Fish and invertebrate deaths resulting from heat or cold shock
- Bioaccumulation of some toxic metals associated with the coal
- Low dissolved oxygen tension stress
- Decreases in invertebrate and fish productivity in the affected areas

It should be noted, however, that these are worst-case analyses and it is not likely that even two of the above impacts would occur at any given spill location.

Lakes. Should a terrestrial coal slurry spill reach a lake or similar confined water body, the medium and coarse coal particles are expected to settle out near the spill's point of entry. This material may migrate through or be redistributed over the lake bed by forces associated with later events, such as storms or spring surges. The fine coal particles may stay in suspension and be redistributed. In cases where the retention time is long compared with settling time, the majority of coal particles would settle to the bottom and contribute to the permanent sediment structure.

Higher-density slurry could significantly deplete dissolved oxygen levels, cause relatively large increases in temperature, and result in elevated TDS and sulfate levels. The significance of these impacts depends primarily on the lake volume but also on detention time, thermal stratification, spill characteristics, background water quality, and other factor factors.

In situations where the spill volume is small relative to the capacity of the lake, the water quality impacts would be minimal, localized, and short-term. The same is true with respect to the quantity of solids entering the lake in the slurry water compared with the lake's annual sediment loading. If the opposite relationship occurs, impacts are expected to be severe but should not persist for extensive periods of time.

Where aerobic substrate conditions exist, settling coal particles could, dependent upon deposition depth, reduce or eliminate macroinvertebrate populations and habitats.

High concentrations of suspended solids could kill the affected biota or cause the more mobile organisms to emigrate to areas of lesser concentrations. Under worst-case conditions, it is anticipated that heat or cold shock and dissolved oxygen stress could also occur, in which case the affected biota would likely perish.

Ground Water

The impact of a pipeline rupture on groundwater quality, even in the most sensitive of environments, is not likely to be severe. Coal slurry spills are not expected to reach the majority of aquifers along the pipeline route. If a spill does reach an aquifer, the plume of contamination is not anticipated to spread beyond a very localized area. Under worst-case conditions, which assume no chemical reactions would occur and no contaminants would be absorbed by the soil, only the federal secondary drinking water standards for TDS, sulfates, and possibly manganese may be exceeded. The secondary standards are concerned primarily with aesthetics. These impacts would, however, be highly localized and persist only for a period of several days.

No biological impacts of any significance are anticipated.

Land

The areal extent of contamination from a land spill of coal slurry depends primarily on the topography of the area and vegetation density. Areas of low relief and extensive vegetative cover would tend to inhibit spill flow and promote deposition near the source. Conversely, areas of high relief tend to channelize the flow, thus increasing the velocity and, in the absence of restrictions, the distance to exhaustion. Depending on the slope of the terrain, quantity spilled, and numerous other factors, the slurry can travel several miles before it becomes exhausted from deposition, ground infiltration, evaporation, and impoundment in natural depressions.

Biological impacts from a terrestrial coal slurry spill are, for the most part, considered insignificant. If the spill were large, it could result in the loss of some small animals (i.e., rodents) and displacement of others. Displaced animals could be subjected to competitive stress, but this is a localized and insignificant effect. Wildlife drinking the slurry water might experience a slight laxative effect (EPA 1976, p. 205).

A coal slurry spill in a wetland area could result in the destruction or permanent alteration of the wetland. Because of the scarcity of wetland habitat in some regions, such a loss would be considered long-term and significant.

4.A.4 VEGETATION

Acreages permanently and temporarily altered by construction of the proposed action and alternatives are presented in Table 4-16. Mileages and acreages were summarized from U.S. Geological Survey land-use maps, Soil Conservation Service soil surveys and range sites, and other literature sources, and represent the vegetation types occurring at surface facilities and along the right-of-way. While vegetation concerns would be locally significant during construction, actual impacts on vegetation would be generally insignificant and for the most part temporary with a successful reclamation program. Successful revegetation and reestablishment of grazing would be expected to occur in most areas along the proposed pipeline route with implementation of the erosion control and revegetation plan outlined in Appendix C-1. From one to five years would be required for a stand of vegetation to become established. Longer periods of time may be required when unfavorable weather conditions occur. In some small areas partial success of revegetation would result in less dense vegetation.

Where the pipeline corridor would traverse woodlands, the preconstruction vegetation would be altered for the life of the project (50 years). In the Sand Hills of Nebraska, revegetation success would be less successful compared with most other areas that would be traversed. Soils in the Sand Hills are characteristically subjected to wind erosion when vegetative cover is removed. Revegetation is also hindered by low water-holding capacity of the sandy soils in the area. Consequently, vegetation density in the corridor after reclamation could be less than preconstruction levels in these sandy areas.

In other areas, revegetation success would vary. It would be least successful in areas with steep slopes susceptible to erosion, in areas with shallow and unfavorable soils, and in the more arid northern portions of the project where annual precipitation is less than 15 inches. Revegetated areas with lower vegetation densities would be susceptible to accelerated soil erosion and invasion of undesirable plants. These areas would require a longer period of time to revegetate, and controlled grazing to protect vegetation would be necessary. A few small areas where adequate vegetation cannot be established and maintained

TABLE 4-16

SUMMARY OF VEGETATION TYPES AND CROPLAND FOR THE PROPOSED ACTION AND ALTERNATIVES

Vegetation Type[a]	Proposed Action: Right-of-Way (Temporary Disturbance)[b] Miles	Acres	Proposed Action: Surface Facilities[c] (Permanent Disturbance) Number	Acres	Market Alternative[d]: Right-of-Way (Temporary Disturbance)[b] Miles	Acres	Market Alternative[d]: Surface Facilities (Permanent Disturbance) Number	Acres	Cypress Bend Pipeline-Barge Alternative[d]: Right-of-Way (Temporary Disturbance)[b] Miles	Acres	Cypress Bend Pipeline-Barge Alternative[d]: Surface Facilities (Permanent Disturbance) Number	Acres	Colorado Alternative[d]: Right-of-Way (Temporary Disturbance)[b] Miles	Acres	Colorado Alternative[d]: Surface Facilities (Permanently Disturbance) Number	Acres
Agriculture[f]	863	10,460	14	340	286	3466	3	75	46	558	1	25	309	3745	1	25
Short-Grass Prairie[g]	60	728	1	25									38	461	2	50
Midgrass Prairie[g]	357	3,758	56	413	137	1660	1	25					223	2703	3	75
Tall-Grass Prairie[g]	12	145											17	206		
Shrub and Brush Rangeland	6	73											1	12		
Ponderosa Pine Forest	13	158			1	12							5	61		
Nonforested Wetlands[h]	2	24														
Forested Wetlands[i]	63	764							3	36			3	36		
Cross Timbers	76	921			1	12										
Oak-Hickory Forest	149	1,806			64	776			24	291						
Southern Pine-Hardwood Forest	226	2,740	4	70					7	85						
Barren Lands	1	12							1	12			6	73		
Urban and Built-up Lands	—	—	3	105	4	48	4	70	—	—	1	205	—	—	-	—
Total	1828	21,589	78	953	493	5974	8	170	81	982	2	230	602	7297	6	150

TABLE 4-16 (Concluded)

Vegetation Type[a]	Niobrara Water Supply System[e]				Crook County Alternative Water Supply System				Oahe Alternative Water Supply System			
	Right-of-Way (Temporary Disturbance)[b]		Surface Facilities (Permanent Disturbance)		Right-of-Way (Temporary Disturbance)[b]		Surface Facilities (Permanent Disturbance)		Right-of-Way (Temporary Disturbance)[b]		Surface Facilities (Permanent Disturbance)	
	Miles	Acres	Number	Acres	Miles	Acres	Number	Acres	Miles	Acres	Number	Acres
Agriculture[f]	1	12			1	12			87	1054	3	3
Short-Grass Prairie[g]							25	63				
Midgrass Prairie[g]	64	776	51	128	36	436			166	2012	5	5
Tall-Grass Prairie[g]												
Shrub and Brush Rangeland	1	12							1	12		
Ponderosa Pine Forest	2	24			6	73			20	242		
Nonforested Wetlands[h]												
Forested Wetlands[i]									1	12		
Cross Timbers												
Oak-Hickory Forest												
Southern Pine-Hardwood Forest												
Barren Lands									1	12		
Urban and Built-up Lands												
Total	68	824	51	128	43	521	25	63	276	3344	8	8

Note: USGS 250,000 scale land use and cover maps, Soil Conservation Service soil surveys, and USGS quad sheets and other literature sources (see Appendix B of the Terrestrial Biology Technical Report [WCC 1980e]) were used to estimate the presence of a particular vegetation type. Vegetation types are listed by component and state in the Terrestrial Biology Technical Report

[a] Vegetation types are described in detail in Appendix B of the Terrestrial Biology Technical Report.

[b] In woodland areas, temporary disturbance refers to understory vegetation.

[c] Permanent surface facilities include preparation plants, pump stations, and dewatering facilities that would cause a land use change for the life of the project. Number refers to the total number of sites in each vegetation type.

[d] Figures shown represent only the areas that would be different from the proposed action.

[e] The Niobrara County water supply system, although included as a component in all coal slurry systems, is listed here for comparison with alternative water supply systems.

[f] Agricultural land is defined as cropland and pasture in this table.

[g] Short-grass, midgrass, and tall-grass prairie and shrub and brush rangeland vegetation types were developed from USGS land use and cover maps, Soil Conservation Service soil survey publications and range site surveys for localized areas along the pipeline route, and other literature sources.

[h] Nonforested wetlands, based on the USGS land use category, may include marshes and other wetlands with no tree overstory.

[i] Forested wetlands, based on the USGS land use category, may include cottonwood and/or willow in the north and bottomland hardwoods in the South.

would require critical area treatment with continuing erosion control measures.

In wooded areas, understory vegetation would be established and maintained along the right-of-way. Trees would not be allowed to reestablish directly over the pipeline. Establishment of trees on fringe areas would require longer periods of time, up to 30 years or more.

4.A.5 WILDLIFE

The proposed construction of the coal slurry pipeline project may directly or indirectly affect wildlife populations in several ways: by causing death, by destroying habitat, or by creating secondary disturbances such as harassment by personnel or equipment. Although the latter impact has a less severe connotation than death or displacement, it can be equally or more damaging to breeding populations. Procedures for reclaiming wildlife habitat on and along the pipeline right-of-way are discussed in Appendix C-1.

Only specific and significant impacts are discussed here under components of the proposed action and alternatives. The insignificant impacts are summarized in the last part of this section.

Significant Impacts

Significant impacts and potential impacts to protected species are discussed below, by proposed action component. The possible impacts to species of special concern are summarized by component for the proposed action and project alternatives in Table 4-17. Stipulations outlined in the draft Memorandum of Agreement between the Bureau of Land Management and the Fish and Wildlife Service (Appendix D-4), which would be attached to any federal right-of-way permit, would ensure that there would be no significant impacts to any federally listed threatened or endangered species.

Coal Slurry Preparation Plants and Water Supply System. Wildlife species of special concern that could be affected by construction, operation, maintenance, or abandonment of the coal slurry preparation plants and water supply system include the black-footed ferret and sage grouse (Table 4-17).

Prairie dog colonies could occur at the preparation plant sites and water supply lines. The presence of prairie dog towns would provide potential habitat for the black-footed ferret. If prairie dog towns do exist at the proposed coal slurry preparation sites, these towns would be disturbed for the life of the project (50 years). Prairie dog towns that would be traversed by water supply lines would be temporarily disturbed. Clearing of rights-of-way may be beneficial to prairie dogs (and therefore to ferrets) if, in fact, prairie dogs used such rights-of-way to expand their towns or to disperse.

The potential of entrapping a ferret in a burrow, running over one with machinery, or causing one to disperse from the area and thereby either abandoning young or not relocating in another suitable town are conceivable consequences of the proposed construction activity. Ferrets are mobile and could possibly move; however, they may seek shelter or hide in burrows. Thus the potential of destroying one exists if it sought refuge in the path of the ditching machinery. In most areas along the northern portion of the proposed right-of-way, prairie dog towns are rather extensive in number and acreage; therefore dispersal of adults, at least temporarily, to suitable habitat is possible.

Although the probability is extremely low that a black-footed ferret would be present within a single prairie dog town disturbed by construction, any prairie dog town within a quarter-mile of the right-of-way would be surveyed for black-footed ferrets. This survey would be required as a stipulation to any right-of-way permits granted by the Bureau of Land Management and the Forest Service as part of the Section 7 consultation process with the Fish and Wildlife Service. If the results of these ferret surveys failed to locate signs of ferret activity along the pipeline corridor, it would be assumed that the project would not significantly affect the black-footed ferret. If ferret signs were discovered along the pipeline right-of-way or at any other project component site, mitigation would be required.

TABLE 4-17

POSSIBLE IMPACTS TO WILDLIFE SPECIES OF SPECIAL CONCERN RESULTING FROM CONSTRUCTION, OPERATION, MAINTENANCE, OR ABANDONMENT OF COMPONENTS OF THE PROPOSED ACTION AND ALTERNATIVES

Project	Black Footed Ferret	Bald Eagle	Whooping Crane	Red-Cockaded Woodpecker	American Alligator	Northern Swift Fox	Greater Prairie Chicken	Interior Least Tern	Golden Eagle	Mule Deer	Sage Grouse
Proposed Action											
Coal Slurry Preparation Plants	X										X
Water Supply System	X										
Slurry Pipelines and Pump Stations	X	X		X	X	X	X	X	X		
Dewatering Plants[a]											
Market Alternative											
Coal Slurry Preparation Plants	X										
Water Supply System	X										
Slurry Pipeline System	X	X		X	X	X	X	X	X		
Dewatering Plants[a]											
Cypress Bend Pipeline-Barge Alternative											
Coal Slurry Preparation Plants	X										
Water Supply System	X										
Slurry Pipeline System	X	X		X	X	X	X[a]	X	X		X
Dewatering Plants[a]											
Colorado Alternative											
Coal Slurry Preparation Plants	X										
Water Supply System	X										
Slurry Pipeline System	X	X	b	X	X	X	X	X	X		
Dewatering Plants[a]											
Crook County Alternative Water Supply System											
Water Wells, Gathering Lines, and Pump Stations	X										
Main Water Pipeline	X										
Oahe Alternative Water Supply											
Water Pipeline	X	X				X		X		X	
Pump Stations	X										

a No significant impacts are expected.

b Impact to the whooping crane would not occur as a result of construction, operation, maintenance, or abandonment of the Colorado Alternative. Significant impact would occur if the Colorado alternative pipeline ruptured and slurry spilled into Cheyenne Bottoms State Waterfowl Refuge in Barton County, Kansas.

Sage grouse strutting grounds could occur on or very near the North Rawhide water line at about milepost (MP) NR-17, NR-23, NR-28, and NR-31. Construction of the water pipeline is scheduled for January through April. Since such a construction schedule would not disturb the sage grouse courting period (April and May), no significant impact would be expected on this important game species (Harju 1980), although some strutting habitat may be temporarily altered.

No other areas of special concern for wildlife have been identified in the vicinity of the coal slurry preparation plants or water supply line.

Slurry Pipeline System. Wildlife species of special interest that could occur along the proposed action pipeline corridor include the black-footed ferret, bald eagle, golden eagle, northern swift fox, interior least tern, greater prairie chicken, red-cockaded woodpecker, and American alligator (Table 4-17).

The black-footed ferret could occur in prairie dog towns along the proposed action route in Wyoming, Nebraska, and Kansas. The ferret is considered extinct in Oklahoma (FWS 1980b). Potential effects from construction of the proposed project on the black-footed ferret are summarized above in the Coal Slurry Preparation Plants and Water Supply System section.

According to federal and state agencies contacted, no bald eagles are known to nest near the route, but overwintering bald eagles may be encountered in all the states traversed by the proposed action route, especially near major rivers. Major rivers where bald eagles may be encountered include the Belle Fourche, North Platte, South Platte, and Republican in Nebraska, and the Arkansas River in Kansas, Oklahoma, and Arkansas. Only one river crossing has been identified as a special concern because of a large concentration of overwintering bald eagles: the Arkansas River near Ponca City, Oklahoma, at MP P-720. Construction of the Arkansas River crossing is scheduled during August and September. According to the Fish and Wildlife Service (1980b), major concentrations of bald eagles usually occur in Oklahoma from November through March. Since no roost trees are known to exist at major river crossings, no impacts to the bald eagle are expected to occur. A bald eagle winter roost area is located approximately 3 miles east of the North Rawhide slurry gathering line at the proposed crossing of the Belle Fourche River. Construction in this area would coincide with the bald eagle's winter roosting period. Some eagles could be disturbed by construction activity and be displaced either up or down the river. However, such disturbances would be short-term and, since no roost trees would be destroyed at the crossing, insignificant.

Golden Eagle. The golden eagle is protected by the Bald Eagle Act. The only known golden eagle nests near the proposed action route are in Nebraska to the north of MP PMB-233, PMB-237, and PMB-246 (L. Carlson 1980). Construction in these areas is scheduled for mid-March through mid-April. The golden eagle nests as early as late February in this area. Consequently, the potential exists for construction disturbing golden eagles during nesting in Nebraska. Therefore a "may affect" designation exists for the golden eagle until field surveys can determine the precise proximity of these nests to the actual construction corridor.

Northern Swift Fox. The northern swift fox, a state-designated endangered species in Nebraska, could occur near MP PMB-106 to PMB-115 (Nebraska Game and Parks Commission 1980). At this location in Nebraska, the route would pass near denning sites of the northern swift fox (L. Carlson 1980). Kilgore (1967) reported that the swift fox abandons dens, particularly those in which whelps are being reared, as a result of increased human activity. Construction is scheduled for early July in this section of Nebraska. Kilgore (1967) reported that swift fox whelps are nearly full grown in mid-July. Consequently, the chances of destroying a female and her whelps by construction in these areas are probably negligible. However, displacement could occur if dens were disturbed. Displacement of the swift fox may be temporary if dens are not destroyed. Destruction of a den may preclude the return of the swift fox to the den site.

Interior Least Tern. The interior least tern is a state-designated threaten ed species in Kansas. Platt et al. (1974) list the least tern as a summer resident. These terns nest on river sandbars, sandflats, and other similar habitat in June and July (South Dakota Ornithologists Union 1978). These birds have been reported to breed in Rooks, Barton, and Stafford counties, which are crossed by the proposed action route. The Arkansas River is scheduled for crossing during August and September; the South Fork of the Solomon River would be traversed in early February. Since crossings at these locations would not coincide with interior least tern nesting, no impact is expected. Rattlesnake Creek would be crossed in late May or early June. Terns could be nesting at the crossing during this time. Some nests could be destroyed, while other nests in the vicinity of the crossing might be abandoned. However, given the small area that would be disturbed and the limited overlap between construction and nesting, impacts to the least tern would not be significant.

Greater Prairie Chicken. The greater prairie chicken could occur between MP P-690 and P-718 in Noble County and between MP P-810 and P-825 in Mayes and Wagoner counties, Oklahoma (Short 1980). Pipeline construction in these areas would not coincide with the April and May breeding activity of these birds; however, some breeding grounds (strutting grounds) could be altered temporarily. Temporary loss of strutting grounds would not affect the prairie chicken in Oklahoma (Short 1980).

Red-Cockaded Woodpecker. The red-cockaded woodpecker inhabits mature, open pine forests such as may be present along parts of the proposed action route in Arkansas and Louisiana. Construction of the pipeline through these areas could result in the loss of suitable habitat, as well as the destruction of active colonies. In addition, construction activity in April and May through these areas may force adult birds to abandon active nests. Field surveys would be conducted prior to construction along any rights-of-way through mature pine woods so that construction activities would have no impact on the red-cockaded woodpecker.

American Alligator. The American alligator is listed as endangered in Arkansas and portions of Louisiana and is listed as threatened in other portions of Louisiana. If any alligator nests were destroyed during construction, then the alligator population could be affected. However, the loss of a small number of eggs or hatchlings would not have a significant impact on the existing alligator population.

In addition to impacts to the protected and game species listed above, removal of riparian vegetation could be locally significant along some of the streams traversed, since this type of wildlife habitat is limited and wildlife species are concentrated in this habitat. The proposed action route would cross wetland habitat in Kansas at Rattlesnake Creek (MP P-551) and in Arkansas near MP PMB-1010. Other wetland habitat could also be crossed in Kansas near the North Fork Ninnescah River crossing (MP P-567) and the South Fork Ninnescah River crossing (MP P-593). Any loss of wetland habitat would be considered significant because of the limited amount remaining and its importance to wildlife, especially for nesting and brood rearing.

Insignificant Impacts

The most direct construction impact on wildlife would be the clearing of wildlife habitat (vegetation) from the pipeline right-of-way and facility sites. Other construction impacts on wildlife include interruption of the habitat continuum and secondary impacts associated with human presence and activity.

For much of the vegetative habitat that would be destroyed by construction activities, up to 5 years would be required for complete restoration as far as adequate wildlife habitat is concerned. The wildlife habitat after 5 years would not be composed of mature trees, since this would take 50 years or more. However, the brushy undergrowth would furnish wildlife food and cover for the life of the project.

Herbivores such as deer and pronghorn antelope would not be significantly affected by the proposed loss of habitat. Within a few weeks after construction ceased, these animals should become adjusted to the cleared areas. As grass and shrub species were restored, these species would be attracted to the right-of-way, and might be expected to again utilize the right-of-way vegetation as a food source. During spring construction some newborn or young animals might be killed or separated from or abandoned by the adults, although such losses would occur only rarely.

Large and small carnivores generally have large ranges over which they regularly move. Such areas may include several habitat types, particularly the riparian communities. The loss of a small portion of the range within the pipeline right-of-way would have a minimal impact. On the other hand, certain species, such as rabbits, tend to have small ranges and are generally restricted to the region immediately surrounding their burrows. Where the pipeline right-of-way passes through these territories, the impact would be more severe, but temporary. Rabbits would return to the right-of-way soon after construction ceased, and the population might increase over preconstruction levels as grasses and shrubs revegetated in regions once dominated by forest. Populations of rabbit, coyote, and other abundant species should recover quickly to preconstruction levels.

Localized elimination of individual small mammals such as mice, ground squirrels, voles, shrews, and/or their habitats might result along the right-of-way because these species have small ranges and tend to retreat to their burrows when disturbed or threatened. However, the impact would be short-term because of the high reproductive potential and short life cycle of most of these species.

Loss of habitat might affect game birds such as grouse, pheasant, dove, and quail. However, the impact would likely be minimal in terms of area population levels. The pipeline right-of-way would not directly affect a significant amount of habitat suitable for waterfowl and water-associated birds.

Nesting sites of birds that occur within the proposed right-of-way would be destroyed. Consequently, some eggs or young birds would be lost or abandoned. This impact is considered to be localized and temporary.

During construction, human activity would be likely to affect several species of wildlife. Generally, the more intense the human activity, the greater the impact on wildlife. Human activity would be most intense at construction sites and along the pipeline construction corridor.

While specific effects cannot be readily predicted, noise from human activity would have some effect. Much of the wildlife in areas adjacent to the construction corridor would be likely to move away from the noise sources initially.

Operation and maintenance of surface facility sites and the pipeline corridor in prairie habitats, rangeland, and agricultural areas would not generally require additional removal of vegetation, so associated wildlife would not be further affected by maintenance activities after recovery from short-term construction effects. In woodland and brushy areas, it would be necessary to periodically remove trees and brush and maintain a 50-foot grassy right-of-way. Thus some small but permanent change would occur because of the existence of this corridor through forested areas. Consequently, the local composition of wildlife along these corridors in wooded areas would change slightly. Such corridors would have a beneficial effect on some wildlife species by offering an edge-type habitat.

Another potential operational wildlife impact would be bird collisions with communications towers along the pipeline route, which would range in height from 40 to 360 feet. The frequency of bird collisions involves variables such as structure height, illumination, weather, time of year, surrounding terrain, and location in migratory corridor. Most reported collisions have been at taller structures, and there have been fewer in the height range of the towers planned for the proposed action (Kemper 1964). While the effect cannot be predicted with certainty, it is predicted that these towers would not result in significant bird mortality.

Several wildlife species appearing on the Fish and Wildlife Service's Section 7 consultation list would not be affected by construction, operation, maintenance, or abandonment of the coal slurry pipeline project. The Eskimo curlew, ivory-billed woodpecker, and Bachman's warbler are considered extinct in states that would contain coal slurry pipeline project components. The red wolf, although possibly still present in Louisiana, would occur well west of project components. Bats listed in the Section 7 consultation could occur in caves in counties that would contain project components; however, these caves are not located in the affected vicinity of the coal slurry pipeline project. The Florida panther's occurrence along the pipeline corridor is mostly a conjectural matter, and no effects are anticipated. The peregrine falcon could occur over much of the proposed pipeline corridor and in the vicinity of surface facilities, but since no nests occur in the affected area, no impacts are anticipated. Each of these species is discussed in detail in the Threatened and Endangered Species Technical Report (WCC 1980f).

4.A.6 AQUATIC BIOLOGY

Although all pertinent information is included here, a more detailed impact analysis is presented in the Aquatic Biology Technical Report (WCC 1980g). In addition, threatened and endangered species are analyzed in more detail in the Threatened and Endangered Species Technical Report (WCC 1980f).

Short-term (or temporary) impacts are considered to be biological disturbances that are anticipated to be detectable for a period of five years or less. Long-term biological impacts must be anticipated to be detectable for more than five years. Intermittent impacts are considered to be short-term, recurring biological disturbances. Impacts are considered significant when they are anticipated to kill or displace numerous fish or macroinvertebrates (whether or not they are sensitive classification species) as a direct or indirect result of project construction or operation.

Significant and insignificant impacts that are discussed in this section, and are anticipated to be similar in nature and extent for other proposed action or alternative project components, are not presented again under those component headings.

Significant Impacts.

Coal Slurry Preparation Plants. During the operation and maintenance phases of the preparation plants, nonpoint source pollutants (including various quantities of fuels, roadway contaminants, erodible soils, and particulate coal fractions) would be washed into local drainages, primarily during rainstorms. Local rainfall characteristics generally suggest that the ephemeral and intermittent streams in the area will flow during the high-rainfall months of April, May, and June (Ecology Consultants, Inc. 1976). The temporary fish fauna that may become established in these streams during periods of flowing water would experience increased turbidity from soil and coal fractions and petrochemical contamination. It has been demonstrated that under natural conditions many fishes do not remain in areas of high turbidity and that turbidity-tolerant rough fish predominate under these conditions (Peters 1967; Herbert et al. 1961; Burnside 1967). Petrochemicals and assorted roadway contaminants would be expected to further stress these temporary fish populations.

It is likely that the total impact of these factors, in conjunction with various pollutants from the operating coal mines, would be a reduction in the number of fishes capable of exploiting these temporary habitats. It is anticipated that these impacts would be detectable in the affected temporary streams for the life of the project, but these impacts would not result in significant changes in the fish fauna of the perennial rivers and streams in these drainages. Recovery of local fish populations would be anticipated within two to three years after abandonment of the mines and preparation plants.

The temporary and limited fauna expected to utilize local intermittent streams (Williams and Hynes 1977) would be stressed by the same factors that would be expected to affect local fishes. Turbidity can decrease invertebrate population densities (Tebo 1955; Williams and Mundie 1978; Allan 1975; Barber and Kevern 1973), alter species composition (Conlan and

Ellis 1979; Rosenberg and Wiens 1978), and modify behavior (White and Gammon 1977). The total effects of the preparation plant nonpoint source pollutants and coal mine operations would result in decreased population densities in the temporary streams, but would be expected to have no significant impact on invertebrate populations in permanent streams in the affected drainages.

These impacts would probably be detectable as decreased population densities in the affected temporary streams for the life of the project, but recovery of local invertebrate populations would be anticipated within two to three years following abandonment of the mines and preparation plants. In that period of time it is likely that rainstorms would scour the accumulated sediments and pollutants out of the affected stream channels.

Water Supply System. Routine operation, maintenance, and abandonment of the proposed water supply system would be anticipated to cause no significant aquatic biological impacts. If the water supply pipeline were to rupture, however, significant aquatic biological impacts could result.

The main water supply pipeline would carry approximately 30 cubic feet per second (cfs) of water to the Jacobs Ranch mine site from the proposed well field. The temperature of the supply water within the pipeline could play an important role in determining the extent of biological damage associated with spills into flowing temporary streams. The approximate subsurface soil temperature in Wyoming (estimated from mean annual air temperature) would be 46°F, and it is expected that pipeline water would maintain this same temperature during all seasons. If a pipeline rupture were to occur in a stream where stream discharge was less than 30 cfs and ambient water temperature was more than 15°F greater than the pipeline water temperature, it could reasonably be expected that a localized fish and invertebrate kill might occur as a result of a "cold shock." This cold shock phenomenon has recently been reported by Burton et al. (1979).

Similarly, if a rupture were to occur in a stream where stream discharge was less than 30 cfs and ambient water temperature was more than 15°F below the pipeline water temperature, a localized fish and invertebrate kill as a result of "heat shock" may ensue. This heat shock phenomenon has been addressed in a review of thermal effects by Talmage and Coutant (1978).

If aquatic populations were subjected to either heat shock or cold shock, it is likely that the effects would be localized, short-term, and biologically significant. The temporary nature of the streams which could be subjected to spill effects makes it reasonable to suggest that population recovery would be anticipated within one or two years of pipeline repair, since the affected populations would be replenished from contiguous permanent streams.

Surface water drawdown resulting from Niobrara well-field operation could significantly affect aquatic biota in some of the drainages identified in Section 4.A.1, above. Stewart and Thilenius (1964) have expressed this concern for drawdown impacts with particular reference to the Black Hills area.

The assessment of surface water drawdown impacts presented here concentrates on basin mainstems because flow duration data are, generally, only available for these mainstem stream sections. Small tributaries to these mainstems are not analyzed, since neither flow nor biological data are available for most of them. In general, however, it can be assumed that affected tributaries would be biologically altered in the same way, but to a greater extent, than their mainstems.

Most decisions regarding the significance of drawdown impacts on affected biota rely on historical flow-duration data from the U.S. Geological Survey used in conjunction with low-flow stream discharge criteria recently developed by Binns and Eiserman (1979). As a result of extensive studies of 36 Wyoming trout streams, Binns and Eiserman (1979) have concluded that low-flow discharge is one of the most important physical factors limiting fisheries' productivity. They have concluded that, in general, stream habitat is considered "completely adequate" for trout production when low stream flow (August and September) is greater than 55 percent of the average daily flow for the water year (Binns and Eiserman (1979). This data will be used in drawdown impact analysis by computing the anticipated "worst-case" low-flow discharge as affected by well-field operation, and comparing it with the average daily flow for the affected water bodies. Where the anticipated low flow is greater than 55 percent of the average daily flow, no significant biological impacts would be expected.

Operation of the Niobrara County well field, in conjunction with other existing water uses, could reduce the discharge of Spearfish Creek approximately 1 cfs. Spearfish Creek maintains a Class I (highest-valued fisheries resource) trout fishery. Flow duration data indicate that during most years, low summer flow is greater than 55 percent of the average daily flow; therefore this stream would be considered adequate for maximum trout productivity (Binns and Eiserman 1979). Nevertheless, during "dry" years trout productivity can be severely limited due to significant decreases in stream discharge. It is anticipated that the additional 1 cfs decrease in discharge would significantly affect the biota only during very dry years. It is likely that the biological impact would be a reduction of approximately 25 percent in year-class strength for the low-flow year (or years) Spearfish Creek is so affected. During "normal" rainfall years no significant impact would be anticipated.

Surface-water drawdown effects on the Cheyenne River (above Angostura Reservoir) could reduce its discharge by approximately 1 cfs. Despite its intermittent nature, the Cheyenne River is considered a Class III (substantial fishery resource) river in South Dakota. Flow duration data from 1963 to 1979 indicate that the Cheyenne River streambed was dry an average of approximately 14 days per year during that period of record. It is anticipated that a decrease of 1 cfs in Cheyenne River discharge would cause an increase in the dry streambed period to an average of approximately 33 days per year. In a "normal" rainfall year this would probably not result in a significant biological impact, since indigenous biota have adapted to intermittent stream conditions in the Cheyenne. In addition, during the 17-year period of record between 1963 and 1979 there were 3 years in which zero river discharge extended for 41, 48, and 96 days under natural conditions with no long-term biological damage.

During dry years, however, the length of time the streambed is dry could be more than doubled. The most available refuge for aquatic biota would be Angostura Reservoir, which could become severely overcrowded. Biota stranded in pools in the Cheyenne River mainstem would be killed from thermal and dissolved oxygen stress. Only when mainstem flow resumed would recovery begin. This scenario would be considered a short-term, localized, significant impact.

<u>Coal Slurry Pipeline and Pump Stations</u>. A direct effect of construction of the proposed slurry pipeline across riverbeds would be the temporary loss of about 111 square yards of benthic substrate (river or stream bottom), and its complementary fish food potential, for each 10 feet of river crossed. The approximate fish food quantity, in the form of benthic invertebrates, expected to occupy that area of substrate would weigh no more than 3.5 pounds (dry weight). If a fish is assumed to be 15 percent efficient in converting its food to flesh, then approximately 0.5 pound (dry weight) of fish flesh would be lost for every 10 feet of river crossed (Table 4-18) (WCC 1980g). This impact would be expected to be localized, short-term, and of limited biological significance.

General construction activity near rivers and streams, in addition to construction activity directly in the riverbeds, would increase stream turbidity. Extensive literature resources have developed regarding the biological effects of increased turbidity, and it has been generally demonstrated that stream productivity is adversely affected (Karr and Schlosser 1978; Stern and Stickle 1978; Cordone and Kelly 1961).

The discharge of untreated hydrostatic test water may increase stream turbidity, decrease dissolved oxygen, and increase iron, oil, and grease concentrations in receiving waters (WCC 1980c). In addition, the physical result of a large-volume instantaneous discharge in a small perennial stream would be "scouring" of the stream bottom and banks, which could displace affected fishes to downstream locations or, in severe cases, wash them out of the stream channel.

The biological impacts associated with increased turbidity are described above.

Decreased dissolved oxygen concentrations in receiving waters would stress affected biota and could kill some sensitive species if concentrations were reduced to 5.0 mg/l or less (EPA 1976). The total impact of these biological effects in low-volume streams or rivers could be a localized "kill" affecting most trophic levels. Recovery of the affected stream or river would be expected within two years (if oil and/or grease do not accumulate in the stream's sediments) as a result of repopulation from unaffected contiguous streams.

The effects of iron concentrations on freshwater aquatic life have been summarized and a water quality criterion of 1.0 milligram per liter (mg/l) has been established for the protection of freshwater biota (EPA 1976). Untreated hydrostatic test water may exhibit concentrations as high as approximately 14 mg/l, which would be anticipated to have various lethal and/or sublethal impacts on affected biota in streams where stream volume would not be sufficient to dilute the concentration to 1.0 mg/l or less.

While detailed criteria for concentrations of oil and grease can be established only for specific water bodies, species, and oil or grease types, it can be generally stated that even an oily sheen on the water surface may be evidence of potentially lethal impacts on affected biota (EPA 1976).

Temporary removal of river substrate as a result of trench-and-fill operations could result in the loss of 3.5 pounds (dry weight) of invertebrates for every 10 feet of river crossed (Table 4-18). While the effect of such habitat disturbance would be locally significant (assuming all removed organisms would be killed), it would be anticipated that benthic population reestablishment in the disturbed area would be complete within a few months of the termination of construction activity. This recovery phenomenon has been discussed by Hynes (1970) and recently documented by Gore and Johnson (1979).

General construction activity along riverbanks and in the affected streams would increase stream turbidity at and downstream from the pipeline crossing locations. In addition to the effects identified in Section 4.A.6, it is possible that freshwater mussels, in particular, would suffer some adverse effects. Ellis (1936) and Cairns (1968) have documented significant reductions in the feeding activity of mussels exposed to turbid water conditions, and under severe siltation conditions large numbers of macroinvertebrates have died (Casey 1959, as reported in Cordone and Kelly 1961). A recent publication by Marsh and Waters (1980), however, demonstrated that upstream drainage disturbance has a negligible impact on invertebrate populations in undisturbed downstream reaches.

It is anticipated, therefore, that the total impacts associated with trench-and-fill operations would be only locally significant and of short duration. Complete reestablishment of invertebrate populations would be expected within a few months of the termination of construction.

Impacts associated with the discharge of untreated hydrostatic test water would be similar in nature to those described above for affected fish populations. Biological damage, however, would be anticipated to be more severe, since invertebrates would be less mobile and therefore less capable of avoiding a discharge "plume."

Threatened and Endangered Species. The Arkansas darter is known to prefer springs and streams with dense populations of watercress or other aquatic plants, which the darter uses for spawning and foraging activity (Cross and Collins 1975). Isolated populations of the

TABLE 4-18

ESTIMATES OF MACROINVERTEBRATE AND EQUIVALENT FISH BIOMASS THAT MAY BE LOST AS A RESULT OF RIVER-CROSSING CONSTRUCTION

River Width (feet)	Macroinvertebrate Biomass (lb, dry weight)	Fish Biomass (lb, dry weight)
10	3.5	0.5
20	7.0	1.0
30	10.5	1.5
40	14.0	2.0
50	17.5	2.5
100	35.0	5.0
200	70.0	10.0
500	175.0	25.0
1000	350.0	50.0
2000	700.0	100.0
5000	1750.0	250.0

Source: WCC 1980g.

darter could occur in many streams between MP P-532 and P-649 in Kansas. Where Arkansas darter distributions coincide with stream crossing locations, it is anticipated that these darters would be affected in the same way and to the same extent that other fishes would be affected (Section 4.A.6). Additionally, however, these darters could lose a portion of their preferred aquatic vegetation habitat as a result of direct removal from the stream bed. It seems likely that the total effects of siltation and habitat removal would be significant in the stream crossing right-of-way and for whatever distance downstream the suspended solids travel (WCC 1980c). Population recovery to preconstruction densities, however, would be expected within a few years of the completion of construction. In that period of time it is anticipated that aquatic vegetation would reestablish in the disturbed area and provide the habitat necessary for darter reestablishment.

If untreated hydrostatic test water were discharged in streams with Arkansas darter populations, the affected darters could experience the impacts described for fishes, above.

Dewatering Plants

It is anticipated that general construction activity associated with the proposed dewatering facilities would contribute considerably to the suspended solids concentrations of the water bodies identified in Section 3.A.5. It is likely that these sediment contributions would occur periodically, primarily during rainstorm activity, for the duration of the one or two years scheduled for construction of each of the dewatering plants. The impact of the increased sediment load on aquatic invertebrates would be the same as described in the preceding Coal Slurry Pipeline and Pump Stations discussion. Operation and maintenance of the dewatering facilities would contribute various nonpoint source pollutants, including petrochemicals and particulate coal fractions, to the various drainages identified in Chapter 3, Section 3.A.5. Similar pollutants would be anticipated from the operating utility stations, and it is likely that these pollutants would not be uniquely attributable to either source. The addition of these pollutants to the local drainages would cause a reduction in invertebrate density and diversity as described in the preceding Coal Slurry Pipeline and Pump Stations discussion.

Insignificant Impacts

Adandonment of surface facilities and the application of biochemicals for maintenance purposes would result in insignificant impacts. The slight reduction in aquatic organism density anticipated to be associated with abandonment procedures would be localized, short-term, and insignificant, since surface structures would be removed and the disturbed land revegetated in a short period of time. In addition, no water bodies would be directly disturbed by proposed abandonment procedures.

No significant aquatic biological impacts would be anticipated as a result of application of biochemicals (e.g., herbicides, fungicides, etc.), since only state and federally approved chemicals would be used and all would be ground-applied in order to minimize aquatic habitat contamination.

The anticipated physical effects of any surface facility or pipeline construction include stream siltation, nonpoint source pollution, fuel spill hazards, flow regime alteration, and habitat destruction where construction would occur in a stream (Rogozen et al. 1977; Anderson et al. 1978; EPA 1976). While these various physicochemical disturbances may be expected to reduce macroinvertebrate and fish populations in perennial stream habitats, such impacts would not be expected to be significant in the intermittent streams in the potentially affected areas. There are two major reasons for anticipating this reduced impact significance. First, the indigenous biota of these temporary habitats are generally less abundant and diverse than the biota of permanent streams (Hynes 1970; Williams and Hynes 1977) and are comprised of organisms which exploit these temporarily available habitats by immigrating to them from neighboring permanent waters (Williams 1977; Larimore 1959). Recent investigations completed by Wesche and Johnson (1980) have documented both the limited aquatic biological resources and the stressful ambient water quality characteristics of many of the region's streams.

Secondly, the physicochemical effects of construction are anticipated to be limited to those periods when severe rainstorms erode soils and other contaminants into local drainages. The large volumes of runoff associated with these storms would be expected to dilute the various construction site pollutants (primarily petrochemicals) and would probably represent a minor (less than 1 percent) increase in suspended solids concentrations (WCC 1980c). Further, the intermittent and short-term nature of such effects would be expected to preclude the possibility of chronic exposure to, or bioaccumulation of, construction site pollutants. In addition, ETSI has proposed to maintain stream flow at all crossing locations and to refuel heavy equipment outside of river channels, when possible. It is likely, therefore, that nonpoint source pollution, petrochemical spills, and flow regime alteration are construction effects that, generally, would not result in significant aquatic biological impacts.

Construction through, or within the drainage of, temporary streams with flowing water and established fish and macroinvertebrate communities would have, as stated above, siltation, petrochemical spill, flow alteration, and habitat alteration effects. The biological impacts associated with these physical effects would probably be the elimination or temporary displacement of a relatively small number of organisms (in comparison to the number of organisms anticipated to be affected in a perennial stream system). Primarily because of the limited density and diversity of temporary stream biota, it is likely that these impacts would be localized, short-term, and biologically insignificant.

If a water pipeline rupture were to occur, the severity of the anticipated impacts would depend upon the quantity and quality of Madison Formation water, in addition to its temperature (temperature-related impacts are discussed above). The quality of the water would vary over the life of the project, but preliminary estimates (WCC 1980c) indicate that water quality criteria would not be exceeded under spill conditions.

Estimates of biological impacts related to water volume (assuming a complete pipeline rupture) can also be made. A spill of 30 cfs volume, or less, in any of the temporary streams crossed by the water supply lines would be anticipated to have no aquatic biological impact if the spill occurred during a dry streambed period.

If, however, a spill occurred during a flowing water period and represented a significant increase in stream discharge volume (e.g., a doubling of volume or greater), then the biological impacts would be similar to those caused by a local rainstorm. The effects on local fishes would be a reduction or suspension of feeding activity and displacement of some species to areas of preferred flow rates. These impacts would be expected to be localized, short-term, and insignificant.

The effects of such a water spill volume on macroinvertebrate populations would be similar to those described for fishes, but the extent of the impact would be somewhat greater because of the relative immobility of fish. Nevertheless, the anticipated impacts would be considered localized, short-term, and insignificant, since recovery to prespill population levels would be expected in the affected area within a few weeks of pipeline repair as a result of the "drift recolonization" phenomenon (Hynes 1970; Waters 1972; Gore and Johnson 1979).

It is anticipated that operation of the Niobrara well field, in conjunction with the Gillette water supply system and other existing water uses, could reduce the discharge of the Belle Fourche River (below Keyhole Reservoir) by approximately 1 cfs. Flow duration data indicate that the Belle Fourche River below the reservoir has been a perennial river for approximately the past 17 years. Previously the Belle Fourche had been an intermittent river with dry periods occurring primarily during late summer and fall months.

While the Belle Fourche River is considered Class IV in Wyoming (low-production waters), it is considered Class II (high-priority fishery resource) in South Dakota. In order to maintain permanent flow in the Belle Fourche and to retain these fisheries ratings, Keyhole Reservoir would have to be managed to release approximately 2 cfs of water during the summer and fall low-flow periods. At the present time Keyhole Reservoir is operated primarily to supply irrigation water to downstream users. Routine irrigation releases have apparently not significantly affected the reservoir fisheries, even during "dry" years. It is anticipated, therefore, that additional 1 cfs releases during low-flow periods would not significantly affect the reservoir fisheries.

Well-field operation, in conjunction with other water uses, could reduce surface flow in the Sand Creek drainage by 2 cfs. Binns and Eiserman (1979) suggest that low-flow stream discharge can be a factor limiting productivity in Wyoming trout streams. A decrease of 2 cfs as a result of well-field operation represents an insignificant discharge decrease under low flow (critical) conditions. Data presented by Binns and Eiserman (1979) indicate that a decrease in discharge of that magnitude would not be anticipated to significantly affect the trout productivity of Sand Creek. Normal low flow discharge is approximately 100 percent of the average daily flow and, therefore, even a decrease of 2 cfs would allow for the maintenance of "completely adequate" discharge conditions.

A decrease in discharge of approximately 1 cfs would be anticipated in Crow Creek as a result of Niobrara well-field operation, in conjunction with the Gillette water supply system and other existing uses. Crow Creek Springs maintains a relatively constant discharge of 17.5 cfs. A 1 cfs decrease in discharge would represent approximately a 6 percent decline in both low-flow and average daily-flow discharge. As discussed above for Sand Creek, a decrease in discharge of 6 percent would not be anticipated to significantly affect the fisheries productivity of Crow Creek.

Surface-water drawdown could decrease the discharge of Cascade Springs (and Cascade Creek) by approximately 3 cfs. One year of record indicates that Cascade Springs maintains a discharge of approximately 24 cfs and this anticipated decrease represents a 12.5 percent reduction in water volume. Lower Cascade Creek is considered a Class III (substantial fishery resource) and maintains a warmwater sunfish fishery (Bailey and Allum 1962). It is unlikely that a decrease in discharge of this magnitude could sufficiently alter habitat or food availability to significantly affect this warmwater fishery.

Hot Springs maintains a discharge to Fall River of approximately 23 cfs. Well-field operation, in conjunction with other existing water uses, could decrease this discharge by approximately 1 cfs. Fall River is a Class III stream in South Dakota with a low-flow discharge averaging approximately 19 cfs. In the 1939 to 1979 period of record, flow duration data indicate that Fall River never experienced a discharge of less than 12 cfs. An additional decrease of 1 cfs, due to well-field operation, would not be expected to significantly affect Fall River biota, even during a "dry" year since it represents only an 8 percent additional decrease in flow.

ETSI has proposed to construct their river crossings "during periods of low flow whenever possible or be timed to eliminate conflicts with critical migration or spawning schedules of any aquatic species." As an example, ETSI has proposed to cross the Arkansas River during August and September. Striped bass migration and spawning "runs" occur during the early spring months in the Arkansas River basin, so no significant impact to striped bass in the basin would be anticipated.

The trout fisheries in the Niobrara and North Platte rivers are of special concern to the state of Nebraska. It is anticipated that river crossing construction would occur during the low-flow months of August/September. This schedule would avoid both the fall and spring spawning seasons and, thus, would minimize impacts on indigenous trout populations.

At those stream and river crossing locations where construction would coincide with fish migration periods, there is a possibility that in-stream activity would interfere with pre- or post-reproductive migration. Such interference has been reported in the literature (EPA 1976), and the severity of the impact would depend upon the spawning behavior of the species involved, the suspended solids increase anticipated, and the delineation of the downstream area to be affected.

In the smaller streams and rivers where instream construction would be completed in a few days, or less, it is likely that migration would be temporarily suspended. Since most fishes migrate over a period of several days or weeks (Geen et al. 1966), migration would be expected to resume shortly after the completion of construction and the settling of suspended materials.

In wide rivers where construction would last for several weeks and would precisely coincide with initial migration periods, spawning could be limited to unaffected downstream areas. This, however, would be an unlikely impact, since construction activity would be confined to a relatively small area along the pipeline crossing transect. It is likely that migrating fishes would use unaffected transect areas as migration corridors and would avoid active construction areas along the transect.

In summary, it is anticipated that there would be no significant impact to indigenous fish populations when river crossing construction schedules do not coincide with critical fish migration or spawning activity.

Threatened and Endangered Species. The distribution of the fat pocketbook mussel and its potential occurrence at MP PMB(1)-93 of the Independence lateral route were discussed in Chapter 3, Section 3.A.5. A recent mussel survey at that location in 1977, however, revealed no living specimens, fossil shells, or even suitable substrate (EPA 1978a). As a result of this survey, it is anticipated that construction of the proposed coal slurry pipeline would have no impact on the fat pocketbook. Furthermore, it would be anticipated that no Independence site project components of the proposed action or any alternative would affect the fat pocketbook, since this survey has indicated its absence from the area.

ETSI has proposed to use biochemicals (primarily herbicides) for the maintenance of the pipeline right-of-way and pump stations. These chemicals have to be both state and federally approved and would be applied by acceptable ground techniques. By following these guidelines, it is likely that the potential for detectable aquatic biological impacts would be minimized.

4.A.7 CULTURAL RESOURCES

To comply with Section 106 of the National Historic Preservation Act, Executive Order 11593, and 36 CFR 800, a Memorandum of Agreement (MOA) between the Bureau of Land Management, the Advisory Council on Historic Preservation, and the appropriate State Historic Preservation Officers (SHPO) is being developed (see Appendix D-3). The MOA outlines procedures and methods to be taken prior to construction to identify, evaluate, and protect cultural resources in, or eligible for inclusion in, the National Register of Historic Places (NRHP) and to mitigate any adverse impacts to these resources. Prior to construction and after consultation with the SHPO, an intensive field inventory (BLM Class III) will be undertaken for all areas to be disturbed by project construction that have been delineated as requiring an intensive inventory. The inventory would be undertaken to locate previously unknown cultural resources in delineated areas.

Avoidance of a resource by route realignment is the preferred means of mitigation of impact. Therefore, all known resources and those located during any inventory would be avoided, if avoidance is prudent and feasible (as determined in consultation with the appropriate surface management agency). Resources that are not prudently or feasibly avoidable would be mitigated, prior to construction, by the procedures in the MOA and/or other considerations (as determined in consultation with the appropriate surface management agency).

The magnitude of impact on cultural resources cannot be determined until a route is chosen and the proposed right-of-way is examined. Sites currently on the NRHP are identified in Appendix F. Significant sites and districts, as known from previous cultural resource inventories, are identified in Section

3.A.6 and the Cultural Resources Technical Report (WCC 1980h). Each site encountered requires site-specific evaluation as to impact from the project. Because avoidance is the preferred means of mitigation, most known sites that would have been in the proposed right-of-way would not be directly affected .

The following discussion applies to the proposed action and the alternatives wherever ground disturbances would take place.

Construction

History and Prehistory. In the areas requiring intensive inventory, known surface and subsurface resources would be avoided, recorded, or have data recovered prior to construction if prudent and feasible. Construction activities may alter, damage, or destroy previously unknown subsurface sites and result in disturbance to or loss of horizontal and vertical subsurface cultural information. Mixing and loss of artifacts and stratigraphic data could also occur. Alteration, damage, or destruction of these subsurface resources could result specifically in the following:

- Loss of scientific and cultural information
- Loss of physical expression of the resource
- Loss of the resource for future research
- Loss of unique resources
- Loss of resources that may have important cultural affiliations
- Loss of artifact materials

Indirect beneficial impacts on cultural resources that could result from project construction are as follows:

- Cultural resources previously unknown could be located.
- Information previously unavailable could be recovered if significant sites are found during the cultural resource inventory or during construction monitoring.

Operation, Maintenance, and Abandonment

History and Prehistory. There would be no direct impacts on resources as a result of normal project operation. If emergency repairs required clearing or trenching, adverse impacts could occur, as previously discussed for construction activities. An increase in ease of conventional vehicle access may occur and, in conjunction with the decrease in project-related activity once construction is completed, may result in a greater potential for vandalism. No additional impacts on cultural resources would occur as a result of project abandonment, since no additional area would be disturbed.

4.A.8 AGRICULTURE

The main concerns related to construction of the proposed action and alternatives on agricultural lands are: (1) loss of crop production during the construction year, (2) restoration of crop production on croplands, (3) reduction of grazing until areas are restored, (4) accelerated soil erosion, (5) disturbance of topsoil and soil compaction, and (6) long-term land use change at surface facility sites. Acreages temporarily and permanently affected by construction, maintenance, and operation of the proposed action and alternatives are presented in Table 4-19.

Impacts on cropland production, livestock grazing, and soils along the pipeline rights-of-way would be considered generally insignificant and temporary with a successful reclamation program. Successful restoration of cropland areas and revegetation of native rangeland areas would be expected along the proposed pipeline routes with the implementation of the Erosion Control and Revegetation Plan outlined in Appendix C-1. The impacts assessed in this section are based on the assumption that the Erosion Control and Revegetation Plan will be fully implemented by ETSI. However, areas where only partial success of revegetation occurs would result in reduced density of vegetation and could have significant localized

TABLE 4-19

SUMMARY OF PRIME AGRICULTURAL LAND AT SURFACE FACILITIES

State	Proposed Action (acres)	Market Alternative[a] (acres)	Cypress Bend Pipeline-Barge Alternative[b] (acres)	Colorado Alternative[c] (acres)	Crook County Alternative Water Supply System (acres)	Oahe Alternative Water Supply System (acres)
South Dakota	NA	NA	NA	NA	NA	1
Wyoming	25	25	NA	0	0	1
Nebraska	25	0	NA	NA	NA	NA
Colorado	NA	NA	NA	0	NA	NA
Kansas	50	75	NA	25	NA	NA
Oklahoma	70	0	NA	NA	NA	NA
Arkansas	85	0	205	NA	NA	NA
Louisiana	120	0	NA	NA	NA	NA
Total	375	100	205	25	0	2

[a] Numbers include only surface facilities not associated with the proposed action.

[b] Numbers include only facilities not associated with the proposed action or market alternatives.

[c] Numbers include only surface facilities along main slurry pipeline between Jacobs Ranch and intersection with market alternative.

effects on grazing production and soil erosion rates within the rights-of-way. Problems could occur on areas with steep, sloping terrain, in areas of shallow or unstable soils, and in the more arid northern portion of the project area, where average annual precipitation is less than 15 inches. Controlled grazing and longer revegetation periods would be required on problem areas.

One of the significant agricultural concerns related to construction of the various project components is the loss of cropland and grazing land. Since all pipeline rights-of-way would be reclaimed (see Appendix C-1) following construction, all reductions or losses of crop production and grazing would be generally temporary (one year). Losses would be greatest at surface facility locations where lands would be taken out of production for the life of the project (Tables 3-21, 3-22, 3-31, 3-32, 3-39, 3-41, and 3-47). Since these areas would be reclaimed during the abandonment phase of the project, they would not be irreversibly converted to other uses and their viability would not be significantly diminished.

The primary agricultural concern is the potential long-term (50 years) loss of crop production on prime agricultural land at surface facility sites (Tables 3-21, 3-22, 3-31, 3-32, 3-39, 3-41, and 3-47). The construction, operation, and maintenance of the 23 slurry pump stations and 9 dewatering plants associated with the proposed action would take approximately 375 acres (13 pump stations and 5 dewatering plants) of prime agricultural land out of production for approximately 50 years. The impact of this potential crop production loss would be relatively minor from a regional standpoint, since it would be spread over six states. The largest potential crop production loss on prime farmland at any one surface facility location would be 35 acres (pump station and dewatering plant). Since the surface facility land areas would be reclaimed during the abandonment phase of the project, these lands would not be irreversibly converted to other uses and their viability would not be significantly diminished.

4.A.9 AIR QUALITY

Coal Slurry Preparation Plants

Construction of the coal slurry preparation plants would cause temporary increases in fugitive dust and gaseous pollutants but no significant impacts on air quality. Emission factors used in estimating impacts are presented in Appendix G-1 and fugitive dust emission estimates are presented in Appendix G-2.

Dispersion modeling of a 25.2-MMTA coal preparation plant has been done based on detailed emission estimates provided by ETSI (1980) and is discussed in Appendix G-2. For the proposed action, the largest preparation plant (Jacobs Ranch) would process 22.4 MMTA. Although modeling of the larger 25.2-MMTA plant overestimates impacts of the 22.4-MMTA plant, detailed emission estimates for the 22.4-MMTA plant are currently not available. The modeling results, which provide a conservative estimate of air quality impacts, are shown in Table 4-20.

Water Supply System

The water supply system would consist of up to 45 wells, gathering lines, access roads, and a main water pipeline. Impacts would include temporary increases in fugutive dust and gaseous pollutants and are not expected to be significant. Emission factors are presented in Appendix G-1, and emission estimates are presented in Appendix G-3.

No significant air quality impacts would be expected. Amounts of fugitive dust due to wind erosion and vehicle travel over access roads would be insignificant.

Slurry Pipelines and Pump Stations

Impacts from the construction of the slurry gathering lines, main slurry pipeline, and slurry pump stations would consist of temporary increases in fugitive dust and gaseous pollutants. In areas along the proposed pipeline route where natural, windblown dust occasionally exceeds the TSP standards, construction activities would contribute to high levels during periods of strong wind. However, construction impacts would be temporary and insignificant. Estimates of pollutant emissions for a worst-case

TABLE 4-20

EXISTING AND PREDICTED AIR QUALITY VALUES ($\mu g/m^3$)

	TSP	SO_2	NO_2
Annual Average			
Existing	20	6	26
Predicted[a]	41	12	29
Federal Maximum Standard	60	80	100
Wyoming Maximum Standard	60	60	100
24-Hour Average Concentration			
Existing	20	28	b
Predicted[a]	65	39	b
Federal Maximum Standard	150	365	b
Wyoming Maximum Standard	150	260	b

a At plant boundaries.

b No standards established for this category.

construction year are presented in Appendix G-4.

All pump stations would employ electric pumps; thus no significant impact on air quality would be expected.

4.A.10 RECREATION RESOURCES

Coal Slurry Preparation Plants

A major consequence of the proposed action would be an increase in hunting within Campbell County and an increase in the number of people traveling outside the county for outdoor natural recreation. New project-related population would increase the demand for hunting licenses at a time when their availability has been diminishing. Based on data compiled by the Wyoming Game and Fish Commission (1979), approximately 19.1 percent of the newcomers would participate in antelope hunting for an average of 1.94 days per hunter. During 1984, the year of maximum population increase attributable to the project, roughly 512 project-related people would hunt in the county for an estimated 993 hunter days. This represents about 8.5 percent of the 1978 demand.

The use of surrounding recreation areas due to project-related population growth is expected to increase slightly but not significantly (Table 4-21). In each case these project-related increases are less than 10 percent of the non-project-related use. The projections are based on extrapolations of past use, so it should be noted that the crowding problems could worsen as a result of changes in recreational use prompted by gasoline shortages and increased travel costs.

The population increase associated with operation, maintenance, and abandonment of the coal slurry preparation plants would be less than that associated with construction. The demands associated with this population increase would add to the total needs for the area but would generate no new demands beyond those associated with construction of the plants.

Slurry Pipelines and Pump Stations

The proposed action would cross 17 rivers having either scenic or recreational value (Table 3-26). Of these, eight have been identified in the Heritage Conservation and Recreation Service (HCRS) draft Nationwide Rivers Inventory, Phase I. In accordance with a Federal Register Notice published September 8, 1980 (Volume 45, Number 175), the Bureau of Land Management (BLM) has requested assistance from the Mid-Continent and South Central Regional Offices of HCRS to determine whether the ETSI proposed project could have an adverse effect on the natural, cultural, or recreation values of the inventoried rivers segments.

For the nine remaining rivers, either state scenic rivers or rivers potentially important to a state as future state scenic rivers, impacts to recreation experiences due to construction would be short-term. At the worst, high quality recreation experiences while participating in float trips, boating, canoeing, kayaking, etc., would not be achieved. Fishing as a recreation experience could be impaired at river crossings due to pipeline activity (e.g., noise intusions, visual impacts, etc.).

The construction phase of pipeline activity would result in short-term (approximately 4-weeks) disruption to recreation resources such as historic, scenic, and recreation trails, and National Natural Landmarks which could affect the quality of the recreation experience during this time period. Because these impacts would be temporary, they are considered of minor significance. Major trails and National Natural Landmarks crossed by the pipeline are identified in Section 3.A.

The slurry pipeline would traverse the proposed Walnut Creek recreation area in Kansas, resulting in temporary (1-2 months) disruption to recreation use and to the quality of user experience.

Though the pipeline does not cross within the boundaries of the following managed recreation areas (Harris 1980) -- Ash Hollow Historic Park, Kingman County State Lake, Sam Houston State Park, Alexander State

TABLE 4-21

PROJECT-RELATED VISITOR USE IN PUBLIC RECREATION AREAS NEAR CAMPBELL COUNTY, WYOMING, 1980, 1985, 1990

Recreation Area	Visitor Days[a]		
	1980	1985	1990
Big Horn National Forest			
Without Project	909,000	1,030,000	1,150,000
With Project[b]		1,036,797	1,154,925
Black Hills National Forest			
Without Project	146,000	165,000	185,000
With Project[c]		169,538	188,288
Devils Tower National Monument			
Without Project	51,000	75,000	99,000
With Project[d]		78,796	101,750
Keyhole State Park			
Without Project	89,000	89,000	88,000
With Project[e]		95,508	92,716

Source: Oblinger-McCaleb 1980

[a] A common unit of measurement for recreation which represents 12 hours in any activity (e.g., 3 people visiting a historic area for 4 hours equals 1 visitor day).

[b] Assumes 33.1 percent of the new residents will visit for an average of 9.92 days per year.

[c] Assumes 22.1 percent of the new residents will visit for an average of 9.92 days per year.

[d] Assumes 50.1 percent of the new residents will visit for an average of 3.66 days per year.

[e] Assumes 29.8 percent of the new residents will visit for an average of 10.55 days per year.

Forest, Will Rogers State Park -- the quality of the recreation experience could be impaired because of alteration to the visual resources of the area.

Dewatering Plants

Actual construction of the dewatering plants would have little direct impact on recreation resources. The proposed sites are not located on or near any managed recreation areas. In addition, the placement of dewatering plants adjacent to power plants would add to the total impact but are unlikely to substantially alter recreational experiences. Increased use of existing areas because of the presence of construction workers and their families is expected to be less than 10 percent of current use and therefore is considered insignificant.

Ancillary Facilities

Two of the microwave communication towers are likely to impact the recreation experience because they would be permanent highly visible facilities. One, located at the southern boundary of the Oologah reservoir and dam site could be visible to water users. The other, located adjacent to the HCRS nationwide inventoried Niobrara River, could foreclose the possible inclusion of this river into the Wild and Scenic Rivers System or lower the category of classification (e.g., from wild to recreational).

In accordance with September 8, 1980, Federal Register Vol 45, No. 175, BLM has requested the assistance of HCRS in determining whether the proposed tower could have an adverse effect on the natural, cultural, or recreational values of the Niobrara River.

4.A.11 TRANSPORTATION NETWORKS

No significant impacts on existing roadways are expected from the operation, maintenance, and abandonment of any project components. Because of the placement of pipeline components and the means of laying the pipe, it is anticipated that there would be no significant impacts on the railroad system, despite numerous rail crossings. Each crossing must be approved by the railroad involved, and it is assumed that in gaining such permission there would be agreement on the timing of the pipeline construction activity to assure no disruption in rail traffic.

Coal Slurry Preparation Plants

Construction activities would increase the volumes of commuter and truck traffic on State Highway 59 between the preparation plant sites and the nearby town of Gillette. However, because of the recent reconstruction of the highway between Douglas and Gillette and the additional construction planned for the next three years, it is not anticipated that any major traffic disruptions would result from project-related activities. In addition, Interstate 90 connecting Gillette and Moorcroft is now complete; so workers commuting to Gillette would cause no significant impacts.

Slurry Pipeline System

Impacts on the existing surface transportation network would result from activities during construction of the proposed pipeline. These impacts are of three primary types:

1. Increased traffic caused by construction workers traveling to the construction work site
2. Increased movement of heavy equipment and materials to the construction site
3. Disruption of roads while the pipeline is placed under existing roadbeds.

In most places these impacts would be minimal because they would last only a few days and the surrounding area is rural, so there would be little traffic movement along the affected roadways. Near large urban centers, commuters on interstates might experience some temporary disruption but would not experience any appreciable delay in travel time. Congestion might occur outside Pine Bluff where the pipeline would cross three access roads to the city: U.S. 270, U.S. 65, and U.S. 79. Scheduling of construction activities could reduce the potential for these impacts. Traffic might be affected for a short period of time where the highways pass through scenic countryside or provide access to high-use recreation areas (Table 4-22). Such short-term disruption of traffic is not considered significant.

TABLE 4-22

AREAS OF POTENTIAL TOURIST TRAFFIC DISRUPTION
DUE TO CONSTRUCTION OF THE PROPOSED ACTION PIPELINE

State	Highway	Milepost	Note
Kansas	U.S. 36	P-394	Oberlin State Park
	U.S. 24	P-414	Sheridan County State Park and Prairie Dog State Park
	U.S. 56/156	P-530	Arkansas River Crossing
Oklahoma	State 51	P-830	Scenic Roadway
	State 266	P-863	Arkansas River and Recreation Area
Arkansas	U.S. 71	P-918	Scenic
	State 23	PMB-939	Scenic
	State 7	PMB-985	Scenic

Dewatering Facilities

Most of the dewatering facilities would be located near urban areas that have well-established transportation networks. In general, project-related activities should have no significant impact on the major highways, except where the activities are quite close to cities such as Oologah, Muskogee, New Roads, and Lake Charles. At these sites there is a greater amount of regular commute traffic, which could experience some slowing during rush hours if large equipment were being moved at that time. Assuming that such equipment movements can be scheduled around the prime commute hours, the impacts at these sites should also be insignificant.

It should be noted that the Lake Charles lateral would cross Interstate 49, the proposed North-South Expressway. This project has been approved and, depending upon the coincidence of its construction and construction of the lateral, there could be disruptions in traffic flow that cannot be determined at this time.

4.A.12 VISUAL RESOURCES

Impacts to visual resources are defined to be changes in the form, color, texture, and/or line of an area. Impacts to "visually sensitive" areas are of most concern. Criteria used to identify visually sensitive areas include proximity to areas used by humans (major roadways, scenic highways, parks and recreation areas, historic and cultural sites, urban developments, waterways and natural or scenic rivers) and proximity to areas alredy designated as having high scenic quality.

To determine the significance of impacts to visually sensitive areas, changes to these areas were classified according to the extent of disturbance, visibility from public areas, and duration of impacts. Standard procedures included in the project description, such as reclamation of disturbed areas and facility design (Appendix C-1), were considered in determining the extent of disturbance that would be caused by construction, operation, maintenance, and abandonment of the project.

Changes directly related to vegetation that would be mitigated through revegetation within one or two growing seasons were considered temporary and, thus, insignificant. Where landform changes would result (e.g., rocky areas) or where revegetation would be difficult (e.g., steep slopes), visual contrasts are likely to remain for a longer time. Modifications that would be noticeable for two to five years were considered short-term; those that would be noticeable for five years to a lifetime were considered long-term.

Visual impacts were considered significant if they occurred in highly sensitive areas and would be extensive or long-term. Significant visual impact areas are summarized in Table 4-8.

Among the most significant impact areas are those where natural and scenic or scenic or recreational waterways are crossed, creating even short-term visual contrasts that could affect the recreation experience and scenic quality of the landscape. Seventeen rivers crossed by the proposed route are either identified for consideration as natural and scenic rivers or are already protected under state legislation (Section 3.A.9, Table 3-26). Of these, only nine are of concern because of their proximity to human use areas or the extent of disruption to the natural features in the landscape. These include Niobrara River, South Fork of the Solomon, the Arkansas River, Chickaskia River, Mulberry River, Bayou Bartholomew, Little River, and Illinois Bayou.

Because of the importance of water as a high quality visual resource (Litton et al. 1971), several other river crossings--not identified for protected status--and recreational lakes/ reservoirs are also considered to be significant impact areas; among these are the South Platte River, the Republican River, the Verdigris River, Oologah Lake, Kingman State Lake, Smokey Hill River, Neosho River, Catahoula Lake, Greers Ferry Reservoir, and the White River.

Visual impacts are also considered to be significant at recreation areas. Visual contrasts in color, line, form, and texture that

TABLE 4-23

SUMMARY OF IMPACTS ON VISUAL RESOURCES: PROPOSED ACTION

Facility and/or Milepost	Sensitivity[a]	Duration of Impact[b]	Notes
Water-Well Field	Low to medium	Long	Some contrast reduced in long term as revegetation takes place. Structures visible over long term.
Pipeline			
MP PMB-91	Medium	Short	Crosses U.S. 20 and Niobrara River, (identified for study by HCRS). Recreational.
Pump Station P-3 and Microwave Tower, MP PMB-91.9	Medium	Long	Highly visible.
MP PMB-265	High	Short to long	Crossing of U.S. 30, South Platte River, I-80. Recreational use. Dense canopy of mature trees.
MP PMB-360	Medium to high[c]	Short	Intersects U.S. 6/34 and Republican River. Recreation use.
MP P-434 - P-436	High[c]	Short to long	Intersects U.S. 24 (scenic) Pacific R.R., and South Fork of Solomon River (identified for study by HCRS).
P P-445	Low to medium	Short to long	U.S. 283, Saline River crossing.
MP P-486	Medium	Short	Smokey Hill River crossing.
MP P-496	Medium	Short	U.S. 183 and Big Timber Creek crossing, 7 miles from town of LaCross.

TABLE 4-23 Continued

Facility and/or Milepost	Sensitivity[a]	Duration of Impact[b]	Notes
MP P-508 - P-515	Medium to high[c]	Short	State Highway 4, Walnut Creek crossing, proposed state recreation area, State 96 intersection.
MP P-530	High[c]	Short to long	U.S. 56 (scenic) and Arkansas River crossing, (identified for study by HCRS), with dense vegetation, 9 miles from Great Bend.
Pump Station P-7 MP P-560	Medium to High	Long	Contrast in scale with low-profile foreground.
MP P-591	High[c]	Short	Kingman State Lake and camping area, Ninnescah River (identified for study by HCRS).
MP P-610	High[c]	Short to Long	Crosses Chickaskia (identified for study by HCRS) River near State Highway 14.
Microwave Tower MP P-677	Medium	Long	Near State 11.
Microwave Tower MP P-726	Medium	Long	Near Arkansas River and State 20.
MP P-761	Medium	Long	Osage Indian Reservation, oak wooded area and rock outcropping.
MP P-770 - P-779	High[c]	Short	Verdigris River crossing; dense vegetation, Oologah Lake to northern borders of Will Rogers State Park.
MP P-808	High[c]	Long	Rock ledge river bank, densely wooded riparian zone, Neosho River.

TABLE 4-23 Continued

Facility and/or Milepost	Sensitivity[a]	Duration of Impact[b]	Notes
MP P-838	High	Short	Crosses Neosho River, 1 mile from seen area of Highway 2, crosses Arkansas River at MP P-843.
MP P-850 - P-866	High	Short	Parallels Arkansas River, crosses Spaniard Creek, adjacent to Webbers Flat lock and dam and across river from Penkiller State Park.
MP P-850 P-866	High	Short	Parallels Arkansas River, crosses Spaniard Creek, adjacent to Webbers Flat lock and dam and across river from Tenkiller State Park.
MP PMB-929	Medium	Short	Crosses Mulberry River near Highway 64; Ozark Nat'l Forest to north.
Microwave Tower MP PMB-946	High[c]	Long	Near national forest.
MP PMB-960 - PMB-999	High[c]	Short to long	Crosses two creeks (both candidates for scenic), the Illinois Bayou; heavily vegetated. Ozark Nat'l Forest to north and Dardanelle Lake to south; parallels I-40 (scenic).
Microwave Tower PMB(I)-30	Medium	Long	Near Republican River and State 25.

TABLE 4-23 Continued

Facility and/or Milepost	Sensitivity[a]	Duration of Impact[b]	Notes
PMB(I)-36-60	High[c]	Short to Long	ROW crosses Cadron Creek, southern portion of Greers Ferry reservoir and Little Red River. Popular recreation and scenic area of state.
MP PMB-1013	Medium to high	Short to long	Crosses Arkansas River between two parks and within sight of State Highway 154.
MP PMB-1021 - PMB-1030	Medium to high	Short to long	Crosses Fourche LaFave River and parallels border of scenic Ouachita Nat'l Forest, northwest of Little Rock.
Microwave Tower MP PM-1118	High	Long	Near Saline River and State 35.
MP PM-1199	High[c]	Short to long	Pipeline crosses state scenic Bayou Bartholomew, disruption to vegetation long-term if mature trees (oak, hickory, willow) are included.
Microwave Tower MP PM-1275	Medium	Long	Near U.S. 84.
MP PM-1288	High[c]	Short to long	Crosses state scenic Little River adjacent to Kisatchie Nat'l Forest and Catahoula Lake.
Microwave Tower MP PM-1301	Medium	Long	Near State 28.
MP PM-1316-PM-1320	High[c]	Long	Crosses Bayou Boeuf and Cocodrie diversion channel adjacent to Kisatchie Nat'l Forest.

TABLE 4-23 Concluded

Facility and/or Milepost	Sensitivity[a]	Duration of Impact[b]	Notes
Microwave Tower MP PM-NW1	Medium	Long	North of Alexander State Forest.
<u>Dewatering Plant</u>			
Independence	Medium to high[c]	Long	Located along White River, heavy vegetation affected (candidate for scenic river).

Note: Each site listed would have a significant degree of modification as a result of the proposed action. Facility locations are shown in Appendix A.

[a] Sensitivity denotes the priority to human use areas, with high sensitivity attributed areas used for recreation, site seeing and water related outdoor experiences.

[b] Duration of impact indicates time period that visual changes are likely to be most obvious, short implies 2-5 years, and long is 5 years and over.

[c] Denotes potentially controversial consequences.

could be seen from parks, hiking trails, national forests, and camping areas are identified in Table 4-23. For the proposed action pipeline construction activities could affect the visual part of the recreation experience at 11 locations.

The final category of areas of significant impacts is directly related to proximity to major roadways. Though the motorist has different expectations than the recreationist for quality visual experiences, many states are attempting to protect and improve the landscapes within the "seen-area" of transportation corridors. The proposed action crosses or parallels 13 major roadways where significant visual contrasts would be noticed by motorists. Impacts at 10 of these crossings are contrasts resulting from alteration of vegetation and landform, and 3 are related to pump stations visible from the roadway.

Visual impacts directly related to the addition of physical structures to the landscape were considered significant only if they contrasted dramatically with the natural setting (e.g., preparation plants were determined to add additional impacts, only, to the existing mining activities and structures, as were the dewatering facilities located next to power plants). The dewatering plants having significant visual impacts because of their interaction with existing or planned power plants are: Independence, Wilton, and Boyce. Three of the pump stations and 12 of the microwave towers would have significant impacts along the proposed route. The visual contrasts resulting from cleared vegetation and the scale and design configuration of these facilities would make them highly visible and would detract from the natural setting. Of minor significance were the remaining dewatering plants; the well field and pipelines; the New Roads and Wilton extensions; and the microwave towers not identified above.

4.B MARKET ALTERNATIVE

Impacts for this alternative are described below only for those portions of the market alternative that differ from the proposed action. For water resources, slurry pipeline ruptures and spills, vegetation, agriculture, cultural resources, transportation, visual resources, and air quality, the impacts for the market alternative were found to be essentially the same as for the proposed action (see Sections 4.A.1, 4.A.3, 4.A.4, 4.A.6, 4.A.7, 4.A.9, 4.A.11, and 4.A.12), even where the routes vary. Specific impacts for this alternative for socioeconomics, wildlife, recreation, and agriculture were found to vary from the proposed action and are discussed below.

4.B.1 SOCIOECONOMIC CONSIDERATIONS

Coal Preparation Plants and Water Supply System

Under the market alternative, the capacity of the North Rawhide preparation plant would be increased to 13.1 million tons annually (MMTA) and the capacity of the Jacobs Ranch preparation plant would be reduced to 14.3 MMTA. The result would be a redistribution of the construction work force nearer to Gillette (less than 10 miles from the North Rawhide plant). There are two possible effects. The shift of employment to the North Rawhide plant would lower the commuting distance traveled by the construction workers who would live in Gillette, and in addition there would be a marginal increase in demand for housing and services in Gillette. However, overall social and economic effects in the Wyoming area under the market alternative would not be significantly different from those caused by the proposed action.

Slurry Pipeline System

This section discusses impacts to areas with pipeline and pump stations only, as shown on Table 4-24. Segments of pipeline and pump stations near dewatering plants are discussed in the Dewatering Plants section.

Construction. The social and economic consequences of construction would generally be of the same type and magnitude as those identified for the proposed action. As under the proposed action, the level of adverse effects of pipeline construction on the affected area would not represent an adverse impact of significant proportions.

TABLE 4-24

EFFECTS OF CONSTRUCTION ON AREAS WITH PIPELINE AND PUMP STATIONS ONLY: MARKET ALTERNATIVE

Area	County/ Parish	1975 Pop.	Project Component[a]	Peak Fixed-Site Employment[b]			Peak Pipeline Employment			Estimated Peak Pop. In-Migration		Estimated Peak Housing Unit Demand		Hotel/Motel Units in Selected Communities
				Qtr/Yr	Total	Non-local	Qtr/Yr	Total[c]	Non-local[c]	Fixed-Site	Pipeline[c]	Fixed-Site	Pipeline[c]	
North Kansas	Decatur	5,100												
	Norton	6,700												
	Phillips	8,000												
	Rooks	7,100	PL, PS	4/83	49	25	3&4/83	748	374	insignificant	486	insignificant	226	195 Russell
	Osborne	6,200		4/83	49	25				insignificant		insignificant		741 Hays
	Russell	9,000												
	Ellsworth	6,200												
	Rice	12,000												
	McPherson	25,400												
South Kansas	Harvey	28,900												
	Sedgewick	345,200												
	Butler	39,700	PL, PS	4/83	49	25	1&2/84	748	374	insignificant	486	insignificant	226	4975 Wichita
	Cowley	33,800												
	Chatauqua	4,700												

Source: Population data are from U.S. Bureau of the Census 1978.

[a]PL = pipeline
PS = pump station

[b]Fixed-site employment includes construction and service sector employment.

[c]Assumes maximum (rough terrain) spread size as a worst case.

Operation, Maintenance, and Abandonment. The pipeline operation work force would be concentrated at maintenance bases at Jacobs Ranch and at the Pryor, White Bluff, and New Roads dewatering plant sites. Pump stations would be automated. Consequently, no significant employment and population effects would be associated with operational work force requirements in counties with pipeline and pump stations only (Table 4-25).

Host counties would derive property tax revenue benefits over the economic life of the pipeline system (Table 4-25). The degree of effect on each county would depend not only on the value of the system in the county (a function of pipeline length and diameter and pump station location), but also on the size of the existing tax base and local decisions on how to incorporate the new source of revenues into the county tax structure.

Upon abandonment, employment and population effects would be nil and property tax revenues would decline.

Dewatering Plants

This section discusses impacts of dewatering plants and their associated pipelines and pump stations as shown on Table 4-26.

Construction. Under the market alternative, there would be a different set of dewatering plants. Construction and operation of the Independence, White Bluff, Boyce, Lake Charles, New Roads, and Wilton dewatering plants would be the same as under the proposed action. In Oklahoma, the Ponca City and Muskogee dewatering plants would not be constructed. However, the Pryor dewatering plant would be increased in capacity from 3.0 to 5.3 MMTA, and a dewatering plant would be built at Oologah, Oklahoma, about 30 miles from Pryor. In Louisiana, the Baton Rouge dewatering plant would be constructed.

Employment and population effects would be insignificant in all the dewatering plant areas (Table 4-26). Even where the Pryor and Oologah plants would be constructed within 30 miles of each other, the aggregate peak work force demand of 483 would be met from the Tulsa area and no in-migration of nonlocal construction workers would occur.

Operation, Maintenance, and Abandonment. Employment and population effects from the dewatering plant and pipeline operation and maintenance would be insignificant (Table 4-27). New property tax revenues would benefit those counties or parishes in which dewatering plants were located. The degree of benefit would depend upon the value of the system in the county, the existing tax base, and local decisions on how to incorporate the new source of revenues into the county tax structure.

Upon abandonment, direct employment would be eliminated and property tax revenues would decline.

4.B.2 WILDLIFE

Insignificant impacts resulting from pipeline construction are summarized in Section 4.A.5. These impacts would be expected to occur similarly if the market alternative route were chosen. Wildlife species of special concern that could be affected by the market alternative are listed by component on Table 4-17.

Wildlife species of special interest that could occur along the market alternative route in Kansas and Oklahoma include the black-footed ferret, bald eagle, interior least tern, and greater prairie chicken (Table 4-17). In addition, loss of riparian vegetation at stream crossings along the market alternative route in Kansas and Oklahoma could be locally significant, since wildlife species are concentrated in these areas.

Generally, potential impacts to the black-footed ferret and bald eagle would be the same as described for the proposed action in Section 4.A.5.

Interior Least Tern

Breeding records exist for this state-protected species from Rooks County, Kansas. The market alternative would traverse the South Fork Solomon River at MP MB-80. Con-

TABLE 4-25

EFFECTS OF OPERATION ON AREAS WITH PIPELINE AND PUMP STATIONS ONLY: MARKET ALTERNATIVE

Area	County/ Parish[a]	Project Component[b]	Annual County Property Tax Revenues: 1976-77 Property Tax Revenues (x $1000)	Annual County Property Tax Revenues: Estimated[c] ETSI Property Tax Revenues (1980 dollars) (x $1000)	Annual County Property Tax Revenues: Percentage of 1976-77 Property Tax Revenues
North Kansas	Decatur	PL	2,192	530	24
	Norton	PL,PS	2,452	540	22
	Phillips	PL	3,108	90	3
	Rooks	PL	2,854	610	21
	Osborne	PL	1,730	150	9
	Russell	PL	4,456	770	17
	Ellsworth	PL,PS	2,962	760	26
	Rice	PL	4,515	340	4
	McPherson	PL	8,720	390	4
South Kansas	Harvey	PL	9,556	670	7
	Sedgewick	PL	90,077	330	0.3
	Butler	PL,PS	11,866	870	7
	Cowley	PL	8,986	630	7
	Chatauqua	PL	1,366	440	32

Note: There would be no direct or secondary permanent employment and no population in-migration.

[a] Only counties in which components are to be located are listed.

[b] PL = pipeline
PS = pump station

[c] Estimated property taxes by county were estimated by ETSI for the EIS by extrapolating previously developed unit cost estimates for components and should in no way be construed as representing the cost estimate for the components. Values shown on this table were derived by ETSI as follows:

Sum of estimated cost of components in county (1980 dollars)	x	Statewide ratio of assessed value to market value	x	Percentage tax rate assumed for county	=	Estimated ETSI property tax revenues in 1980 dollars

TABLE 4-26

EFFECTS OF CONSTRUCTION ON AREAS WITH DEWATERING PLANTS: MARKET ALTERNATIVE

				Peak Fixed-Site Employment[b]			Peak Pipeline Employment			Estimated Peak Pop. In-Migration		Estimated Peak Housing Unit Demand		
Area	County/ Parish	Project Components[a]	Existing Construction Labor Pool	Qtr/Yr	Total	Non-local	Qtr/Yr	Total[c]	Non-local[c]	Fixed-Site	Pipeline[c]	Fixed-Site	Pipeline[c]	Hotel/Motel Units in Selected Communities
Oologah-Pryor, OK	Osage, Washington, Rogers, Mayes, Tulsa, Wagoner, Cherokee, Adair	PL, DP, MB, PS	11,990 in Tulsa SMSA & N.E. Okla. regions	1/84	483	0	3/83 3/84	670 670	335 335	0	435 435	0	200 200	150/Pryor; 400/Bartlesville; Tulsa not inventoried
Baton Rouge, LA	W. Baton Rouge, E. Baton Rouge	PL, DP	24,675 in Baton Rouge labor mkt. in 1978	4/85	259	0	3/84	260	130	0	169	0	80	3500 units in Baton Rouge

Source: Labor pool data are from WCC 1980d.

[a]PL = pipeline
DP = dewatering plant
MB = maintenance base
PS = pump station

[b]Fixed-site employment includes construction and service sector employment.

[c]Assumes maximum (rough terrain) spread size as a worst case.

Table 4-27

EFFECTS OF OPERATION ON AREAS WITH DEWATERING PLANTS MARKET ALTERNATIVE

Area	County/Parish[a]	Project Component[b]	Annual County Property Tax Revenues: 1976-77 Property Tax Revenues (x $1000)	Annual County Property Tax Revenues: Estimated ETSI Property Tax Revenues (1980 dollars) (x $1000)[c]	Annual County Property Tax Revenues: Percentage of 1976-77 Property Tax Revenues	Permanent Employment: Direct	Permanent Employment: Secondary	Estimated Population In-Migration
Oologah-Pryor, OK	Osage	PL	3,208	440	14	107	118	508
	Washington	PL	5,945	300	5			
	Rogers	PL,DP,PS	4,362	1031	24			
	Mayes	PL,DP,MB,PS	2,126	1084	51			
	Cherokee	PL	1,366	380	28			
	Adair	PL	916	210	23			
Baton Rouge, LA	W. Baton Rouge	PL	2,562	127	5	40	44	189
	E. Baton Rouge	PL,DP	36,694	369	1			

[a]Only counties in which components are to be located are listed.

[b]PL = pipeline
DP = dewatering plant
MB = maintenance base
PS = pump station

[c]Estimated property taxes by county were estimated by ETSI for the EIS by extrapolating previously developed unit cost estimates for components and should in no way be construed as representing <u>the</u> cost estimate for the components. Values shown on this table were derived by ETSI as follows:

Sum of estimated cost of components in county (1980 dollars) x Statewide ratio of assessed value to market value x Percentage tax rate assumed for county = Estimated ETSI property tax revenues in 1980 dollars

struction in this portion of Kansas is scheduled for early March 1984. Interior least terns probably nest in the area in June and July. The interior least tern would not be affected in Kansas.

Greater Prairie Chicken

In Oklahoma, the range of the prairie chicken might be encountered between about MP MB-324 to MB-337 of the market alternative, and at about MP MB-442 of the market alternative.

Construction is scheduled in this portion of Oklahoma in October. Since the greater prairie chicken strutting season is in April and May, construction would not interfere with breeding birds. Some strutting grounds could be temporarily altered by construction; however, such temporary impacts would be localized and insignificant (Short 1980).

4.B.3 RECREATION RESOURCES

Slurry Pipeline and Pump Stations

Most recreational impacts resulting from construction of the market alternative would be temporary (less than 2 visitor seasons), similar to those discussed for the proposed action. Of significant recreational concern would be: the 5 managed recreational areas within 5 miles of the pipeline (including 2 state parks--Prairie Dog and Rooks County in Kansas that are both within 3 miles of the pipeline); the 7 waterways crossed by the pipeline and having recreational or scenic value (the Illinois River in Oklahoma and the Caney River in Kansas are both considered prime water and scenic recreation resources by their respective states); the 11 major recreation/historic trails crossed by the pipeline (including 2 recommended for the National Trails System--the Santa Fe and the Old Cattle); the proximity of both the pipeline and dewatering plant to the Will Rogers State Park and Oologah Lake recreation area; and one microwave tower (near MP MB-485) located within view of the Ozark National Forest boundary.

Similar to the impacts discussed in Section 4.A.10, the nature of the recreation impacts is directly related to modifications to the visual resources in the area, noise from construction activities, and the prominence of existing man-made intrusions (e.g., access roads, towers, stacks) in the natural environment which would degrade the quality of the recreation experience. Though some of these impacts are of short duration (1-2 months), they would be significant if they occurred at any time coinciding with peak visitor use. Water-related impacts such as at river crossings are particularly sensitive during seasonal use of waterways.

4.B.4 AGRICULTURE

The construction, operation, and maintenance of the eight market alternative slurry pump stations and two dewatering plants (not associated with the proposed action) would take approximately 100 acres (four pump stations, Table 4-20) of prime agricultural land out of production for approximately 50 years. The impact of this potential crop production loss would be relatively minor from a regional standpoint. Since the surface facility land areas would be reclaimed during the abandonment phase of the project, these lands would not be irreversibly converted to other uses and their viability would not be significantly diminished.

4.B.5 VISUAL RESOURCES

Similar to the proposed action, the visual impacts for the market alternative are primarily concentrated around landscapes where water- or recreation-related activities predominate and where alteration of the natural vegetation would result in noticeable contrasts in color, line, texture, and form. Significant impacts are summarized in Table 4-28.

Several river crossings are identified as significant: these include four that are proposed for study by the National Heritage Conservation and Recreation Service; three that are protected wild and scenic state rivers; and one that has been identified for state protection (see Table 3-34). In addition, five rivers

TABLE 4-28

SUMMARY OF IMPACTS ON VISUAL RESOURCES: MARKET ALTERNATIVE

Facility and/or Milepost	Sensitivity[a]	Duration of Impact[c]	Notes
MP MB-36-42	High[b]	Short	Crosses Prairie Dog Creek at edge of state park, 2 miles from Norton.
MP MB-60-83	High[b]	Short	Intersects U.S. 24 west of Stockton; crosses South Fork of Solomon River and near Rooks County State Park; south of Webster State Park.
MP MB-115-137	Medium to high[b]	Short	Rolling terrain with numerous creeks and heavy vegetation, Wilson Reservoir and Saline River (identified for study by HCRS) sport-recreation areas.
MP MB-172	Medium	Long	Microwave tower near State 4.
MP MB-324-330	Medium to high[b]	Long	This area is considered picturesque; Rock Creek close to wilderness trail, good riparian vegetation.
MP MB-347-366	Medium	Short to long	Close to Osage State Park, Bartlesville, crosses Caney River (identified for state study), rock outcropping and steep slopes.

TABLE 4-28 Concluded

Facility and/or Milepost	Sensitivity	Duration of Impact [c]	Notes
MP MB-373.5 Pump Station	Medium to high	Long	Contrast in scale, between pump station facilities and low-profile foreground.
MP MB-417-427	Medium to high	Short to long	Camping-recreation area, steep slopes, scenic.
MP MB-440-446	High[b]	Short to long	Pipeline crosses two state scenic rivers (Barren Fork and Illinois) through well vegetated mountainous region.
MP MB-482.5 Pump Station	High	Long	Contrasts with forested mountain setting in scale and texture.
MP MB-825 Pump Station	High	Long	Microwave tower near Ozark National Forest.
Dewatering Plant (Total Impacts)			
Oologah	High[b]	Long	Borders Will Rogers State Park and south end of Oologah Lake.

Note: Impacts caused by dewatering plants would be the same as those described for the proposed action (Table 4-23).

[a] Sensitivity denotes the proximity to human use areas, with high sensitivity attributed to areas used for recreation, sightseeing, and water-related outdoor experiences.

[b] Denotes potentially controversial consequences.

[c] Duration of impact indicated time period that visual changes are likely to be most obvious; short implies 2-5 years; long is 5 years and over.

would be crossed that have not been proposed for state or national protection but have been identified as having significant visual qualities. Other bodies of water where visual impacts would result from pipeline activity include the lakes and reservoirs where recreation or scenic experiences may be affected; these include Wilson Reservoir, Norton Reservoir, and Tenkiller Reservoir. Removal of vegetation along the pipeline right-of-way, or the addition of pump stations, access roads, and microwave towers in these areas, would result in visual contrasts in color, line, texture, and form to the natural landscape. In many instances, even temporary visual consequences would be sensitive in these environments.

Other sites where the market alternative construction activities could affect the scenic recreation experience include the eight parks, hiking trails, campgrounds, and forest lands within the "seen area" of the pipeline.

Additional visual consequences would occur where pipeline and pump station activities are visible by motorists at the eight mileposts near major roadways.

4.C CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

Impacts to water resources, socioeconomics, aquatic biology, agriculture, air quality, and recreation are discussed below for only that portion of the Cypress Bend pipeline-barge alternative that is not in common with the market alternative (MP PMB-1092 to B-81). Since the analysis identified no major impacts, the following topics are not discussed: vegetation, wildlife, cultural resources, transportation networks, visual resources, and ruptures and spills.

4.C.1 WATER RESOURCES

Surface Water

Impacts would be similar to those for the proposed action, with the exception that under this alternative, temporary turbidity effects in bayou/wetland areas of Louisiana would not occur.

4.C.2 SOCIOECONOMIC CONSIDERATIONS

Coal Preparation Plants and Water Supply System

Under the pipeline-barge alternative, the capacity of the North Rawhide preparation plant would be 18.9 MMTA and the capacity of the Jacobs Ranch preparation plant would be 8.5 MMTA. The result would be a redistribution of the construction work force nearer to Gillette (less than 10 miles from the North Rawhide plant). There are two possible effects. The shift of employment to the North Rawhide plant would lower the commuting distance traveled by the construction workers who would live in Gillette, and in addition there would be a marginal increase in demand for housing and services in Gillette. However, overall social and economic effects in the Wyoming area under the market alternative would not be significantly different from those caused by the proposed action.

Slurry Pipeline System

The social and economic consequences of construction, operation, maintenance, and abandonment would generally be of the same type and magnitude as those identified for the proposed action or market alternative. Those unique to the Cypress Bend lateral are shown in Tables 4-29 and 4-30.

Dewatering Plants

Construction. The pipeline-barge alternative dewatering plants would be identical to the market alternative as far as White Bluff; one additional plant would be located at Cypress Bend.

Employment and Population. Construction of the Cypress Bend dewatering plant, steam plant, and barge loading facility would generate some employment, population, and housing effects on local communities because of the generally rural character of southeast Arkansas and the distance from major labor pools (Table 4-29). The nearest cities are Greenville, Mississippi (57 miles), and Pine Bluff, Arkansas (77 miles). The site is relatively remote, and a large proportion of construction workers would have to move into the area during construction.

TABLE 4-29

EFFECTS OF CONSTRUCTION: CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

Area	County/ Parish	Project Components[a]	Existing Construction Labor Pool	Peak Fixed-Site Employment[b] Qtr/Yr	Total	Non-local	Peak Pipeline Employment Qtr/Yr	Total[c]	Non-local[c]	Estimated Peak Pop. In-Migration Fixed-Site	Pipeline[c]	Estimated Peak Housing Unit Demand Fixed-Site	Pipeline[c]	Hotel/Motel Units in Selected Communities
Cypress Bend, AR	Lincoln, Desha, Drew, Chicot, Ashley	PL, DP, BL	964 in 5 counties in 1977	1/84	715	608	3/84	390	195	1593	254	547	165	223 units in 4 communities

Source: Labor pool data are from WCC 1980d.

[a]PL = pipeline
DP = dewatering plant
BL = barge-loading facility

[b]Fixed-site employment includes construction and service sector employment.

[c]Assumes maximum (rough terrain) spread size as a worst case.

Table 4-30

EFFECTS OF OPERATION: CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

Area	County/ Parish[a]	Project Component[b]	Annual County Property Tax Revenues: 1976-77 Property Tax Revenues (x $1000)	Annual County Property Tax Revenues: Estimated ETSI Property Tax Revenues (1980 dollars) (x $1000)[d]	Annual County Property Tax Revenues: Percentage of 1976-77 Property Tax Revenues	Permanent Employment: Direct	Permanent Employment: Secondary	Estimated Population In-Migration
Cypress Bend, AR	Lincoln	PL	964	203	21	167	184	780
	Desha	PL, DP	2,233	162[c]	7			

[a]Only counties in which components are to be located are listed.

[b]PL = pipeline (pump station)
DP = dewatering plant
MB = maintenance base

[c]Pipeline only, does not include value of dewatering plant, plus terminal facilities.

[d]Estimated property taxes by county were estimated by ETSI for the EIS by extrapolating previously developed unit cost estimates for components and should in no way be construed as representing the cost estimate for the components. Values shown on this table were derived by ETSI as follows:

Sum of estimated cost of components in county (1980 dollars) x Statewide ratio of assessed value to market value x Percentage tax rate assumed for county = Estimated ETSI property tax revenues in 1980 dollars

Assuming the composition, source, and behavior of the construction work force for the ETSI project facilities at Cypress Bend would be similar to those of the work force that constructed the Potlatch paper mill, completed in Desha County in 1977, the ratio of local to nonlocal workers at Cypress Bend would be 15 percent local to 85 percent nonlocal. The paper mill is located less than 10 miles from the Cypress Bend site and had a peak force of 1000 workers, about 300 more than projected for ETSI-Cypress Bend facilities (Wilson 1980). Sixty percent of the total work force would be nonlocals who relocate temporarily to residences within 40 miles of the job site, and 25 percent of the total work force would commute on a daily basis from farther than 40 miles away (i.e., from places such as Pine Bluff and Little Rock and from Greenville, Mississippi, and Monroe, Louisiana) (Wilson 1980).

Of an estimated peak construction work force of 715 in the first quarter of 1984, some 608 would probably be nonlocal. Of these, 429 would probably relocate to the local area during construction and 179 would commute from 60 to 100 miles away. About 107 local workers would be employed at the peak.

Secondary employment that would be generated as a result of construction of the Cypress Bend site is estimated to be about 365 new service jobs, which would be spread throughout the local area (i.e., communities within 40 miles of the site, such as Arkansas City, McGehee, Dermott, and Dumas). Most of the estimated 365 new secondary jobs would be filled by present residents of local communities that host the nonlocal construction workers.

The pipeline spread construction work force for the Cypress Bend lateral would be 390. It is assumed that half would be nonlocal and half would reside within a 100-mile radius (which includes the Little Rock and Pine Bluff areas). There would be no significant secondary employment generated as a result of pipeline construction.

The population increase that would be attributable to the ETSI fixed-site construction at Cypress Bend is estimated to be a maximum of around 1593 persons. This in-migrant population would be distributed among communities within 40 miles of the site, and principally in Arkansas City, McGehee, Dermott, and Dumas. During pipeline construction in the third quarter of 1984, 275 nonlocal pipeline workers would be in the area. Total mobile pipeline population would be about 300 (Table 4-29).

Housing. The total estimated peak demand for housing units in the area would be a maximum of about 547 in the first quarter of 1984. Because rental housing of any kind is in very short supply, mobile homes would be the principal solution to the demand for housing by the in-migrant population.

Pipeline construction workers would demand an estimated 165 housing units in the area in the third quarter of 1984. This is over 75 percent of the 223 hotel and motel units in the four local communities, so some nonlocal pipeline workers would possibly have to commute daily from farther away (i.e., Pine Bluff, Monroe, Little Rock).

According to several local leaders, there would be no great problem in providing housing for the construction workers and their families that move to the area to construct the dewatering plant and barge facilities. During construction of the Potlatch paper mill, which employed 1000 at peak, local mobile home parks expanded their facilities and additional mobile homes were brought in. According to Mr. Merle Peterson of the Dumas Chamber of Commerce, there are 100 or more vacant mobile home spaces available in Dumas and the surrounding area. Mr. Peterson states that the communities had no serious problems accommodating the influx of people during the Potlatch mill construction, that the local citizens would welcome the growth opportunity, and that the area should be able to handle the ETSI construction period with no major problems (Peterson 1980).

Public Services. No significant stress on local public facilities and services is expected as a result of increased demands during construction of the dewatering plant and barge loading facility. With the exception of

Dermott, which needs an additional 300,000-gallon water storage tank, the local communities have excess capacity in both water and sewage disposal systems.

School districts in Arkansas City, McGehee, Dermott, and Dumas are expanding and upgrading facilities and could accommodate increases in enrollment during construction of the Cypress Bend facilities.

The Potlatch paper mill is contributing considerable property tax revenues to Desha County, and the local public services are fiscally healthy. For example, the Arkansas City School District receives some $600,000 per year from property taxes on the Potlatch paper mill and plans to construct a new high school.

Operation, Maintenance, and Abandonment. As shown on Table 4-30, signficant employment, population, and tax revenue effects would result from operations at the Cypress Bend dewatering plant and barge loading facility, where 167 direct jobs, an estimated 184 secondary jobs, and an estimated population increase of 780 persons are expected. New property tax revenues would benefit Desha County. The degree of benefit would depend upon the existing tax base and local decisions on how much to use the new source of revenues. Upon abandonment, direct jobs would be eliminated and property tax revenues, already reduced by depreciation, would decline further.

Employment and Population. In the Cypress Bend area, the estimated in-migrant population of 780 is expected to locate throughout the area, principally in the communities of Arkansas City, McGehee, Dermott, and Dumas.

Housing. An estimated 280 housing units would be required. Though permanent workers are expected to prefer single-family homes, at operation start-up mobile homes would probably be the dominant housing type for permanent personnel.

Public Services. Local public services would have to meet new demands created by the in-migrant permanent population. With one exception, the water and sewer services in the four communities surveyed have now or will soon have excess capacity available to meet increased demands. The exception is the Arkansas City water system, which serves 300 customers now and would have to be expanded to accommodate a significant increase in demand.

Public schools in Arkansas City, McGehee, Dermott, and Dumas currently have capacity for additional students. All four school districts are in good fiscal condition and have ongoing capital improvement programs. No problems are expected from increased enrollments.

Local fiscal conditions in Desha County and the Arkansas City School District have been improved considerably by the revenues from the new Potlatch paper mill. Arkansas City has just built a new fire station, and the school district is going to build a new high school. Estimated ETSI assessed value and property tax revenue that would accrue to Lincoln and Desha counties are compared to 1976-77 property tax revenues in Table 4-30.

4.C.3 AQUATIC BIOLOGY

Significant Impacts

River bottom habitats and their invertebrate communities would be destroyed or displaced where piles for the barge loading facility would be driven. This would be a locally significant (limited to the construction area), short-term biological impact. It is anticipated that a positive impact associated with the barge facility support columns would be their colonization by communities of aquatic invertebrates shortly after their placement in the river.

Insignificant Impacts

The Cypress Bend dewatering plant would discharge its clariflocculator overflow to the Mississippi River. Since this effluent would be required to meet National Pollutant Discharge Elimination System (NPDES) water quality standards, it is anticipated that there would be no detectable aquatic biological impact associated with the Cypress Bend dewatering plant discharge.

Construction of the barge loading facility would progress in stages and would extend over a period of 7 years (1982-1989). No dredging would be required, and the riverward dock face would be approximately 3000 feet long. It is anticipated that indigenous adult and juvenile fishes (Section 3.C.4.) would avoid the construction area, at least during construction activity. This displacement impact would be localized, intermittent (recurring during periods of construction activity), and biologically insignificant, since affected fishes would quickly reestablish in disturbed areas.

The primary physical effect of in-river construction activity, which would be anticipated to affect fish eggs and larvae, would be increased turbidity. The general biological impact of increased turbidity and siltation on fish eggs and larvae is described in Section 4.A.6 and is expected to be similar for the Mississippi fish fauna. ETSI's proposal to avoid construction dredging would be expected to minimize egg and larval mortality as a result of substrate in-filling and smothering. Nevertheless, some mortality would be expected, but the impact would probably be localized and biologically insignificant on a population level.

The potential for petrochemical spills exists on all construction sites. It is anticipated that low-volume spills originating from construction activities and equipment would have a limited, generally insignificant impact. Contamination of the Mississippi River by spilled materials would occur primarily during rainstorms, when they would be washed into the river through natural drainage channels. Since aromatics are generally the most lethal portion of these petroleum products, spills on land would lose their most volatile (i.e., toxic) components to evaporation before reaching the river.

According to the ETSI barge consultant, Meece Marine Enterprises, Inc., there would be no need for maintenance dredging at the barge loading facility. It is notable that maintenance dredging is considered to be the most significant impact associated with barge facilities and, as such, its elimination from the maintenance routine for ETSI's facility suggests that there would be no significant aquatic biological impacts associated with the routine operation and maintenance of the facility.

Two towboats per day would be used for coal transport; this would represent an increase in 9-foot-draw towboat traffic of approximately 17 percent in the lower Mississippi River (COE 1977).

Based on recent research results (Sparks 1975; Ragland 1974; COE 1976; Johnson 1976), increases in turbidity from ETSI tow traffic in the lower Mississippi River would probably be insignificant due to the naturally elevated ambient turbidity conditions and the low number of daily tows (one to two ETSI tows per day).

Wave wash as a result of barge river towboat traffic has received some attention by various state and federal biologists. As a towboat passes a point, there is a slight increase in the water level followed quickly by a rapid decrease in water level of approximately 1.5 feet at the shoreline. If there is a shallow slope on shore, a considerable portion of the river bottom is exposed. As the stern passes, the water rushes back in a series of waves. Narrow points with sloping shorelines would have a more pronounced wave action. A towboat could alter the rate and direction of flow inside channels.

The drawdown would expose benthic organisms along the shoreline. Mollusks will withdraw into their shells when exposed, with a resultant disruption of feeding and respiration. The other possibility is that the mollusks burrow deeper into the mud or retreat to deeper waters. These effects would normally be short-term and be of limited impact.

Fishes would probably not be affected by wave wash, as they would be able to leave the affected area and are normally subjected to wave action (Sparks 1975).

The proposed barge route is confined to the lower Mississippi River. Since the effects from waves are more significant in shallow and narrow rivers, wave wash in the deeper portions of the lower Mississippi River would be expected to be biologically insignificant.

4.C.4 AGRICULTURE

The construction, operation, maintenance, and abandonment of the Cypress Bend dewatering plant and barge loading facility (only facilities not associated with proposed action or market alternative) would take approximately 205 acres of potential prime agricultural land out of production for approximately 50 years (Table 4-20). The impact of this crop production loss would be relatively minor from a regional standpoint. Since this land area would be reclaimed during the abandonment phase of the project, this land would not be irreversibly converted to other uses and the viability of the land resource would not be significantly diminished.

4.C.5 AIR QUALITY

Coal Slurry Preparation Plants

For this alternative, the North Rawhide plant would process 18.9 MMTA of coal. This capacity represents about 85 percent of the 22.4-MMTA capacity of the Jacobs Ranch plant described for the proposed action (Section 4.A.9). Although air pollutant emissions are not directly proportional to processing capacity, the North Rawhide plant would probably result in pollutant concentration increases equal to about 80 to 90 percent of those discussed for the Jacobs Ranch plant in the proposed action. Processing capacities, and thus air quality impacts, of the other plants for this alternative would be much less. No violations of the ambient air quality standards would be expected.

Dewatering Plants

Impacts from operation of a coal-fired dewatering boiler would include emissions of particulates and gaseous pollutants. These emissions, and the pollutant concentration increases associated with them, are discussed in Appendix G-5. Dispersion modeling results indicate that ambient air quality standards would not be violated because of operation of the boiler.

Barge Loading Facility

Construction impacts would include temporary increases in fugitive dust and gaseous pollutant concentrations due to construction activities and equipment. These impacts are not expected to be significant. Noise impacts would be similar to those discussed for the coal slurry preparation plants.

The barge loading facilities would be sources of fugitive particulate emissions from the open coal stockpiles and the barge loading operations. The coal on the barges would also be a source of windblown particulates. These emissions would be strongly dependent on meteorological conditions at the site, and under certain conditions could cause high particulate concentrations near the facilities for short periods. Impacts on regional and/or long-term air quality would be expected to be insignificant. Emission estimates for stockpile wind erosion are presented in Appendix G-6.

Tugboats used to tow the barges would be sources of gaseous pollutants during operation. Estimates of these emissions are also presented in Appendix G-6.

4.C.6 RECREATION RESOURCES

Slurry Pipelines and Pump Stations

The only segment of pipeline where minor recreation consequences may result is the crossing at Bayou Bartholomew (B-24), a river inventoried by Heritage Conservation and Recreation Service in the nationwide inventory, Phase I, and by the state of Arkansas for consideration as a protected waterway. These consequences are considered insignificant because of their short duration.

Dewatering Plants and Barge Loading Facility

The site of the Cypress Bend dewatering plant is a relatively rural area where, unlike the locations of other dewatering plants, there is no existing power plant. The area is easily accessible and is desirable for casual recreation use. While the use of the site for the dewatering plant and barge loading facility would permanently remove the land as a recreation resource, the impact is not considered significant because there is substantial area still available nearby.

4.D COLORADO ALTERNATIVE

The Colorado alternative is an alternative northern pipeline segment that could be used in conjunction with the proposed action, market alternative, or Cypress Bend pipeline-barge alternative. Only impacts associated with the Colorado alternative segment (MP C-1 to C-602) are discussed here. The impacts to cultural resources, air quality, or transportation would be similar to those described for the proposed action (see Sections 4.A.3, 4.A.7, 4.A.9, 4.A.11, and 4.A.13).

4.D.1 WATER RESOURCES

Surface Water

Impacts would be similar to those for the proposed action, with the exception that the largest single hydrostatic test water discharge is estimated to be 49 acre-feet. This would correspond to a continuous discharge over 24 hours of approximately 25 cubic feet per second and would exceed the background flow at most crossings, except for major rivers. The effects of this impact are discussed in Section 4.A.1 under Surface Water.

4.D.2 SOCIOECONOMIC CONSIDERATIONS

Under the Colorado alternative pipeline route, the main slurry pipeline would follow a route nearly due south from Jacobs Ranch across the northeastern corner of Colorado (as opposed to crossing Nebraska) and east-southeast across Kansas to Rice County, where the Colorado route would rejoin the market alternative route. As a result, a different set of counties and communities would be in the affected area (Tables 4-31 and 4-32). The social and economic impacts of construction, operation, maintenance, and abandonment would generally be of the same type and magnitude as those identified for the proposed action. As under the other alternatives, the effects would not be significant.

4.D.3 SLURRY PIPELINE RUPTURES AND SPILLS

A spill between MP C-315 and C-325 of the Colorado alternative could result in some loss of greater prairie chicken strutting habitat. According to the Colorado Division of Wildlife, any loss of strutting habitat would result in a decrease in production and the possible abandonment of the ground by this state-protected species. In addition, a spill at Deception Creek (MP C-558), also of the Colorado alternative, could have an impact on the Cheyenne Bottoms State Waterfowl Refuge located 10 miles downstream from the stream crossing. The refuge is a critical staging area for whooping cranes and a nesting area for the state-protected (Kansas) interior least tern. Any loss of habitat in Cheyenne Bottoms as a result of sedimentation would be considered a long-term significant impact. The potential for bioaccumulation of heavy metals in the food chain of Cheyenne Bottoms could significantly affect the whooping crane and interior least tern, as well as waterfowl species, by possibly causing sterility and reduced production or even death in affected adults.

4.D.4 VEGETATION

The Colorado butterfly-weed will be added to the federal threatened and endangered species list by the Fish and Wildlife Service. This species may occur on the Colorado alternative route and will be addressed in the Memorandum of Understanding between the Bureau of Land Management and the Fish and Wildlife Service (Appendix D-4). Once the exact location of this plant is identified, the possible impacts and mitigation measures can be determined.

4.D.5 WILDLIFE

Wildlife species of special concern that could be affected by the Colorado alternative in Wyoming, Colorado, and Kansas include the sage grouse, black-footed ferret, bald eagle, golden eagle, greater prairie chicken, and whooping crane.

TABLE 4-31

EFFECTS OF CONSTRUCTION ON AREAS WITH PIPELINE AND PUMP STATIONS ONLY: COLORADO ALTERNATIVE PIPELINE ROUTE

Area	County/ Parish	1975 Pop.	Project Components[a]	Peak Fixed-Site Employment[b]			Peak Pipeline Employment			Estimated Peak Pop. In-Migration		Estimated Peak Housing Unit Demand		Hotel/Motel Units in Selected Communities
				Qtr/Yr	Total	Non-local	Qtr/Yr	Total[c]	Non-local[c]	Fixed-Site	Pipeline[c]	Fixed-Site	Pipeline[c]	
Southeast Wyoming	Goshen	12,000												
	Laramie	63,000	PL				3/84	748	562		731		337	1700 Cheyenne
	Platte	7,300												500 Scottsbluff
	Scotts Bluff, NB	36,200												
Northeast Colorado	Weld	107,400												
	Logan	19,500												
	Washington	5,500	PS, PS	4/83	49	38	2/84	748	562	insignificant	731	insignificant	337	400 Sterling
	Yuma	8,900		4/83	49	38				insignificant		insignificant		
	Morgan	21,800												
West Kansas	Cheyenne	4,100												
	Sherman	8,200												
	Thomas	8,100												
	Sheridan	4,000												
	Gove	4,000	PL, PS	4/83	49	24	3&4/83	748	374	insignificant	486	insignificant	226	309 Colby
	Trego	4,500												741 Hays
	Ellis	25,500												
	Rush	5,000												
	Barton	30,900												
	Ellsworth	6,200												
	Rice	12,000												

Source: Population data are from U.S. Bureau of the Census 1978.

[a]PL = pipeline
PS = pump station

[b]Fixed-site employment includes construction and service sector employment.

[c]Assumes maximum (rough terrain) spread size as a worst case.

TABLE 4-32

EFFECTS OF OPERATION ON AREAS WITH PIPELINE AND PUMP STATIONS ONLY: COLORADO ALTERNATIVE PIPELINE ROUTE

Area	County/ Parish[a]	Project Component[b]	Annual County Property Tax Revenues: 1976-77 Property Tax Revenues (x $1000)	Estimated[c] ETSI Property Tax Revenues (1980 dollars) (x $1000)	Percentage of 1976-77 Property Tax Revenues
Southeast Wyoming	Goshen	PL	2,628	1,286	49
	Laramie	PL	14,620	721	5
Northeast Colorado	Weld	PL,PS	39,950	860	2
	Logan	PL	7,074	550	8
	Washington	PL	2,686	400	15
	Yuma	PL,PS	3,467	1,250	36
West Kansas	Cheyenne	PL	1,112	540	49
	Sherman	PL	3,118	150	5
	Thomas	PL	4,472	620	14
	Sheridan	PL	1,710	160	9
	Gove	PL	2,947	340	17
	Trego	PL	1,608	430	27
	Ellis	PL,PS	6,002	600	9
	Rush	PL	2,500	370	14
	Barton	PL	9,368	370	4
	Ellsworth	PL	2,062	760	3
	Rice	PL	4,515	340	8

Note: There would be no direct or secondary permanent employment and no population in-migration.

[a] Only counties in which components are to be located are listed.

[b] PL = pipeline
PS = pump station

[c] Estimated property taxes by county were estimated by ETSI for the EIS by extrapolating previously developed unit cost estimates for components and should in no way be construed as representing the cost estimate for the components. Values shown on this table were derived by ETSI as follows:

Sum of estimated cost of components in county (1980 dollars)	x	Statewide ratio of assessed value to market value	x	Percentage tax rate assumed for county	=	Estimated ETSI property tax revenues in 1980 dollars

Sage Grouse

No sage grouse strutting grounds are expected to be directly crossed by the Colorado alternative in Wyoming. However, between about MP C-60 and C-75 several strutting grounds could occur as close as a half-mile from the pipeline right-of-way. Construction is scheduled in this area during September 1984. Since the sage grouse breed in May and June, no impact would be expected to breeding birds. The chance does exist that a strutting ground could be traversed, although the resulting impact would be local and insignificant.

Greater Prairie Chicken

In Colorado, the greater prairie chicken is listed as endangered by state-level endangered species legislation. Between about MP C-315 and C-325 of the Colorado alternative (northwest of Wray), there is concern for a remnant population of greater prairie chickens. According to the Colorado Division of Wildlife (1980), if the alignment passes through greater prairie chicken strutting grounds, these areas could be permanently abandoned, resulting in a significant, long-term impact on the species.

Whooping Crane

In Kansas the whooping crane occurs only as a transient visitor during March, April, and October (Platt et al. 1974). Cheyenne Bottoms State Waterfowl Refuge in Barton County, Kansas, is designated as critical habitat for migrating whooping cranes. The Colorado alternative would run approximately 5 miles north of the refuge. Queal and Wood (1980) indicated that at this distance, the whooping cranes would not be disturbed by pipeline construction. However, concern exists that a slurry spill in Deception Creek would severely affect Cheyenne Bottoms and consequently the whooping crane's critical habitat (Queal and Wood 1980). The Colorado alternative would cross Deception Creek at MP C-558 in Barton County, Kansas. A major rupture in Deception Creek could cause a reduction in suitable whooping crane habitat in Cheyenne Bottoms. The effects of a potential spill in Deception Creek are described in more detail in the Threatened and Endangered Species Technical Report (WCC 1980f) and in the Ruptures and Spills section here (Section 4.D.3).

Golden Eagle

The most probable area for the occurrence of golden eagle nests would be between about MP C-210 and C-240 in the Pawnee Buttes area northeast of Greeley, Colorado (L. Carlson 1980). If golden eagles were nesting along or near any of this alignment, construction of this alignment could result in the loss or abandonment of the nest site. Construction in this area is scheduled for early April. The golden eagle nests as early as late February in this area. Consequently, the potential exists for construction disturbing golden eagles during nesting in Colorado. Therefore a "may affect" designation exists for the golden eagle until field surveys can determine the precise proximity of nest sites to the actual construction corridor.

Other Species

Potential impacts to the black-footed ferret and bald eagle would be the same as those described for the proposed action in Section 4.A.5.

4.D.6 AQUATIC BIOLOGY

Significant and insignificant impacts associated with construction, operation, maintenance, and abandonment of the Colorado alternative coal slurry pipelines and pump stations, would be similar in nature and extent to impacts discussed in Section 4.A.6, except for potential impact to two "threatened" fishes.

Threatened and Endangered Species

Construction of the Colorado alternative slurry pipeline would be anticipated to occur during the low-flow months of August and September, which would avoid probable spawning periods (April through June) for the Plains orangethroat darter (in Colorado) and the Topeka shiner (in Kansas). Since construction would not coincide with spawning periods, no significant impact is anticipated (see discussion in Section 4.A.6).

If untreated hydrostatic test water were discharged into the Topeka shiner or Plains orangethroater darter's streams, some individuals may be affected as described in Section 4.A.6, or they may be killed.

4.D.7 AGRICULTURE

The construction, operation, and maintenance of the five Colorado alternative slurry pump stations (not associated with the proposed action or market alternative) would take 25 acres (pump station C-6 in Kansas, Table 4-20) of prime agricultural land out of production for approximately 50 years. The impact of this potential crop production loss would be relatively minor from a regional standpoint. During the abandonment phase of the project, all surface facility land areas would be reclaimed; therefore these land areas would not be irreversibly converted to other uses and their viability would not be significantly diminished.

4.D.8 RECREATION RESOURCES

Recreational consequences resulting from the Colorado alternative would occur at the Fort Laramie National Historic site in Wyoming, at the pipeline crossing of the Arikaree River in Colorado (inventoried by Heritage Conservation and Recreation Service for national protection), and the Pawnee Buttes landmark in Colorado. The impacts are directly related to the changes in visual quality resulting from construction activities and are considered of short duration (1-2 growing seasons). The effect of these changes on the quality of the recreation experience would be significant only during peak visitor months.

The microwave tower located near Cedar Bluff State Park could affect the quality of the recreation experience through visual intrusions.

4.E COAL CLEANING OPERATION ALTERNATIVE

The coal cleaning alternative would involve an additional processing function at the coal preparation plants and would be located within the preparation plant boundaries. This alternative would not result in any additional impacts besides those already discussed for the proposed action at the preparation plants for water resources (Section 4.A.1), vegetation (Section 4.A.4), wildlife (Section 4.A.5), cultural resources (Section 4.A.7), agriculture (Section 4.A.8), air quality (Section 4.A.9), transportation networks (Section 4.A.11), and visual resources (Section 4.A.12). This alternative would result in additional environmental impacts only for socioeconomic considerations, aquatic biology, and recreation resources, as discussed below. The additional requirement of 300 acre-feet of water per year for the coal cleaning alternative was included in the proposed action to provide a worst-case analysis.

4.E.1 SOCIOECONOMIC CONSIDERATIONS

Construction

Population and Employment. Construction of the three coal cleaning plants as part of the preparation plants would require 25 percent more manpower (about 300 people) than under the proposed action, market alternative, or pipeline-barge alternative. The resultant increment in in-migrant population would place additional demands on Gillette and the other Wyoming communities, particularly Niobrara County and the town of Lusk. This increment would add marginally to the impacts created by the proposed action, market alternative, or pipeline-barge alternative.

The demand for housing during construction would be increased, and more temporary housing units would be necessary.

Public Services. Construction-period stress on public services and facilities would be marginally increased, but there is excess capacity so there would be no problem providing additional water, sewer, or school services.

Operation, Maintenance, and Abandonment

Population and Employment. Operation of the three coal cleaning plants would be integrated within the three preparation plants and would require about 25 percent more permanent ETSI-related workers (Table 1-21). Secondary employment would be increased by 25 percent over projected ETSI-related employment in response to the greater number of jobs.

Housing. Although the increment in long-term demand for housing in the Gillette area would be greater than without the coal cleaning plants, the net increase in total housing would be under 2 percent.

Public Services. Facilities would experience a 25 percent greater increment in demand under the coal cleaning alternative than they would without coal cleaning.

4.E.2 AQUATIC BIOLOGY

The coal slurry preparation plant impacts identified in Section 4.A.6, would be further aggravated by the rejection of at least 200 tons/year of coal from each of the facilities as a result of the coal cleaning operation. The cumulative impact of this alternative in conjunction with preparation plant and mine impacts would probably be a reduction in the number and diversity of invertebrates using the affected stream habitats, which would result in a complementary reduction in the abundance and diversity of fishes.

4.E.3 RECREATION RESOURCES

The total population increase associated with this alternative would be greater than that estimated for the proposed action. The impacts anticipated from this additional increase would be minimal in most cases. These impacts would be experienced in the park areas in Gillette and Campbell County. However, since both areas already have substantial parkland acreage and requirements for parks to be set aside as new areas are developed, it is not expected that the increment in population associated with this alternative would cause significant impacts on local recreation facilities.

4.F CROOK COUNTY ALTERNATIVE WATER SUPPLY SYSTEM

This alternative is similar to the well field for the proposed action; hence many of the impacts are the same and are not repeated in this section. For a discussion of impacts to these resources, refer to Section 4.A.4 (vegetation), 4.A.7 (cultural resources), 4.A.10 (recreation), 4.A.11 (transportation networks), and 4.A.12 (visual resources). See Section 4.A.3 for a discussion of the likelihood of a pipeline rupture and the impacts of a resulting spill.

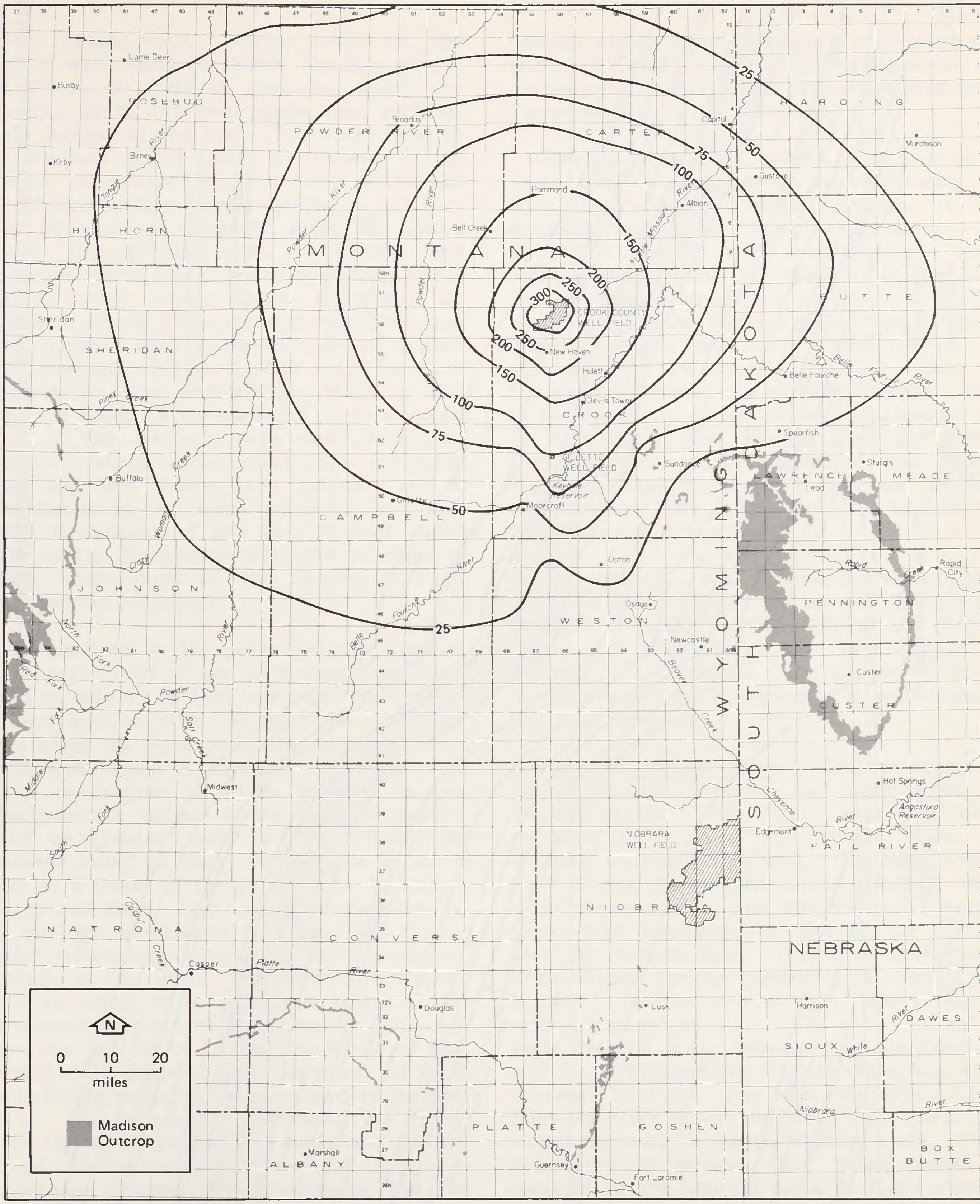
4.F.1 WATER RESOURCES

Ground Water

Water Levels. Pumping of approximately 1 million acre-feet of water from the Madison aquifer at the Crook well field over the ETSI project's 50-year design life (1985-2035) would result in large declines in the potentiometric surface of the Madison aquifer system (Map 4-3 and Figure 4-5). Drawdowns greater than 25 feet in the Madison potentiometric surface would occur within a region of about 16,700 square miles centered on the Crook County site after 50 years of pumping. This region encompasses parts of Crook, Campbell, Johnson, Sheridan, and Weston counties in Wyoming; Carter, Powder River, and Rosebud counties in Montana; and Butte, Harding, and Lawrence counties in South Dakota. Drawdowns greater than 100 feet due to pumping would occur in a region of more than 3000 square miles in Weston, Powder River, and Carter counties. Drawdowns greater than 200 feet due to pumping would occur only within a radius of 10 miles (470 square miles) from the Crook County well field.

The cone of depression is asymmetrical due to variations in the hydrogeologic properties within the Madison aquifer system (Map 4-3). The extent of the cone of depression is limited southeast of the Crook County well field by the Madison aquifer recharge areas in the Black Hills region. The recharge areas and the low-transmissivity zone along the Black Hills monocline are the cause of the irregular shape of the contours south and southeast of the well field. The steeper contours northeast of the Crook County well field are the result of the low transmissivity in the Madison aquifer system north of the trend of the Lake Basin fault zone.

Many existing Madison and Minnelusa water users would have increased pumping lifts as a result of the declines in the potentiometric



Map 4-3. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING FROM CROOK COUNTY WELL FIELD ONLY (PLAN 3)

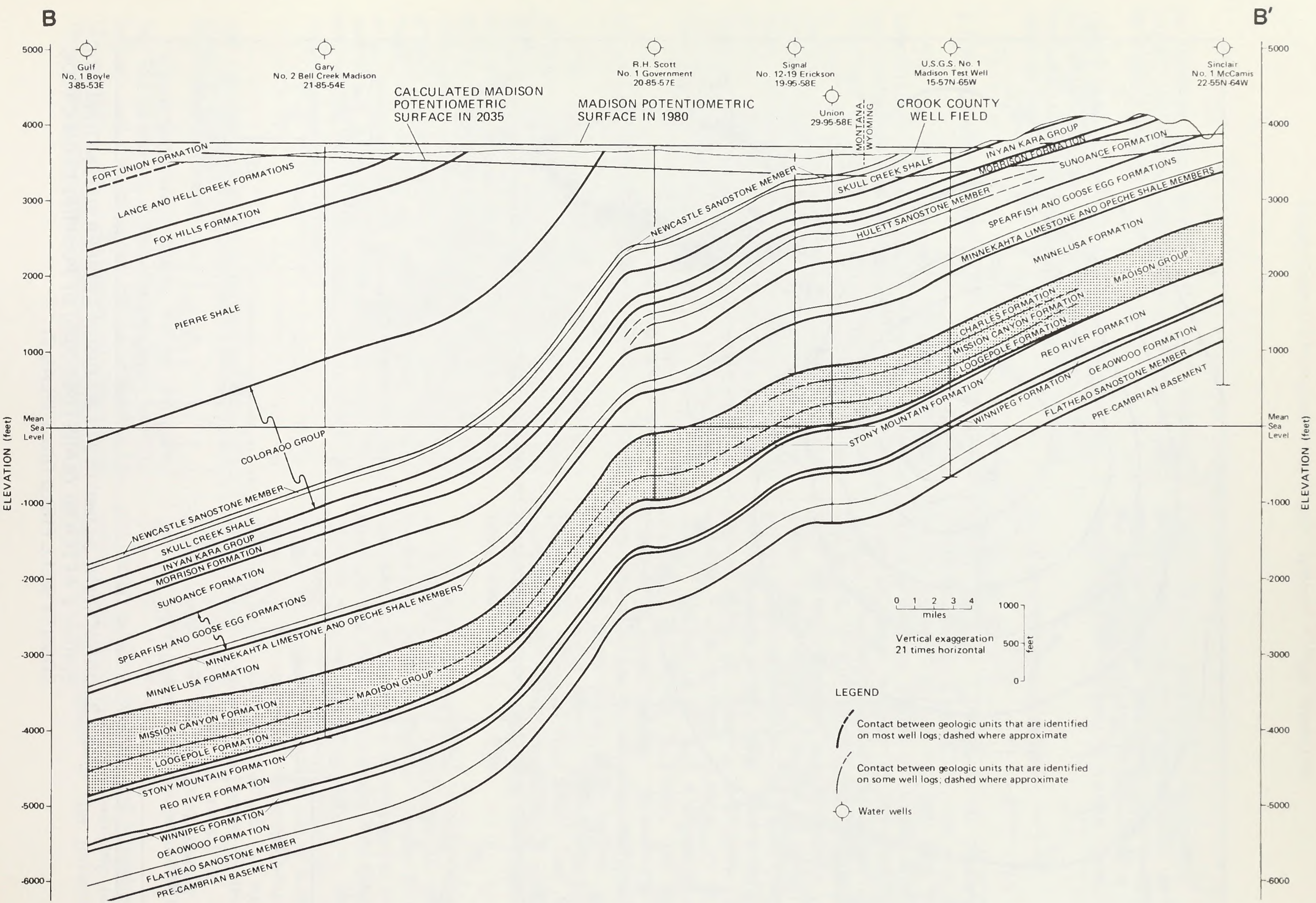


Figure 4-5. DRAWDOWNS IN THE MADISON POTENTIOMETRIC SURFACE AFTER 50 YEARS OF PUMPING FROM THE CROOK COUNTY WELL FIELD ONLY (PLAN 3)

Note: See Map 3-3 for location of cross section B-B′.

surface (Table 4-2). Water levels at the Madison wells used for water flooding at the Bell Creek oil field in Montana, which are currently 40 to 200 feet above land surface, would decline by 162 feet. The water level in the Madison water well at Devils Tower National Monument, which is now within 20 feet of land surface, would decline by 144 feet after 50 years of pumping from the Crook County site (Figure 4-6). Madison and Minnelusa water levels in the Spearfish, South Dakota, area, where large quantities of Minnelusa ground water are currently produced from artesian wells for irrigation, would decline by approximately 40 feet. This would result in a substantial flow reduction in many of the irrigation wells. A drawdown of 55 feet would occur at the Madison wells near Sundance, Wyoming, where water levels are currently about 400 feet below land surface; and a drawdown of 51 feet would occur at the Upton wells. Drawdowns of less than 25 feet would occur in the Newcastle area and 31 feet at Osage, where most of the current Madison water production occurs.

The declines in the potentiometric surface in the upper part of the Minnelusa Formation would be only a few feet less than those in the Madison aquifer after 50 years of pumping. Many small oil field wells that produce from stratigraphic traps in the upper Minnelusa exist within the region in which declines in the potentiometric surface of the upper Minnelusa would be greater than 25 feet. Reservoir pressures would be likely to decrease in these fields as a result of the pumping at the Crook County well field. Due to the complexities of the geology associated with the oil fields, further refinements concerning impacts cannot be made at this time. The impacts, however, would be equal to or less than those in the corresponding rock unit at equivalent distances from the well field. The reliability of the calculated drawdowns were assessed using a Monte Carlo technique as discussed in Section 4.A.1. The probability distribution of drawdowns in the Madison aquifer calculated at the city of Gillette well field show that there is a 98 percent chance that drawdowns will be greater than 46 feet, a 50 percent chance that drawdowns will be greater than 76 feet, and a 2 percent chance that drawdowns will be greater than 120 feet. The reliability estimates are discussed in detail in the Well-Field Hydrology Technical Report (WCC 1980b).

Once pumping has ceased, water levels in these wells would recover rapidly during the first few years and would continue to rise gradually thereafter (Figure 4-5). Water levels at Bell Creek oil field Madison wells would recover 92 feet from the 150-foot decline after the 50-year period of pumping (Table 4-4). The water level in the Madison water well at Devils Tower National Monument would recover approximately 119 feet after 50 years of recovery. Madison and Minnelusa water levels in the Spearfish, South Dakota, area would rise 13 feet during the 50-year recovery period. Madison wells near Sundance and Upton, Wyoming would recover 10 feet and 14 feet, respectively, from their respective 55-foot and 51-foot pumping declines.

Water Quality. The concentration of total dissolved solids (TDS) in the well field would increase gradually over the life of the project, from 900 milligrams per liter (mg/l) to 910 mg/l. Changes in TDS concentrations at Madison water wells currently in use would be less than 1 percent.

Spring and Stream Flow. Ground-water discharge to the streams and springs in the vicinity of the Crook County well field would decrease as a result of pumping from the Madison aquifer (Table 4-3). The base flow of Sand Creek in eastern Crook County would decrease by 4 cfs. The base flow of Spearfish Creek was calculated to decrease by 1 cubic foot per second (cfs). The total discharge of Crow Creek Springs, near the McNenny Fish Hatchery in Lawrence County, South Dakota, would decrease by 2 cfs. The base flow of the Belle Fourche River between Keyhole Reservoir and the Wyoming-South Dakota state line would decrease by 4 cfs. The base flow of the Little Missouri River above the state line in Wyoming would decrease by approximately 1 cfs. These reductions in stream flow would result in impacts to the aquatic biota of these streams as discussed in Section 4.F.4. Additional data concerning the flow characteristics of these

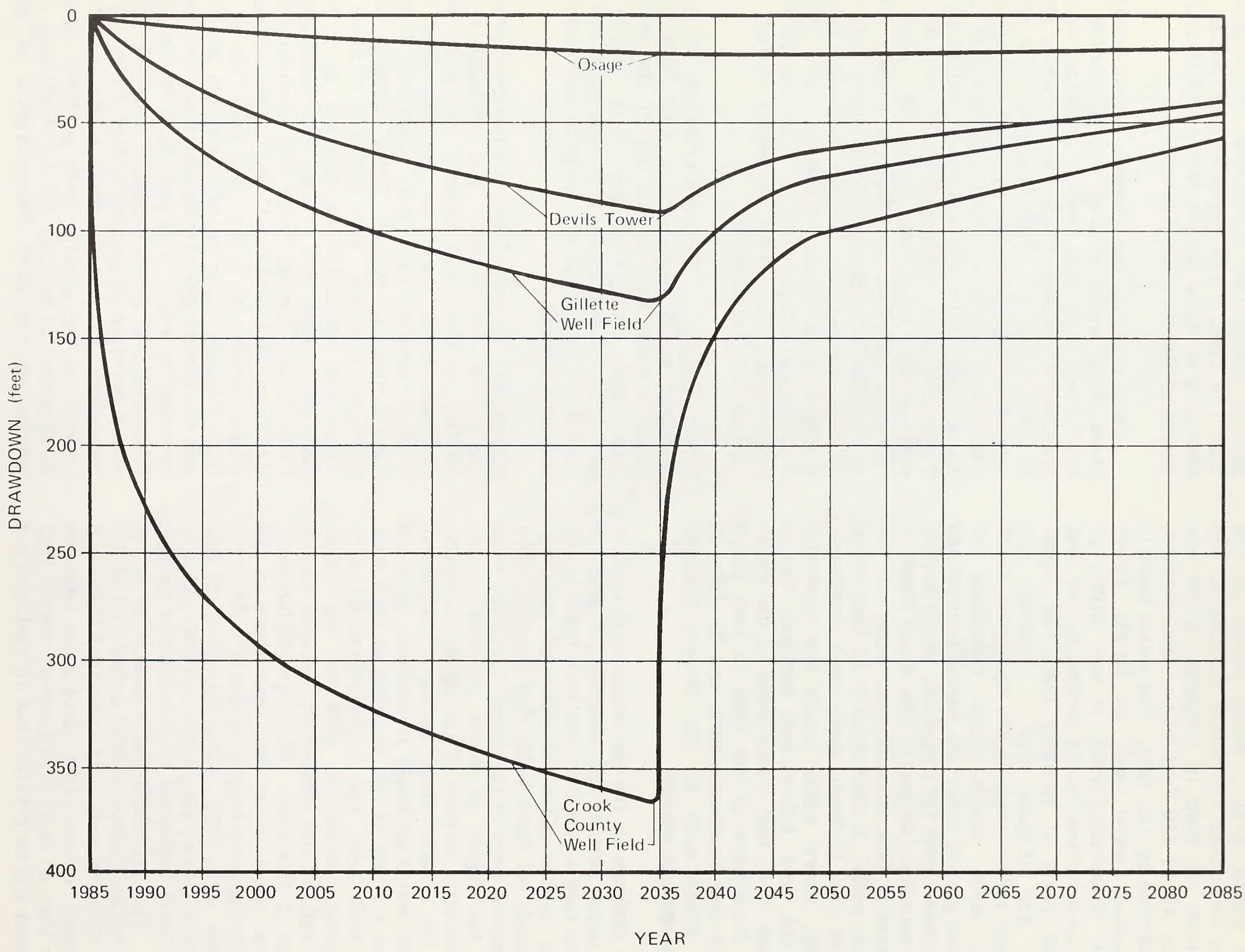


Figure 4-6. TIME-DRAWDOWN PLOT WITH PUMPING FROM CROOK COUNTY WELL FIELD ONLY (PLAN 3)

streams is contained in Appendix I of the Well-Field Hydrology Technical Report (WCC 1980b) and the Aquatic Biology Technical Report (WCC 1980g).

Crook County Alternative with Gillette Supplemental Water

Water Levels. Pumping 1 million acre-feet of ground water from the Madison aquifer system during the period 1985-2035 would cause large drawdowns in the potentiometric surface of the Madison (Map 4-4). The cone of depression in the Madison aquifer system and the calculated spring flow and stream flow reductions are similar to those calculated for pumping from the proposed Crook County well field alone, except that the cone of depression is more asymmetrical. The pronounced asymmetry is the result of the low-transmissivity zone along the Black Hills monocline, which is located west of the Gillette well field.

With both the Crook County and Gillette well fields pumping simultaneously, drawdowns would be somewhat greater than those for Plan 3 at Osage, Upton, Sundance, and Devils Tower. Drawdowns of 50 feet, 95 feet, 74 feet, and 179 feet would occur at Osage, Upton, Sundance, and Devils Tower, respectively, after 50 years of pumping (Table 4-2, Figure 4-7). Drawdowns at the Bell Creek, Montana, wells would be 127 feet; this is 35 feet less than drawdowns calculated for Plan 3. Drawdowns in the Belle Fourche and Spearfish areas of South Dakota would be 5 and 2 feet less than drawdowns for Plan 3.

Water Quality Changes. The TDS concentrations of the ground water would increase gradually from 900 to less than 910 mg/l at the Crook County well field over the life of the project, and TDS concentrations would increase gradually from 600 to 620 mg/l at the city of Gillette well field over the life of the project. This would not significantly change the treatment requirements.

Spring Flow and Stream Flow Reduction. Stream and spring flow reductions would be the same as those for Plan 3, except that the base flow of Stockade-Beaver Creek would decrease by 1 cfs instead of 0 cfs (Table 4-3). Aquatic impacts resulting from these reductions are discussed in Section 4.F.4.

4.F.2 SOCIOECONOMIC CONSIDERATIONS

Construction

It is assumed that the Crook County well field, located about 40 miles northeast of Gillette, would have approximately half the manpower demands of the Niobrara County well field.

It is generally expected that new workers would migrate to the region and settle principally in Crook County, with only a few locating in Campbell County. Those locating in Crook County would most likely settle in Sundance, Moorcroft, or Hulett. The net effect on population, housing, and public services would not be significant. It is expected that the population increase in the county would be about 2.7 percent. The impact to the individual communities is expected to be about the same. Table 4-33 indicates the relative changes in employment, population, and housing that would be attributable to this alternative.

Since there is already adequate water and sewer capacity in each of these communities to handle the projected population increases, no adverse impacts to public services are anticipated.

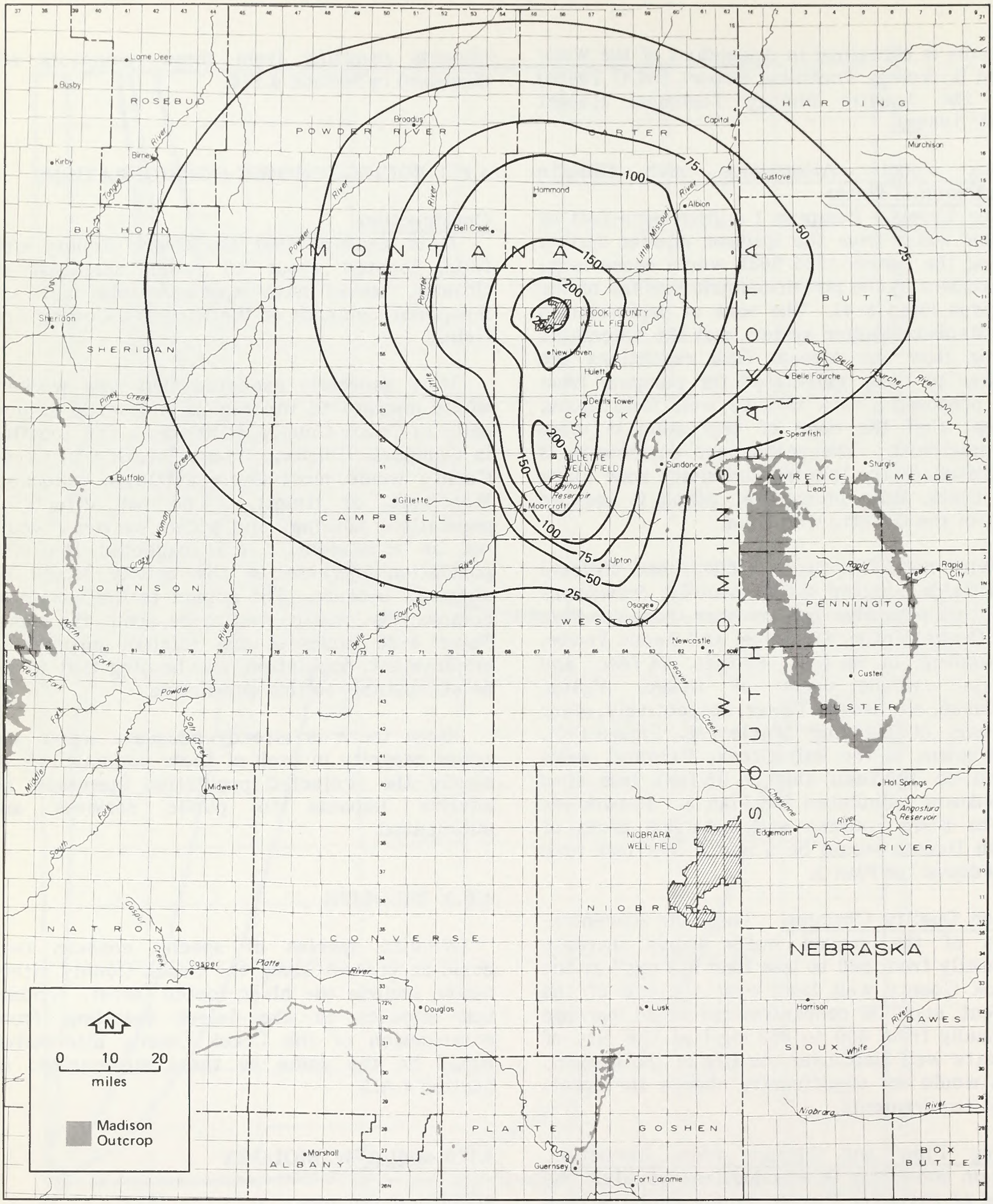
4.F.3 WILDLIFE

Wildlife species of special concern that could be present along the Crook County alternative include the black-footed ferret. Potential impacts to the ferret resulting from construction of the Crook County alternative would be the same as those summarized in Section 4.A.5.

4.F.4 AQUATIC BIOLOGY

Significant Impacts

Water Wells. Determination of the significance of biological impacts resulting from anticipated



Map 4-4. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING FROM CROOK COUNTY AND GILLETTE WELL FIELDS (PLAN 4)

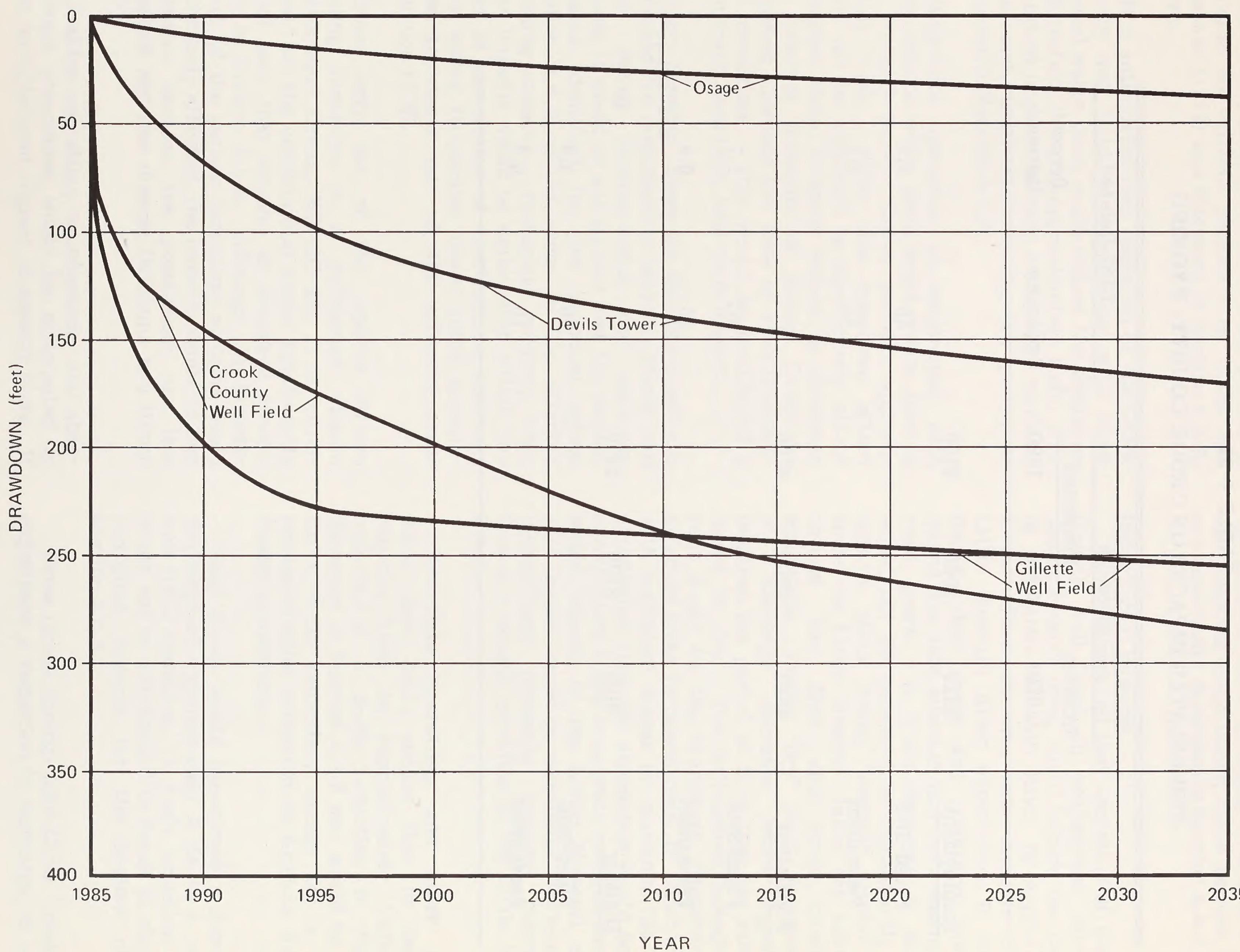


Figure 4-7. TIME-DRAWDOWN PLOT WITH PUMPING FROM THE CROOK COUNTY AND GILLETTE WELL FIELDS (PLAN 4)

TABLE 4-33

ETSI-RELATED IMPACTS ON CROOK COUNTY, WYOMING

	Baseline			ETSI-Related	
	Existing	Projected			
	(1979)	1984	1990	Employers	Percent Increase
Employment	2339	2500	2750		
Fixed-Site				80	3.2
Permanent				13	4.7
Population	5661	6000	6700		
Fixed-Site				161	2.7
Permanent				25	0.4
Housing	2000	2100	2400		
Fixed-Site				69	3.3
Permanent				10	0.4

Crook County alternative well field drawdown is based on criteria published by Binns and Eiserman (1979) and discussed in Section 4.A.6, above.

It is anticipated that operation of the Crook County well field, in conjunction with other planned water uses, could reduce the discharge of Spearfish Creek by approximately 1 cfs. The biological impacts of such a reduction could be significant, particularly during dry years, as discussed in Section 4.A.6.

Well-field operation, in conjunction with other planned water uses, could reduce flow in the Stockade-Beaver Creek drainage approximately 1 cfs. While this drawdown effect would not be expected to significantly affect mainstem biota, it could reduce or eliminate the fisheries potential of Beaver Creek by producing extended low flow or even intermittent conditions. This would be considered a significant, localized, long-term impact.

Delivery Pipeline. Since the delivery pipeline is scheduled for construction between March and June, during flowing-water and spawning periods, it would be anticipated that the various impacts identified for the proposed action (Section 4.A.6) would occur in the affected Wyoming streams. Biological recovery from these impacts would be anticipated within two years of completion of construction, however, since spring floodwater would scour accumulated sediments out of the affected areas (Gammon 1970).

Since only one of the pipeline stream crossing locations is a permanent stream (Cottonwood Creek, MP CC-29), it is anticipated that the construction would significantly affect only that stream, as discussed generically in Section 4.A.6. Although the invertebrates of the various temporary streams would be similarly affected, the impacts would be less extensive because the populations are less abundant and less diverse (Williams and Hynes 1977).

Routine operation, maintenance, and abandonment procedures would be anticipated to have no significant impact on aquatic biota. If the pipeline were to rupture, however, significant impacts could occur; these various impacts are generically described in Section 4.A.6.

Insignificant Impacts

It is anticipated that operation of the Crook County well field, in conjunction with other planned water uses, could reduce the discharge of the Little Missouri River by approximately 1 cfs. Flow duration data indicate that the Little Missouri River experiences 0 discharge during "dry" years and maintains low flows during the late summer and fall months during most years. A 1-cfs decrease in discharge would not be expected to significantly affect aquatic biota during "normal" rainfall years, since the Little Missouri fauna are adapted to natural low flow and even intermittent conditions. During "dry" years, however, a 1-cfs discharge decrease could significantly lengthen the period of time that the streambed would be dry. The anticipated biological impact would be the temporary displacement of affected biota to downstream or tributary areas with sufficient water to maintain life. It is anticipated that the streambed would be recolonized from these temporary refuges when flow would resume in the Little Missouri channel. This impact would be considered short-term and insignificant primarily because intermittent flow is a natural condition in the Little Missouri River.

Well-field operation, and other planned water uses, could reduce flow in the Belle Fourche River by approximately 4 cfs. The impacts of a 2-cfs reduction in flow are discussed in Section 4.A.6 and would be similar for a 4-cfs reduction, except for a limited (unquantifiable) reduction in Keyhole Reservoir fishery production.

Sand Creek would experience a decrease in discharge of approximately 4 cfs as a result of well-field operation. A 4-cfs reduction in flow would not be anticipated to result in significant biological impacts for the reasons cited in Section 4.A.6.

Crow Creek Springs (and Crow Creek) could experience a reduction in discharge of approximately 2 cfs as a result of well-field operation. A 2-cfs decrease would represent a decrease of approximately 11 percent in both low flow and average daily flow discharge (approximately 17.5 cfs). As discussed in Section 4.A.6, such a decrease in Crow Creek would not be anticipated to significantly affect the fisheries productivity of Crow Creek.

4.F.5 AGRICULTURE

The construction, operation, and maintenance of the Crook County alternative water pipeline pump station and well field would not affect any prime agricultural land.

4.F.6 AIR QUALITY AND NOISE

Construction

Impacts at water wells, pipelines, and access roads would include temporary increases in fugitive dust and gaseous pollutants. These impacts are not expected to be significant. Estimates of fugitive dust emissions, calculated using emission factors presented in Appendix G-1, are provided in Appendix G-7.

4.G OAHE ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would replace the Niobrara County well field as a source of water for the proposed action. Since this alternative consists of only a pipeline and pump stations, there would be no impact to ground water and in particular to the Madison Formation and its users. For other resources, such as vegetation, cultural resources, air quality, transportation networks, and visual resources, the types of impacts would be the same as those discussed for the proposed action in Sections 4.A.4, 4.A.7, 4.A.9, 4.A.11, and 4.A.12, respectively. In addition, impacts resulting from a rupture and subsequent spill would be similar to those described in Section 4.A.3, except any spilled material would contain only water.

4.G.1 WATER RESOURCES

Surface Water

The total Missouri River inflow into the Oahe Reservoir averages approximately 21,000,000 acre-feet per year (N. Carlson 1980). Studies conducted by the U.S. Army Corps of Engineers (N. Carlson 1980) on withdrawals of 2-6 million acre-feet per year showed negligible effects upon the reservoir for all conditions except major droughts, which resulted in only minor drawdowns. The proposed withdrawal of 30,200 acre-feet (less than 0.15 percent of annual inflow) is not, therefore, expected to generate a measurable change in reservoir levels.

4.G.2 SOCIOECONOMIC CONSIDERATIONS

Construction

Population and Employment. No major adverse socioeconomic effects would be likely in South Dakota during construction of the 280-mile water pipeline through western South Dakota and Wyoming from the Oahe Reservoir to the preparation plants.

Approximately 75 percent of the construction work force would be nonlocal. The other 25 percent would be available from the Pierre and Rapid City labor markets. Only the Wyoming segment of the water line may require as much as 100 percent of the construction work force to be imported from outside the region. Construction of the Oahe water supply system would not cause any socioeconomic effects in Wyoming significantly different from those of the proposed action.

Housing. There would be no significant effect on local housing as a result of construction of the Oahe alternative water supply system. Nonlocal construction workers on the Oahe pipeline would require temporary housing in communities along the route. The pipeline alignment is roughly parallel to U.S. Interstate 90, a heavily traveled east-west route, and there are numerous and adequate motel accommodations available in Pierre, Wall, Rapid City, Spearfish, and other smaller communities in South Dakota. The contractor would most likely establish temporary spread headquarters in Pierre, Rapid City, and Gillette, and mobile construction workers would look there first for accommodations.

In Wyoming, temporary quarters for mobile pipeline construction workers may be more difficult to find. The socioeconomic impacts on Gillette and other Wyoming communities would not be significantly different under the Oahe alternative from what they would be under the proposed action.

Operation, Maintenance, and Abandonment

Population and Employment. Operation of the Oahe water pipeline would employ about 12 persons. Pump stations would be automated and would require no permanent operations personnel. No significant secondary employment would be created in the communities along the route.

4.G.3 WILDLIFE

Wildlife species of special concern that could occur along the Oahe alternative water supply system include the mule deer, black-footed ferret, northern swift fox, bald eagle, whooping crane, golden eagle, and interior least tern. In addition, concern has been expressed for potential impacts to sharptailed grouse dancing grounds (courtship areas), but no details of where they would occur along the Oahe alternative route in South Dakota have been identified (L. Carlson 1980).

Mule Deer

Between approximately MP O-195 and O-220, an important winter range area of mule deer in Wyoming would be traversed by the Oahe alternative (Nimick 1980). One concern (Nimick 1980) is that if construction occurred through this area in winter when the deer were present in large numbers, a significant impact to the regional population could occur. If the alignment were constructed through this area in a season other than winter, no significant impact to mule deer would occur (Nimick 1980). The current assumed schedule does not allow identification of when construction would occur in this area. Operation, maintenance, and abandonment of this route in Wyoming would not affect the mule deer.

Northern Swift Fox

The northern swift fox could occur in prairie dog towns along the entire Oahe route through South Dakota (Sharps 1980). Although the chances of destroying individuals during construction is probably negligible, construction near dens could displace some individuals. If dens are not destroyed by construction, the swift fox may return after construction in the area ceases. Others may be permanently displaced. If construction occurs in areas containing females and whelps, the females may be forced to abandon the young. Some individuals may be lost if construction occurs in the spring. A loss of individual swift foxes would be considered a significant impact in South Dakota.

Black-Footed Ferret

The black-footed ferret could possibly occur along most of the Oahe alternative pipeline corridor in Wyoming and South Dakota. Potential impacts to the ferret would be the same as previously described in Section 4.A.5.

Bald Eagle

Since no nests are known in the affected areas and roost trees would not be destroyed during construction, no significant impacts to the bald eagle are expected.

Whooping Crane

Since there are no known staging areas currently being used by whooping cranes along the Oahe alternative, no impacts would be expected.

Interior Least Tern

Recent nesting records of the interior least tern in portions of South Dakota that would contain Oahe alternative components do not exist (South Dakota Ornithologists Union 1978). Consequently, no impacts are anticipated.

4.G.4 AQUATIC BIOLOGY

Significant Impacts

Construction of the intake structure in the Oahe Reservoir would disturb or eliminate some substrate and aquatic vegetation. The impact of such a habitat modification would be limited to the construction area and would be considered of limited, short-term significance to the affected invertebrate population. Repopulation of the substrate would be anticipated within one year of the completion of construction, since at least one new generation of invertebrates would be available to colonize the disturbed area.

The nature and extent of aquatic biological impacts anticipated to be associated with pipeline construction through rivers and streams are discussed for the proposed action in Section 4.A.6. They would be expected to be similar for South Dakota and Wyoming stream crossing locations, except for four protected fishes in South Dakota.

Threatened and Endangered Species. The finescale dace, longnose sucker, northern redbelly dace, and sturgeon chub would be affected by pipeline construction through the streams in which they occur in the same way, and to the same extent, that other fishes would be affected as identified in Section 4.A.6. Since construction would be anticipated to occur during low flow conditions (late summer-early fall), peak spawning periods for these species would not coincide with construction activity. It is anticipated, therefore, that no significant impacts on these species would occur.

Routine operation, maintenance, and abandonment procedures would be anticipated to have no significant impact on aquatic biota. If the pipeline were to rupture, however, significant impacts could occur; these various impacts were generically described in Section 4.A.6. The four protected South Dakota fishes would be similarly affected if a rupture were to occur in the streams in which they occur.

Insignificant Impacts

Although construction of an intake structure in the reservoir would disturb some shoreline vegetation, it is anticipated that the reservoir fishery would not be significantly affected, since affected fishes would simply leave the area of disturbance during construction periods.

The water intake would draw a maximum of 30,200 acre-feet per year (approximately 42 cubic feet per second) from the Oahe Reservoir, of which 20,200 acre-feet would be used by ETSI. Depending on the intake design and location, it may entrain (draw into the intake) eggs and newly hatched fish, including yellow perch, buffalofish, and shiners, and may impinge (draw against the intake structure) adult and juvenile fish. Generally, however, an intake pumping such a small volume of water, located below the water surface and away from a shoreline area, and pumping at a velocity of less than 0.5 foot per second would be expected to have limited biological impact (Nelson and Beckman 1979).

4.G.5 AGRICULTURE

Construction, operation, and maintenance of the eight pump stations associated with the Oahe alternative water pipeline would take approximately 2 acres (two pump stations, Table 4-20) of potential prime agricultural land out of production for approximately 50 years. The impact of this potential crop production loss would be relatively minor from a regional standpoint. Since all surface facility land areas would be reclaimed during the abandonment phase of the project, these land areas would not be irreversibly converted to other uses and their viability would not be diminished.

4.G.6 RECREATION RESOURCES

No significant recreation impacts are anticipated as a result of construction, operation, maintenance, and abandonment of the Oahe alternative water supply system. However, the visual quality of the Oahe Reservoir and recreation area could be reduced until revegetation takes place. Water-related recreation activities are unlikely to be affected in the long term. The pipeline passes two other recreation areas, the Bear Butte State Park (pump station located here also) and Black Hills National Forest, where temporary impacts could occur if landscape disruption takes place during visitor seasons. The crossing of the Cheyenne River (identified for study by the Heritage Conservation and Recreation Service) would not have impacts because human access is not accommodated at that point. The Western Black Hills Volcanic Intrusion in Wyoming would have temporary direct impacts due to noise and visual intrusions affecting the quality of recreation experiences in this area.

4.H SLURRY PIPELINE WATER DISCHARGE ALTERNATIVE

This alternative would only affect water quality of the receiving streams; hence other resource topics are not discussed here. No significant impacts to aquatic biology would occur, since the water to be discharged would have to meet requirements of a National Pollutant Discharge Elimination System (NPDES) permit.

4.H.1 WATER RESOURCES

Surface Water

The estimated rates of discharge of the slurry pipeline water (dewatering plant effluent) are presented in Table 4-34.

Characteristics of Dewatering Plant Effluent. The water quality characteristics of the dewatering plant effluent would depend on a number of factors, principally the characteristics of the source coal and water, the degree of processing or treatment during dewatering, and to some extent the detention time, or travel time, in the pipeline.

Simulation studies (simulated coal slurry transport of proposed coal and water sources) indicate that the level of total dissolved solids (TDS) and sulfate (SO_4) could significantly increase in the slurry carrier water (Plummer and Associates 1980). Increments up to 1000 milligrams per liter (mg/l) TDS and 625 mg/l (SO_4) could leach from proposed coal sources into proposed carrier waters. Additionally, a biochemical oxygen demand (BOD_5) of 125 to 175 mg/l would be exerted in the slurry dewatering plant effluent.

Chemical analyses for 129 potentially toxic constituents, classified by the U.S. EPA as "priority pollutants" have been performed on two simulated slurry filtrates. The leaching of organic constituents resulted in levels in the carrier water below the limits of instrument detection and below the U.S. EPA (1979, 1980) draft criteria for these priority pollutants.

Several trace metals were measured in the simulated slurry filtrate but were also present at levels below U.S. EPA Draft Water Quality Criteria for these priority pollutants. The Surface Water Quality Technical Report (WCC 1980c) presents a summary of these simulation test results. At this time, additional investigations (Plummer and Associates 1980) are underway to evaluate the potential alteration in carrier water quality due to long-term coal storage, and to verify estimates made for the alteration in a higher-TDS carrier water.

Applicable State and Federal Standards. In compliance with the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500, 86 Stat. 816, 33 USC 1151), Oklahoma, Arkansas, and Louisiana have established water quality standards for surface waters within each state. These standards are designed to enhance the present, future, and potential beneficial uses of particular water-ways, and include both numerical and nonnumerical criteria for maintenance of the physical and chemical quality of surface waters. Table 4-35 presents a summary of the designated beneficial uses, and applicable standards, for the specific reaches of rivers proposed as alternative discharge sites. As can be seen from the table, the standards vary widely.

Discharge of pollutants from point sources into waters of the United States is regulated under the Federal Water Pollution Control Act Amendments of 1972 and subsequent amendments. Under Section 402 of this act, a permit for discharge may be issued in accordance with the National Pollutant Discharge Elimination System (NPDES). Discharge without a permit is unlawful. Authority to issue NPDES permits has not been transferred to Oklahoma, Arkansas, or Louisiana. Therefore NPDES permits would be issued by EPA Region VI, subsequent to certification by each state that applicable state receiving-water standards had been met.

TABLE 4-34

SLURRY EFFLUENT DISCHARGE RATES

Discharge Location	Discharge (cfs)			
	Proposed Action (cleaned)	Proposed Action (uncleaned)	Market Alternative	Pipeline-Barge Alternative
Ponca City	4.35	4.35	-	-
Pryor	1.98	1.98	3.50	3.50
Oologah	-	-	2.31	2.31
Muskogee	3.30	3.30	-	-
Independence	3.30	3.30	3.30	3.30
White Bluff	3.30	3.30	3.30	3.30
Cypress Bend	-	-	-	12.28
New Roads	1.32	1.32	1.32	-
Baton Rouge	-	-	3.83	-
Lake Charles	2.64	2.64	2.64	-
Boyce	1.19	1.19	1.19	-
Wilton	3.30	3.30	3.30	-

TABLE 4-35

BENEFICIAL USES AND STATE STANDARDS AT EFFLUENT DISCHARGE LOCATIONS

Delivery Terminal	Receiving-Water Beneficial Uses	Receiving-Water Standards							
		TDS (mg/l)	SO_4 (mg/l)	Cl (mg/l)	DO (mg/l)	96-hr TLM[a] (percent)	Radium (picocuries/liter)	pH	Turbidity (JTU)
Ponca City (Oklahoma)	B, C, D, F, G, H, J	2076[d]	257[d]	657[d]	5	5	5[b]	6.5-8.5	50
Pryor (Oklahoma)	A, C, D, E, F, G, H, J	261[d]	61[d]	17[d]	5	5	5[b]	6.5-8.5	50
Oologah (Oklahoma)	A, C, D, E, F, G, H, I, J	649[d]	272[d]	112[d]	5	5	5[b]	6.5-8.5	50
Muskogee (Oklahoma)	B, C, D, E, F, G, H, I, J	1876[d]	172[d]	860[d]	5	5	5[b]	6.5-8.5	50
Independence (Arkansas)	A, C, H	430	60	20	5	1	3[c]	6.0-9.0	50
White Bluff (Arkansas)	A, C, H	750	100	250	5	1	3[c]	6.0-9.0	50
Cypress Bend (Arkansas)	A, C, H	425	150	60	5	1	3[c]	6.0-9.0	50
New Roads (Louisiana)	A, C, H	400	120	75	5	10	-	6.5-9.0	-
Baton Rouge (Louisiana)	A, C, H	400	120	75	5	10	-	6.5-9.0	-
Lake Charles (Louisiana)	C, G, H	225	35	62	4	10	-	6.0-8.5	-

TABLE 4-35 Concluded

Delivery Terminal	Receiving-Water Beneficial Uses	Receiving-Water Standards: TDS (mg/l)	SO_4 (mg/l)	Cl (mg/l)	DO (mg/l)	96-hr TLM[a] (percent)	Radium (picocuries/ liter)	pH	Turbidity (JTU)
Boyce (Louisiana)	A, C, H	780	112	184	5	10	-	6.0-8.5	-
Wilton (Louisiana)	A, C, H	400	120	75	5	10	-	6.5-9.0	-

Note: In Oklahoma the criteria apply to all flow conditions greater than the 7-day, 2-year flow. In Arkansas, the criteria apply to all stream flows greater than the 7-day, 10-year low flow. In Louisiana, the criteria apply to all flow conditions.

[a] Refers to the 96-hour TLM (median tolerance limit) for persistent toxicants; permissible concentrations in the receiving water after mixing are given as a percent of the 96 hour TLM concentration.

[b] Refers to the permissible level of radium 226 plus radium 228.

[c] Refers to the permissible level of radium 226.

[d] Refers to the sample standard

Abbreviations:

A = public and private water supply
B = emergency water supply
C = fish and wildlife propagation
D = agriculture
E = hydroelectric power generation
F = industrial and municipal cooling water
G = primary body contact recreation (e.g., swimming)
H = secondary body contact recreation (e.g., boating)
I = navigation
J = aesthetics
K = smallmouth bass fisheries
L = trout fisheries
mg/l = milligrams per liter
TDS = total dissolved solids
SO_4 = sulfate
Cl = chloride
DO = dissolved oxygen
TLM = mean tolerance limit
JTU = Jackson turbidity unit

To date, national standards of performance for the control of slurry effluent discharge reflecting best available technology have not been established.

Relationship of Discharge to Existing Standards. Based upon simulation studies completed to date, and the estimated water quality of the Madison aquifer source water over the 50-year project lifetime, the range in quality characteristics of the slurry dewatering plant effluent is presented in Table 4-36.

The estimated allowable discharge quality at each of the proposed sites (Table 4-37) is based upon existing stream standards and design low flow (Table 3-48) and the proposed discharge rates (Table 4-34). A comparison of the estimated worst-case effluent quality with the allowable discharge quality enables an estimation of the level of treatment required for each of the three standard-specific minerals. These treatment levels are presented in Tables 4-38, 4-39, and 4-40.

The potential variations among the three principal water sources (Niobrara and Crook County well fields and Oahe Reservoir) are also indicated.

Biological treatment would also be required at several discharge sites in order to reduce discharge levels to an equivalent secondary level of treatment. At this time, investigations are underway to determine specific requirements for each site.

4.I NO-ACTION ALTERNATIVE

The no-action alternative (both the all-rail and railroad-barge routes) would have impacts only on socioeconomic conditions and air quality (noise), as discussed below. No major impacts on other resources as a result of the no-action alternative have been identified, primarily because no new rights-of-way would be required for the no-action alternative. Thus no discussion is presented for water resources, vegetation, wildlife, aquatic biology, agriculture, recreation, transportation, or visual resources for the no-action alternative.

4.I.1 SOCIOECONOMIC CONSIDERATIONS

All-Rail Alternative

Approximately 500 communities would experience some impacts that could be attributed to the increased rail traffic associated with the movement of 37.4 million tons annually (MMTA) of coal. Some of these impacts would be minor, in part depending on the location of the town with respect to the train tracks; others would be more significant. Further, these impacts would be both positive and negative. Specifically, the impacts would be increases in employment, rail accidents, and community disruption. Train derailments, because they typically do not result in injury to either rail employees or the public and are instead financial problems for the railroads, are not considered (Boyce 1980).

Employment. Total employment related to the movement of 37.4 MMTA of coal is approximately 5700 persons, based on Burlington-Northern's (BN) planning factor of 8 million ton miles of coal per year per employee (Boyce 1980) and an estimated 46,270 annual ton-miles. The employment related to rail operation alone is estimated to be approximately 2500. Whether this results in the same number of new jobs is a function of overemployment at some of the railroads as well as expected future gains in productivity. If, in the extreme, this employment results in both new jobs and new-to-the-area people, location-specific socioeconomic impacts would not be significant. New workers would be distributed along the 3623 miles of unduplicated track and among the 500 communities with population in excess of 2.9 million.

Employment related to rail maintenance and support staff could be an additional 2500 people. These would be located in such cities as Alliance, Nebraska, Kansas City, Missouri, and other cities identified as maintenance or inspection stops. Again, because of the number of towns where these people could be expected to settle, the only town identified as one likely to be significantly affected is Alliance, Nebraska.

A majority of Alliance's population is dependent upon BN for employment and so tends to

TABLE 4-36

ESTIMATED WATER QUALITY OF DEWATERING PLANT EFFLUENT UNDER VARYING PROJECT CONDITIONS

Conditions	Constituent	Initial Concentration[a] (mg/l)	Concentration After 50 Years (mg/l)
Typical	TDS	900 - 1300	960 - 1310
	SO_4	425 - 750	467 - 757
	BOD_5	125 - 175	125 - 175
	Cl	50 - 70	50 - 70
Extreme[b]	TDS	1500 - 1900	1560 - 1910
	SO_4	750 - 1075	792 - 1082
	Cl	50 - 70	50 - 70
	BOD_5	125 - 175	125 - 175

Source: Alan Plummer and Associates 1980.

Notes:

mg/l = milligrams per liter

TDS = total dissolved solids

SO_4 = sulfate

BOD_5 = biochemical oxygen demand

Cl = chloride

[a] A function of well-field water quality, quantity of leached constituents, and coal processing procedures.

[b] Worst-case estimates, occurring a minimum percentage of the time.

TABLE 4-37

ESTIMATED ALLOWABLE DISCHARGE QUALITY

Site	Dewatering Discharge (cfs)	Alternative	Allowable Discharge Quality (mg/l)		
			TDS	Cl	SO_4
Ponca City	4.4	PA	a	a	a
Pryor	3.5	MA, BA	4,419	17	1,110
Pryor	2.0	PA	7,537	17	1,897
Oologah	2.3	MA, BA	881	164	402
Muskogee	3.3	PA	a	a	a
Independence	3.3	PA, MA, BA	a	1,140	4,300
White Bluff	3.3	PA, MA, BA	a	a	6,918
Cypress Bend	12.3	BA	a	a	a
New Roads	1.3	PA, MA	a	a	a
Baton Rouge	3.8	MA	a	a	a
Lake Charles	2.6	PA, MA	225	62	35
Boyce	1.2	PA, MA	a	184	112
Wilton	3.3	PA, MA	a	a	a

Notes:

cfs = cubic feet per second
mg/l = milligrams per liter
TDS = total dissolved solids
Cl = chloride
SO_4 = sulfate
PA = proposed action
MA = market alternative
BA = pipeline-barge alternative
a = The allowable discharge quality level is greater than 10,000 mg/l, which is much greater than the level of the slurry quality; the allowable water quality level would not be exceeded.

TABLE 4-38

PRELIMINARY ASSESSMENT OF TREATMENT REQUIREMENTS (percent SO_4 removal)

Carrier Water:	Oahe Reservoir / Niobrara County Well Field			Crook County Well Field
	Concentration in Transport Water (mg/l)			
	400	500	1000	1200
Discharge Site				
Ponca City	None	None	None	None
Pryor[a]	None	None	None	8%
Oologah	None	27%	60%	64%
Muskogee	None	None	None	None
Independence	None	None	None	None
White Bluff	None	None	None	None
Cypress Bend	None	None	None	None
New Roads	None	None	None	None
Baton Rouge	None	None	None	None
Lake Charles[b]	91%	94%	97%	97%
Lake Charles[c]	None	None	None	None
Boyce	None	None	None	None
Wilton	None	None	None	None

Source: Alan Plummer and Associates 1980.

[a] Applies to highest proposed discharge of 3.5 cfs.

[b] Above salt-water barrier.

[c] Below salt-water barrier.

TABLE 4-39

PRELIMINARY ASSESSMENT OF TREATMENT REQUIREMENTS (percent TDS removal)

Carrier Water:	Oahe Reservoir / Niobrara County Well Field			Crook County Well Field
	Concentration in Transport Water (mg/l)			
	800	1000	1200	1500
Discharge Site				
Ponca City	None	None	None	None
Pryor[a]	None	None	None	None
Oologah	None	12%	27%	36%
Muskogee	None	None	None	None
Independence	None	None	None	None
White Bluff	None	None	None	None
Cypress Bend	None	None	None	None
New Roads	None	None	None	None
Baton Rouge	None	None	None	None
Lake Charles[b]	72%	78%	81%	85%
Lake Charles[c]	None	None	None	None
Boyce	None	None	None	None
Wilton	None	None	None	None

Source: Alan Plummer and Associates 1980.

[a] Applies to highest proposed discharge of 3.5 cfs.

[b] Above salt-water barrier.

[c] Below salt-water barrier.

TABLE 4-40

PRELIMINARY ASSESSMENT OF TREATMENT REQUIREMENTS (percent chloride removal)

Carrier Water: Oahe Reservoir; Niobrara County Well Field; Crook County Well Field

Discharge Site	Concentration in Dewatering Plant Effluent (mg/l) 40	50	60	70	100
Ponca City	None	None	None	None	None
Pryor[a]	58%	66%	72%	76%	83%
Oologah	None	None	None	None	None
Muskogee	None	None	None	None	None
Independence	None	None	None	None	None
White Bluff	None	None	None	None	None
Cypress Bend	None	None	None	None	None
New Roads	None	None	None	None	None
Baton Rouge	None	None	None	None	None
Lake Charles[b]	None	None	None	11%	38%
Lake Charles[c]	None	None	None	None	None
Boyce	None	None	None	None	None
Wilton	None	None	None	None	None

Source: Alan Plummer and Associates 1980.

[a] Applies to highest proposed discharge of 3.5 cfs.

[b] Above salt-water barrier.

[c] Below salt-water barrier.

be supportive of further rail-related growth. While housing construction has increased as the population has increased, there has not been a similar growth in retail services, particularly entertainment. The police department no longer deals just with "the town drunk" but now faces more of the problems associated with rapid urban growth, including domestic fights, drug abuse, and petty theft (Fortune 1980). While local officials voice no concern over the future, it seems likely that at some point needed retail services and recreational opportunities as well as certain public facilities will have to be provided. Given the lack of interest on the part of the current absentee landlords, it seems likely that the railroad itself would be the likely provider, as its stock in the town's welfare is substantial.

Rail Accidents. Rail accidents attributable to the all-rail alternative would be approximately 17 per year (Williams 1980). At any one crossing, the rate is less than one accident every 10 years (WCC 1980a). Overall, this increase is small and insignificant.

Community Disruption. Community disruption is due largely to the presence of at-grade crossings, which when occupied by a train result in passenger vehicle delay as well as possibly emergency vehicle delay. Approximately 500 communities are potentially so affected.

The potential impact of the all-rail alternative is illustrated in Table 4-41, which shows existing and future numbers of daily trains for the most heavily traveled mine-to-market route. For the Nebraska portions of the route, the 37.4 MMTA movement would account for approximately 20 percent of the traffic. Delays due to this traffic would depend on the speed of the train which is a function of track conditions, grade, equipment and traffic control systems.

Precise estimates of the impacts due to the 37.4-MMTA-related traffic are further complicated by the fact that the railroads have been working extensively with individual towns to relieve perceived or anticipated problems. While it could be expected that related impacts would be the most severe in towns in Nebraska, it is impossible to predict the magnitude due to other projected increases in rail traffic and the changes that these may induce. Changes such as rerouting tracks around a city that is now bisected by the railroad (such as Broken Bow), would mean that there would be no impacts.

Solutions to grade crossing problems must be considered on a site-specific basis. The movement of 37.4 MMTA alone would not cause significant community disruption. Considered with other rail traffic and expectations for growth in this traffic, however, it could cause significant disruption. While this disruption cannot be identified by town or quantified for the whole of the route, it can be noted that there are increasing local attempts to correct current rail-related problems. If it is assumed that a community's willingness to spend funds for a rerouting or other rail modification effort is an adequate indication of a significant rail-related disruption, then in towns such as Lincoln the current impacts are significant and it can be expected that in the future such impacts in other towns will also be significant.

Rail-Barge Alternative

Socioeconomic impacts associated with this alternative would be minor and would be the following:

1. Employment for 40 people in St. Louis at a new or expanded transshipment facility that would handle approximately 18.3 MMTA. This would not drastically affect local employment (Mankus 1980). The cost of this facility has been estimated to be at least $19 million (Rieber and Soo 1977a, p. 4-73).

   Employment for 729 people as crew on the barges. Even if these workers were all new to the area, the impact when distributed over towns along the 800 miles of the barge route would be insignificant.

2. An increase of about 2 to 3 tows per day on the Mississippi River. No significant impact is anticipated from this increase, as the open channel of the lower Mississippi is assumed to have virtually unlimited capacity and has been judged capable of handling an increase of 70 MMTA with ease (Rieber and Soo 1977b, p. 1-17).

Table 4-41
EXISTING AND FUTURE TRAIN TRAFFIC OVER ROUTE FROM
WYOMING MINE TO REDFIELD, ARKANSAS

Town	Number of Trains per Day, 1983	Number of Trains per Day, 1990[a] Total Without ETSI	Number Related to 37.4 MMTA of Coal	Total	Percent Increase
Torrington, WY	30[b]	68[b]	20	88	29
Scottsbluff, NE	29[b]	67[b]	20	87	30
Alliance, NE	23[b]	58[b]	20	78	34
Broken Bow, NE	50[b]	130[b]	20	150	15
Ravenna, NE	48[b]	128[b]	20	148	16
Grand Island, NE	57[b]	139[b]	20	159	14
Lincoln, NE	54[b]	131[b]	20	151	14
Greenwood, NE	24[b]	51[b]	20	71	15
Osawatomie, KS	35[c]	d	8	NA	NA
Durand, KS	28[c]	d	8	NA	NA
Dearing, KS	29[c]	d	8	NA	NA
Okay, OK	29[c]	d	8	NA	NA
Van Buren, AR	17[c]	d	5	NA	NA
N. Little Rock, AR	16[c]	d	5	NA	NA
Redfield, AR	17[c]	d	5	NA	NA

[a] Number of trains per day includes loaded and empty trains. Conversion factor of 1.848 tons per year per train per day applied to all ETSI-related traffic over particular route segment.

[b] PMM 1979.

[c] ICC Docket No. 36719 and conversion factor of 1.848 tons per year per train per day.

[d] Projections of future traffic not made beyond 1983.

3. Recreational use of the Mississippi River would be unaffected. Most of the recreational boat use of the river is north of St. Louis, where the water quality is better. South of St. Louis, few pleasure craft use the river (Mankus 1980). Further movement of 18.3 MMTA would not affect recreation in such areas as Memphis, Vicksburg, or New Orleans (Hill 1980).

4. At present, traffic on the Mississippi is at the rate of one tow per hour. Two or three additional tows per day would therefore not significantly increase traffic, congestion, or accidents (Feld 1980).

4.1.2 AQUATIC BIOLOGY

The potential for hopper car spills into water bodies exists, and it is anticipated that such spills could have localized, short-term significant impacts. A single-car (100-ton) spill would be expected to smother and kill stream-bottom invertebrates in at least a 100-square-yard area. This would represent a loss of approximately 3 pounds (dry weight) of invertebrates and 0.5 pound (dry weight) of fish flesh that would have been produced from foraging on the affected invertebrate population (Table 4-18).

4.1.3 AIR QUALITY AND NOISE

Impacts from operation of coal unit trains would include coal dust blown from hopper cars and pollutant emissions from locomotive engines. Emissions data relating to coal-dust blow-off are scarce; estimates range from 0.05 percent to 1.0 percent of total tonnage hauled (EPA 1978b). These figures are in agreement with the "rough approximation" of 0.1 percent presented by the Office of Technology Assessment (1977). The actual amount of coal lost would vary with train speed, meteorological conditions, and coal composition, but it appears that losses from a 100-car train hauling 100 tons per car could range from 5 to 100 tons. These emissions would be spread over the entire route, and violations of the standard for total suspended particulates (TSP) would not be expected.

Emissions of pollutants from locomotive engines depend on the type of engine and the terrain along the route, and are directly proportional to the amount of fuel consumed. Emission factors have been published by the EPA and summarized by the OTA (1977). These composite average factors (expressed as pounds per thousand gallons of fuel consumed) are as follows: carbon monoxide, 174; hydrocarbons, 78; nitrogen oxides, 430; particulates, 25; sulfur oxides, 57.

A study done for the Federal Railroad Administration (Peat, Marwick, Mitchell and Co. 1979) presents a fuel consumption figure of 16,360 gallons for a unit train round trip between between Arco Junction and Kansas City. This route is expected to be similar to the railroad route for proposed action markets. Applying the above factors would yield the following pollutant emissions (in tons per trip): carbon monoxide, 1.4; hydrocarbons, 0.6; nitrogen oxides, 3.5; particulates, 0.2; sulfur oxides, 0.5.

These emissions would occur during every round trip and would lead to increases in ambient pollutant concentrations. Site-specific meteorological data would be necessary to quantify these increases; however, a report done for the OTA (1977) indicates that short-term ambient concentrations would be below the federal ambient air quality standards.

Noise levels resulting from railroad operations depend on train speed, the number and type of locomotives, train weight, and track type. Maximum sound levels at distances of 50 feet may range from 50 to 100 decibels, A-weighted scale (OTA 1977; Peat, Marwick, Mitchell and Co. 1979). The EPA (1974) has suggested an ambient noise level of 55 decibels as adequate to protect public health and welfare. Calculations of projected distances from railroad tracks where noise levels exceed 55 decibels indicate that persons located closer than about 2000 feet from the tracks would be exposed to levels above this limit (Peat, Marwick, Mitchell and Co. 1979). Thus unit train operation would have a significant noise impact, but the number of people affected would depend upon population distribution along the rail route.

MITIGATION MEASURES

The mitigation measures presented are in addition to several measures (revegetation, for example) already incorporated into the project design and discussed in Chapter 1, or will be attached as stipulations to the Authorizing Actions as detailed in Appendix D. ETSI has reviewed the mitigation measures presented in this section and is committed to implement these measures.

Federal field compliance officers would conduct field inspections to ensure that all stipulation requirements are met by the grantee (ETSI) and its contractors. During key construction periods, the compliance officer may be at a specific site until construction is completed. If the grantee violates the terms and conditions of the right-of-way grant, the federal agency may issue immediate orders to suspend operations in order to protect public health and safety and the environment.

These measures apply to the proposed action and alternatives, except where measures apply to a specific alternative as noted.

1. Measure: Where higher volumes of test water would be discharged into streams during low flow periods, route hydrostatic test water through settling or detention basins or through straw or hay bales in order to decrease the levels of iron and suspended solids in the discharge water.

   Effectiveness: Field experience by Butler (1980), McCabe (1980), and Bennett (1980) indicates that these measures can reduce the levels of iron and suspended solids in the discharge water to meet applicable local requirements. Such measures would therefore be effective in eliminating any water quality impacts.

2. Measure: To control erosion and excess levels of stream turbidity, hydrostatic test water will be routed directly into a flowing stream at reduced levels of velocity. By careful routing of discharge water into the drainage and controlling velocities, erosion and excess levels of turbidity will be avoided.

   Effectiveness: This measure would reduce the potentially high velocity of flow of the discharge and would be effective in controlling erosion and excess levels of stream turbidity.

3. Measure: In order to avoid affecting wetland habitat, site-specific visits should be made to detail the location of these wetlands: in Kansas, at the crossing of Rattlesnake Creek (MP 551); North Fork Ninnescah River (MP 567); South Fork Ninnescah River (MP 593); and in Arkansas, MP 1010. When mapped in more detail in relationship to the proposed action route, these areas should be avoided to the extent possible.

   Effectiveness: These actions would be anticipated to be successful in eliminating significant effects on wildlife associated with these wetlands.

4. Measure: When strutting grounds of the greater prairie chicken along the Colorado alternative route between MP C-310 and C-330 are located prior to right-of-way acquisition, these areas will be avoided. During strutting periods of the greater prairie chicken, steps will be taken to avoid disturbing the birds as required.

   Effectiveness: These actions would be anticipated to reduce any potential effects on the greater prairie chicken in Colorado.

5. Measure: In order to avoid affecting the northern swift fox along the Oahe pipeline in South Dakota, a more detailed identification of denning sites in relationship to the Oahe alternative pipeline route between MP 35 and 65 should be made.

   Effectiveness: This action would be anticipated to be successful in eliminating the possibility of destruction of denning sites between MP 35 and 65.

6. Measure: In order to avoid affecting an important winter range area for mule deer, construction should be avoided along the Oahe water pipeline in Wyoming between

MP 195 and 225 from December through March.

Effectiveness: This scheduling adjustment would be anticipated to be entirely successful in eliminating significant effects on wintering mule deer between MP 195 and 225 of the Oahe alternative.

MONITORING PROGRAMS

Because of the potential impact associated with the use of Madison Formation water by ETSI, a ground-water and surface-water monitoring network in addition to that required by Wyoming state law should be implemented by the grantee (ETSI). This monitoring program would not mitigate impacts but would allow determination of impacts and allow possible solutions to be developed. This monitoring program would serve as:

- An early warning of impending impacts so that remedial measures could be implemented to prevent significant impacts to water users other than ETSI
- A data base that can be used to update and reassess potential impacts, should this become necessary
- A data base that would allow distinctions to be made between changes in the water resource caused by ETSI, changes caused by other water users, and changes caused by natural fluctuations in the environment, such as climate

This network is designed to complement federal, state, and university programs now being conducted. Adopting the network would require that ETSI implement several additional courses of action once the well-field site (Niobrara or Crook County) is chosen. Table 4-42 is a general outline of this proposed monitoring network; more details of this network are provided in the Well-Field Hydrology Technical Report (WCC 1980b).

TABLE 4-42

OUTLINE OF MONITORING RECOMMENDATIONS

- Continue USGS stream gage and observation well program (Table 4-43).

- Monitor Madison ground-water users in northeastern Wyoming and western South Dakota for water levels (potentiometric head), water quality, and water use.

- A Minnelusa water-well monitoring program should be designed and implemented near the selected ETSI well-field site after an inventory of these wells is completed.

- Install one Madison Group well and one Minnelusa Formation well between the city of Gillette well field and Upton, Wyoming.

- After the ETSI well field has been constructed and is in operation, monitor all ETSI production wells for rate of production, water levels, and water quality.

- A person or group, designated by mutual agreement with ETSI and state and federal agencies, should be established to collect, analyze, and report on the information collected by this monitoring network. A responsible authority, not associated with this person or group and having an understanding of the well-field operation and the Madison aquifer system, should be designated to review the data and analyses from the above-named person or group and to respond to any problems that could occur as a result of ETSI's well-field development.

TABLE 4-42 Continued

- These general recommendations should be implemented regardless of which individual plan is followed. Except for the recommendations directly pertaining to ETSI's development, these recommendations should be implemented in order to establish more complete hydrologic baseline conditions in the area and to assess impacts that are likely to occur as a result of present use of the water resources. The stress on the hydrologic system in this area, both present and future, is significant enough to warrant such a program, regardless of whether ETSI's project is approved. Programs by the U.S. Geological Survey, the U.S. Environmental Protection Agency, the University of Wyoming Water Resources Research Institute, and others that are inventorying and monitoring the water resources in the area should be continued.

<u>Plan 1: Niobrara County Well Field Only</u>

- All Madison (Pahasapa-Englewood Formation) and Minnelusa ground-water users in the Edgemont area should be monitored for water levels, water quality, and water use.

- Observation wells should be installed at or near locations OW-5 through OW-8 (Map 4-5). Wells OW-5 through OW-7 should be completed in the Madison Group, and Well OW-8 should be completed in the Minnelusa Formation. Periodic water-level measurements should be made from these wells. Except when initially installed, no water quality samples need to be collected from these wells.

<u>Plan 2: Niobrara County and City of Gillette Well Fields</u>

- The recommendations as outlined under Plan 1 should be implemented.

- Production from the Gillette well-field should be measured to account for the amount of water supplied to ETSI.

TABLE 4-42 Concluded

Plan 3: Crook County Well Field Only

- All Madison ground-water users in the well-field area should be monitored (Bell Creek, Montana; western Butte and Lawrence Counties, South Dakota; Crook County, Wyoming) for water levels and water quality.

- Observation wells should be installed at or near locations OW-9 through OW-11 (see Map 4-5). Wells OW-9 and OW-10 should be completed in the Madison Group, and well OW-11 should be completed in the Minnelusa Formation. Periodic water-level measurements should be made from these wells. Except when initially completed, no water quality samples need to be collected from these wells.

- A stream gage, measuring daily stream flow and similar to those used by the U.S. Geological Survey, should be installed on the Belle Fourche River near Township 57 North and Range 63 West in Wyoming.

Plan 4: Crook County and Gillette Well Fields

- The recommendations outlined under Plan 3 should be implemented.

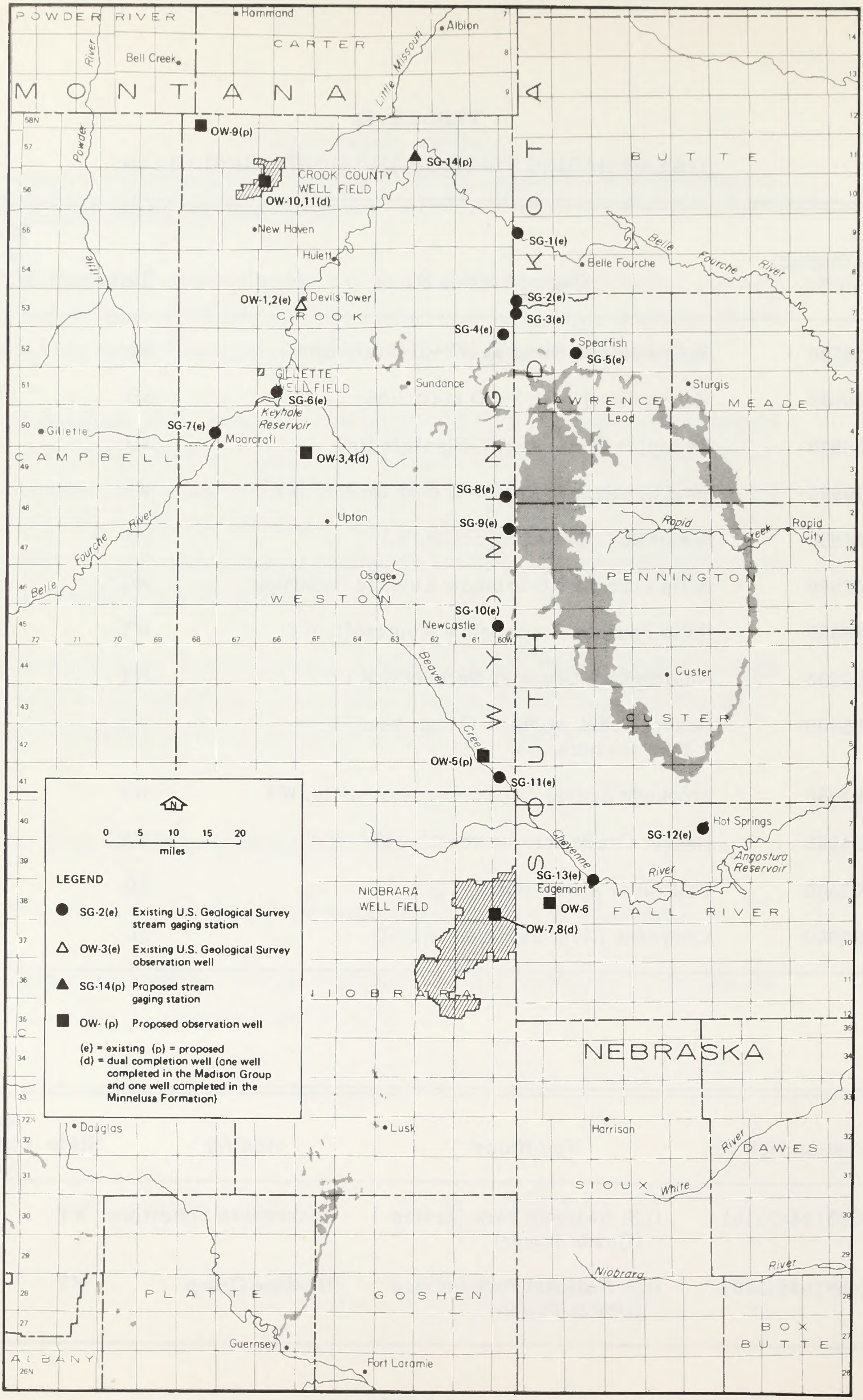
- Production from the Gillette well-field should be measured to account for the amount of water supplied to ETSI.

TABLE 4-43

STREAM GAGING STATIONS AND MONITORING WELLS

Stream Gaging Station No.	Gaging Station Name	State	Monitoring Location No. (Map 4-5)
06428500	Belle Fourche River at WY-SD state line	SD	SG-1
06430000	Murray Ditch at WY-SD state line	SD	SG-2
06430500	Redwater Creek at WY-SD state line	SD	SG-3
06429905	Sand Creek near Ranch A, near Beulah, WY	WY	SG-4
06431500	Spearfish Creek at Spearfish, SD	SD	SG-5
06427500	Belle Fourche River below Keyhole Reservoir	WY	SG-6
06426500	Belle Fourche River below Moorcroft, WY	WY	SG-7
06429500	Cold Springs Creek at Buckhorn, WY	WY	SG-8
06392900	Beaver Creek at Mallo Camp, near Four Corners, WY	WY	SG-9
06392950	Stockade Beaver Creek near Newcastle, WY	WY	SG-10
06394000	Beaver Creek near Newcastle, WY	WY	SG-11
06402000	Fall River at Hot Springs, SD	SD	SG-12
06395000	Cheyenne River at Edgemont, SD	SD	SG-13

Observation Well No.	Well Name	Aquifer	State	Monitoring Location No. (Map 4-5)
443503104425101	U.S. National Park Service (Devils Tower)	Minnekahta Limestone	WY	OW-1
443459104425601	U.S. National Park Service (Devils Tower)	Madison Group	WY	OW-2



Map 4-5. LOCATION OF EXISTING AND PROPOSED STREAM GAGES AND OBSERVATION WELLS FOR THE ETSI MONITORING NETWORK

CHAPTER 5

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USE OF THE ENVIRONMENT, MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY, AND IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

This chapter provides a perspective of the effects of the proposed project on the long-term use of man's environment. Of special concern are any irreversible and irretrievable commitments of resources. An irretrievable commitment of a resource means that such a commitment is incapable of being reversed; i.e., once initiated, the use, direction, or condition would continue. An irretrievable commitment means the resource is essentially irrecoverable, not reusable.

The cumulative impacts, trends, long-term benefits and trade-offs, commitment of resources, relationship to National Environment Policy Act goals, and possible conflicts with land use plans are discussed below.

5.A CUMULATIVE IMPACTS

Cumulative impacts are the impacts on the environment which result from the incremental impact of the action when added to known and proposed future projects. Only those projects that would interact with the construction or operation of the proposed acron were considered. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

The assessment of cumulative impacts for the coal slurry pipeline system indicated that the only major cumulative impacts would occur to water resources and socioeconomic considerations, as described below.

5.A.1 WATER RESOURCES

The purpose of this section is to discuss the cumulative impacts that are calculated to occur between 1985 and 2035 as a result of ground-water withdrawals by present and planned users of Madison water, as well as by ETSI (Tables 5-1 and 5-2). Present users and proposed ETSI withdrawals were considered in Sections 4.A.1 and 4.F.1.

The proposed ETSI withdrawals from the Madison aquifer would not be the only production that occurs from the Madison aquifer in the western part of the Black Hills region during the period 1985 to 2035. Existing Madison water users will continue to produce ground water, and new water supply systems will be developed to produce ground water from the Madison aquifer. Only two water supply systems, besides ETSI's Niobrara County well field, are planned to begin operation between 1980 and 2035. The city of Gillette plans to produce ground water from the Madison aquifer at a well field near Moorcroft in 1981, and Black Hills Power and Light plans to begin producing ground water from the Madison aquifer for a new power plant near Osage in the 1990s. Ground water produced for these two new projects are projected to average 6.2 cubic feet per second (cfs) (4500 acre-feet per year) and 2.0 cfs (1450 acre-feet per year), respectively.

The projected water production from the Madison aquifer during the period 1985 to 2035 was simulated so that the cumulative impacts of Madison water production, defined as all present and planned production, could be assessed (Tables 4-1, 5-1, and 5-3). The drawdowns that occur as the result of simulated water production during this period, excluding the proposed ETSI development, are shown on Map 5-1 and Table 5-1. Drawdowns of greater than 50 feet would occur only near the Gillette well field and Osage, Wyoming, areas where simulated production rates increase during the period 1985 to 2035. The spring and stream flow reductions for the period 1985 to 2035 are listed in Table 5-2. Most of this impact would be caused by pumping from the city of Gillette well field (Column B on Table 5-1). The flow of Sand Creek would decrease by 3 cfs, but base flow reductions in other streams would be less than 0.5 cfs. The impacts of the stream flow reductions on aquatic biology are discussed in

TABLE 5-1

DRAWDOWNS IN THE MADISON POTENTIOMETRIC SURFACE[a]

Approximate Location[b]	Location No. (See Map 3-9)	Calculated Drawdowns (feet)[c]														
		Current Use Only		Current Use Plus Planned Use	Plan 1: Niobrara Well Field Only			Plan 2: Niobrara Well Field Plus Gillette Well Field			Plan 3: Crook Well Field Only			Plan 4: Crook Well Field Plus Gillette Well Field		
		1900-1980 Time Period	(Column A) 1985-2035 Time Period	(Column B) 1985-2035 Time Period	ETSI only	ETSI Plus Col. A	ETSI[e] Plus Col. B	ETSI only	ETSI Plus Col. A	ETSI[e] Plus Col. B	ETSI only	ETSI Plus Col. A	ETSI[e] Plus Col. B	ETSI only	ETSI Plus Col. A	ETSI[e] Plus Col. B
Niobrara County Well Field, WY	1	18	9	9	666	675	675	464	473	473	-	9	9	-	9	9
Edgemont, SD	2	44	8	8	295	303	303	203	211	211	-	8	8	-	8	8
Provo, SD	3	31	8	8	335	343	343	230	237	237	-	8	8	-	8	8
Hot Springs, SD	4	1	1	1	7	8	8	5	6	6	-	1	1	-	1	1
Cascade Springs, SD	5	3	3	3	32	35	35	22	25	25	-	3	3	-	3	3
Lusk, WY	6	-	1	1	6	7	7	4	5	5	-	1	1	-	1	1
Newcastle, WY	7	128	18	29	2	21	31	1	20	30	4	23	33	7	26	36
Osage, WY	8	68	14	76	-	14	76	24	38	100	17	31	93	36	50	112
Upton, WY	9	32	13	66	-	13	66	56	69	122	38	51	104	82	95	148
Sundance, WY	10	5	8	35	-	8	35	34	42	69	47	55	82	66	74	101
Gillette Well Field, WY	11	11	10	132	-	10	132	191	202	224	91	101	223	254	264	384
Devils Tower, WY	12	8	10	64	-	10	64	77	87	141	134	144	198	169	179	233
Hulett, WY[d]	13	7	9	53	-	9	53	60	69	113	125	134	178	147	156	200
Crook County Well-Field, WY	14	10	10	32	-	10	32	30	40	62	366	376	398	286	296	318
Bell Creek, MT	15	30	10	22	-	11	22	15	26	37	151	162	173	117	127	139
Belle Fourche, SD	16	2	4	13	-	4	13	11	15	24	49	53	62	44	48	57
Spearfish, SD	17	1	4	12	-	4	12	11	15	23	38	42	50	36	40	18

Note: Numbers in the columns have been rounded to nearest whole number and may not add exactly in the rows because of this rounding.

[a]Calculated drawdowns.

[b]Exact locations are shown on Map 3-9.

[c]Pumping schedules used in drawdown calculations are listed in Tables 3-4, 4-1, and 5-3.

[d]Drawdowns calculated for the Minnelusa aquifer unit only.

[e]This column, highlighted by the box, pertains directly to cumulative impacts.

TABLE 5-2

CHANGES IN GROUND-WATER DISCHARGE RATES TO THE MAJOR STREAMS AND SPRINGS IN THE BLACK HILLS REGION AS A RESULT OF WITHDRAWALS FROM THE MADISON AQUIFER DURING THE PERIOD 1985 TO 2035

Approximate Location[b]	Location No. (See Map 3-9)	Calculated Change in Discharge Rate (cfs)[a]														
		(Column A) Current Use Only, 1985-2035 Time Period	(Column B) Current Use Plus Planned Use, 1985-2035 Time Period	Plan 1: Niobrara Well Field Only			Plan 2: Niobrara Well Field Plus Gillette Well Field			Plan 3: Crook Well Field Only			Plan 4: Crook Well Field Plus Gillette Well Field		
				ETSI Only	ETSI Plus Col. A	ETSI Plus Col. B[c]	ETSI Only	ETSI Plus Col. A	ETSI[b] Plus Col. B[c]	ETSI Only	ETSI Plus Col. A	ETSI[b] Plus Col. B	ETSI Only	ETSI Plus Col. A	ETSI[b] Plus Col. B[c]
Little Missouri River at the Montana-Wyoming State Line	18	-	-	-	-	-	-	-	-	1	1	1	1	1	1
Belle Fourche River (Keyhole Reservoir to Wyoming-South Dakota State Line	19	-	1	-	-	-	1	1	2	4	4	4	4	4	4
Sand Creek (entire drainage basin)	20	-	3	-	-	-	2	2	5	3	4	7	4	4	7
Crow Creek Springs, SD	21	-	1	-	-	-	1	1	1	2	2	3	2	2	3
Spearfish Creek (entire drainage basin)	22	-	1	-	-	-	1	1	2	1	1	2	1	1	2
Stockade-Beaver Creek (entire drainage basin)	23	-	-	-	-	-	-	-	-	-	-	-	1	1	1
Rapid Creek (entire drainage basin west of the Precambrian core of the Black Hills uplift)	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cheyenne River (upstream of Angostura Reservoir)	25	-	-	1	1	1	1	1	1	-	-	-	-	-	-
Cascade Springs, SD	26	-	-	4	4	4	3	3	3	-	-	-	-	-	-
Hot Springs, SD	27	-	-	2	2	2	1	1	1	-	-	-	-	-	-

Note: Numbers in the columns have been rounded to the nearest whole number and may not add exactly in the rows because of this rounding.

[a]Pumping schedules used in drawdown calculations are listed in Tables 3-4, 4-1, and 5-3.

[b]Exact locations are shown on Map 3-9.

[c]This column, highlighted by the box, pertains directly to cumulative impacts.

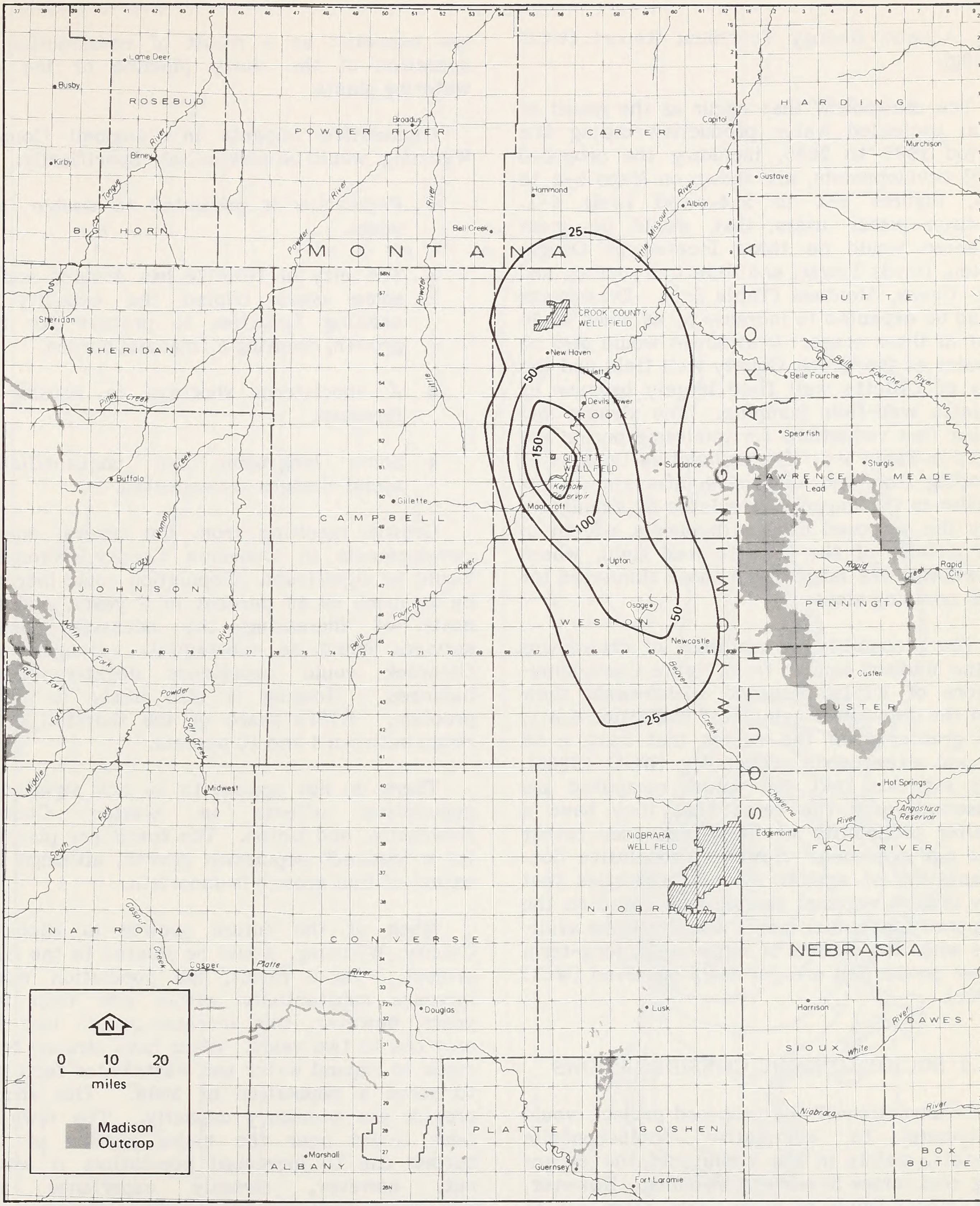
TABLE 5-3

PUMPING SCHEDULE FOR CITY OF GILLETTE WELL FIELD NEAR MOORCROFT, WYOMING

Time Period (years)	Total Pumping Rate: cfs (acre-feet per year)	Amount Supplied to City of Gillette: cfs (acre-feet per year)	Maximum Amount That Could Be Available to ETSI: cfs (acre-feet per year)
1985-1995	15.60* (11,292)	4.19 (3032)	11.41 (8260)
1995-2005	15.60 (11,292)	5.91 (4272)	9.69 (7020)
2005-2015	15.60 (11,292)	6.77 (4902)	8.83 (6390)
2015-2025	15.60 (11,292)	7.23 (5232)	8.37 (6060)
2025-2035	15.60 (11,292)	7.46 (5402)	8.14 (5890)

Source: James M. Montgomery Consulting Engineers 1979.

*Equivalent to 10 million gallons per day



Map 5-1. DRAWDOWNS (in feet) IN THE MADISON POTENTIOMETRIC SURFACE FOR THE YEAR 2035 WITH PUMPING BY CURRENT AND PLANNED MADISON WATER USERS ONLY

the Aquatic Biology Technical Report (WCC 1980g).

The drawdowns that occur as the result of total projected water production during the period 1985 to 2035, including the proposed ETSI developments, are shown on Maps 5-2 to 5-5, Figures 5-1 to 5-4, and Table 5-1. Madison water users that would be most affected would be those located at Osage, Upton, Devils Tower, and Hulett, Wyoming, and Bell Creek, Montana (Table 5-1). Drawdowns could be expected to increase by as much as 50 feet in these areas. Drawdowns would also be greater at the Crook County well field and the city of Gillette well field largely because of Gillette well-field pumping. The stream and spring flow reductions for this same period are listed in Table 5-2. The cumulative impacts of pumping from the Madison aquifer system are similar to the impacts calculated by simulating only the proposed ETSI withdrawals, except in the vicinity of the Gillette well field, where drawdowns are larger than those simulated for ETSI pumping alone.

The probability distributions of drawdowns in the Madison aquifer from Monte Carlo simulations of ETSI's proposed withdrawals show that the drawdowns calculated in Section 4.A.1. are greater than the values that have a 50 percent exceedance probability (WCC 1980b). This suggests that the values computed are conservative in the sense that they have a smaller probability of being exceeded rather than not exceeded. However, conclusive documentation of aquifer system properties that may lead to regional assessments based on the proposed conceptual model would only be available when the effects of large-scale, long-term water production are carefully observed (WCC 1980b).

5.A.2 SOCIOECONOMIC CONSIDERATIONS

Construction of the proposed project would contribute to cumulative socioeconomic impacts, mainly in the vicinity of the expanding coal mines in eastern Wyoming. However, this impact would be short term, from one to two years. No significant cumulative impacts are expected as a result of construction or operation of the slurry pipeline or the dewatering plants.

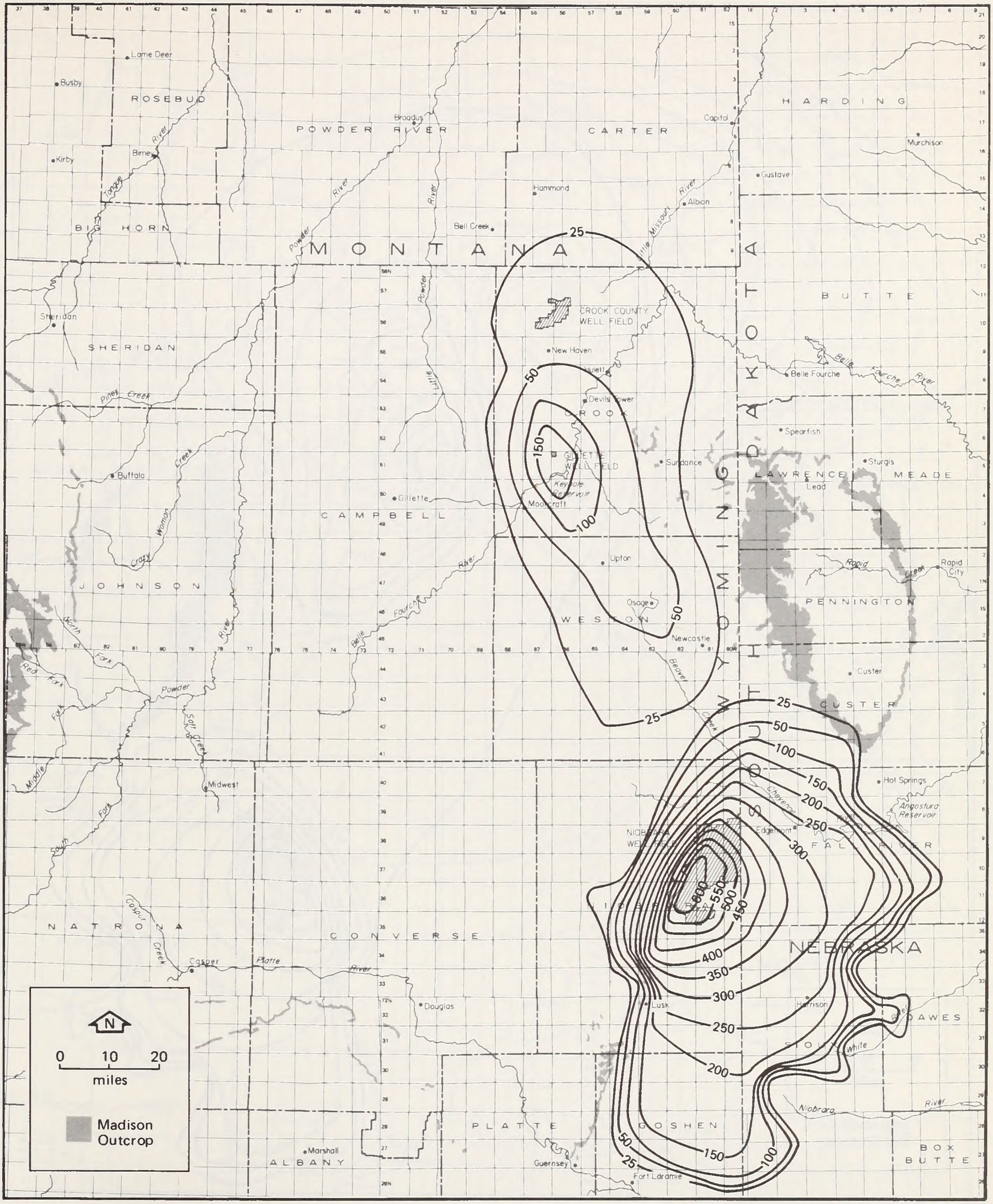
Cumulative impacts in Campbell County, Wyoming, would be substantial. Specifically:

- Population is projected to double in 5 years.
- The city of Gillette has doubled and in some cases tripled the capacity of existing facilities to prepare for this growth, creating a financial burden.
- A short-term shortage in housing is foreseen.
- Some long-term, but unquantifiable, social changes are expected.

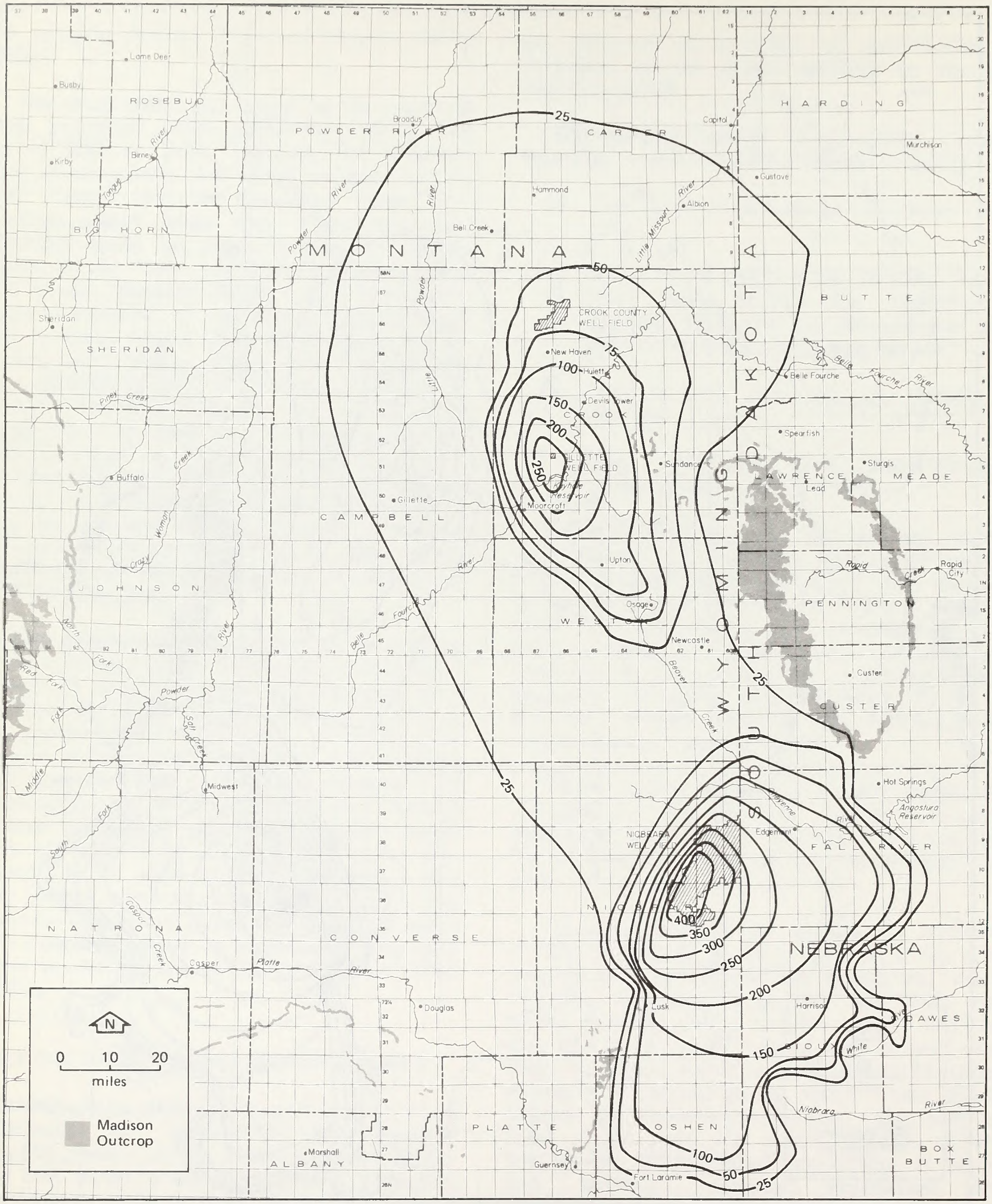
Growth resulting from the several energy developments in Converse County, Wyoming, would be significant. Population could increase by as much as 40 percent in 5 years, and the costs of increasing the necessary public services could be substantial. Douglas and Glenrock could experience negative fiscal balances. Housing is also likely to be a problem. ETSI's share of the shortfall could range between 1 and 10 percent.

There do not appear to be any significant cumulative effects in Weston County, Newcastle, and Upton. The towns are planning for a "desired" population growth, although the extent of that growth is uncertain.

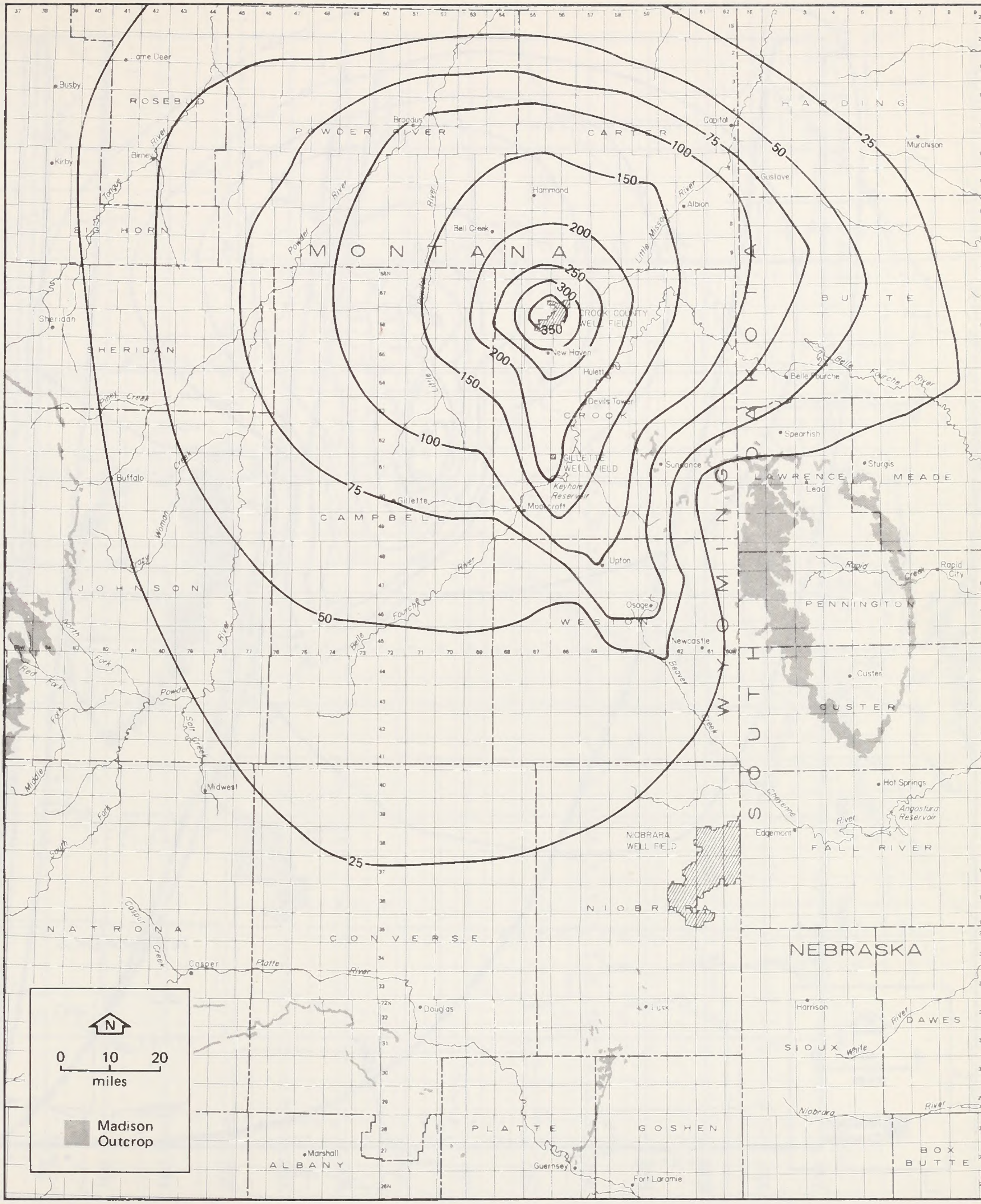
Much of the future growth in Niobrara County, Wyoming, would be related to the ETSI project. As a result, the population would increase substantially within less than two years, however, this increase would last for only one to two years. Plans have already been made to expand water and wastewater facilities to serve a population of 3000. This should provide the necessary capacity. The town of Lusk would bear the major portion of the burden due to increased population; it would not, however, directly experience any significant increase in property tax revenues from the ETSI components.



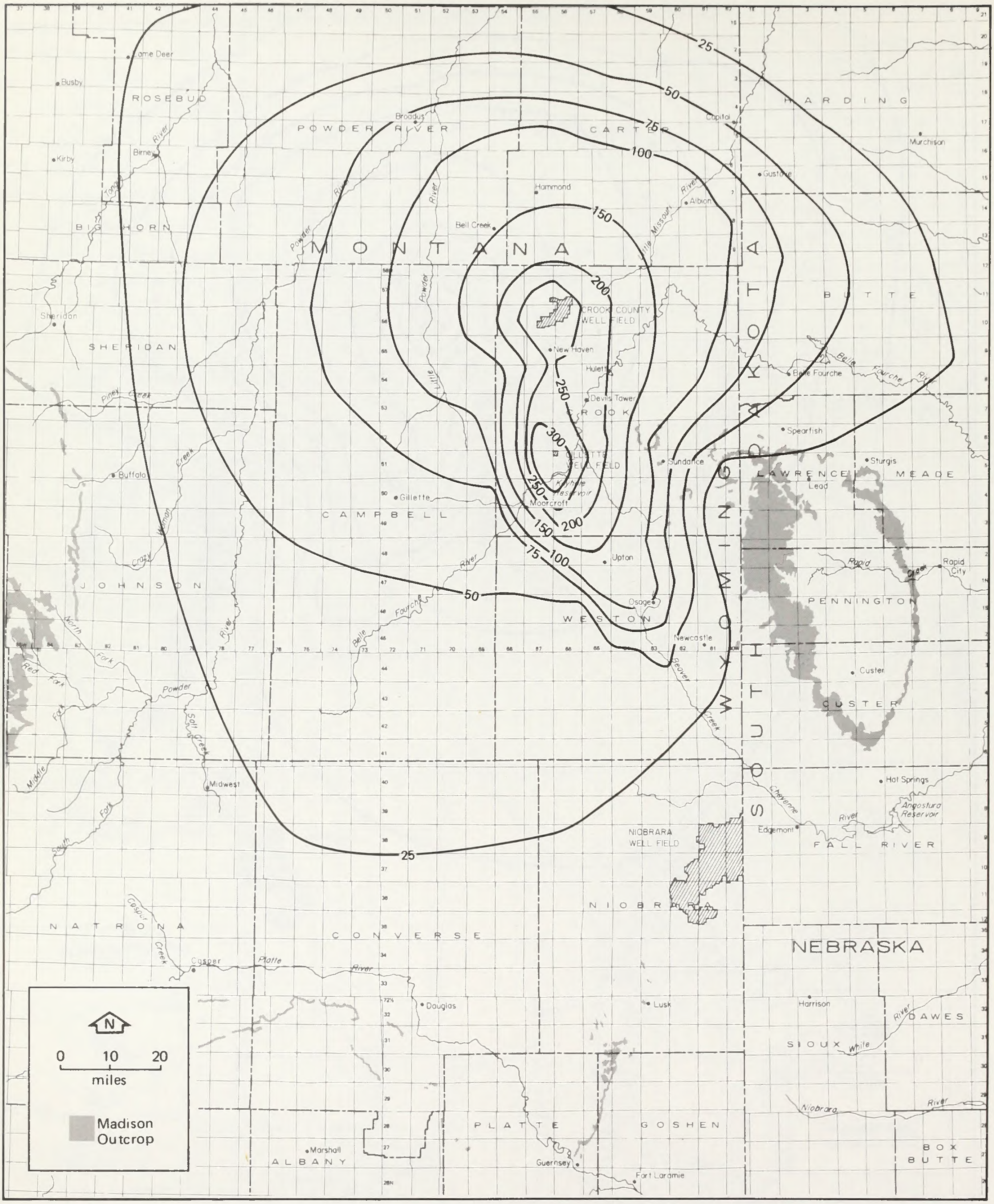
Map 5-2. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING BY EXISTING AND PLANNED MADISON USERS, WITH ETSI PUMPING FROM NIOBRARA COUNTY WELL FIELD ONLY (PLAN 1)



Map 5-3. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING BY EXISTING AND PLANNED MADISON USERS, WITH ETSI PUMPING FROM NIOBRARA COUNTY AND GILLETTE WELL FIELDS (PLAN 2)



Map 5-4. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING BY EXISTING AND PLANNED MADISON USERS, WITH ETSI PUMPING FROM CROOK COUNTY WELL FIELD ONLY (PLAN 3)



Map 5-5. DRAWDOWNS (in feet) IN THE MADISON AQUIFER POTENTIOMETRIC SURFACE AFTER 50 YEARS (1985-2035) OF PUMPING BY EXISTING AND PLANNED MADISON USERS, WITH ETSI PUMPING FROM CROOK COUNTY AND GILLETTE WELL FIELDS (PLAN 4)

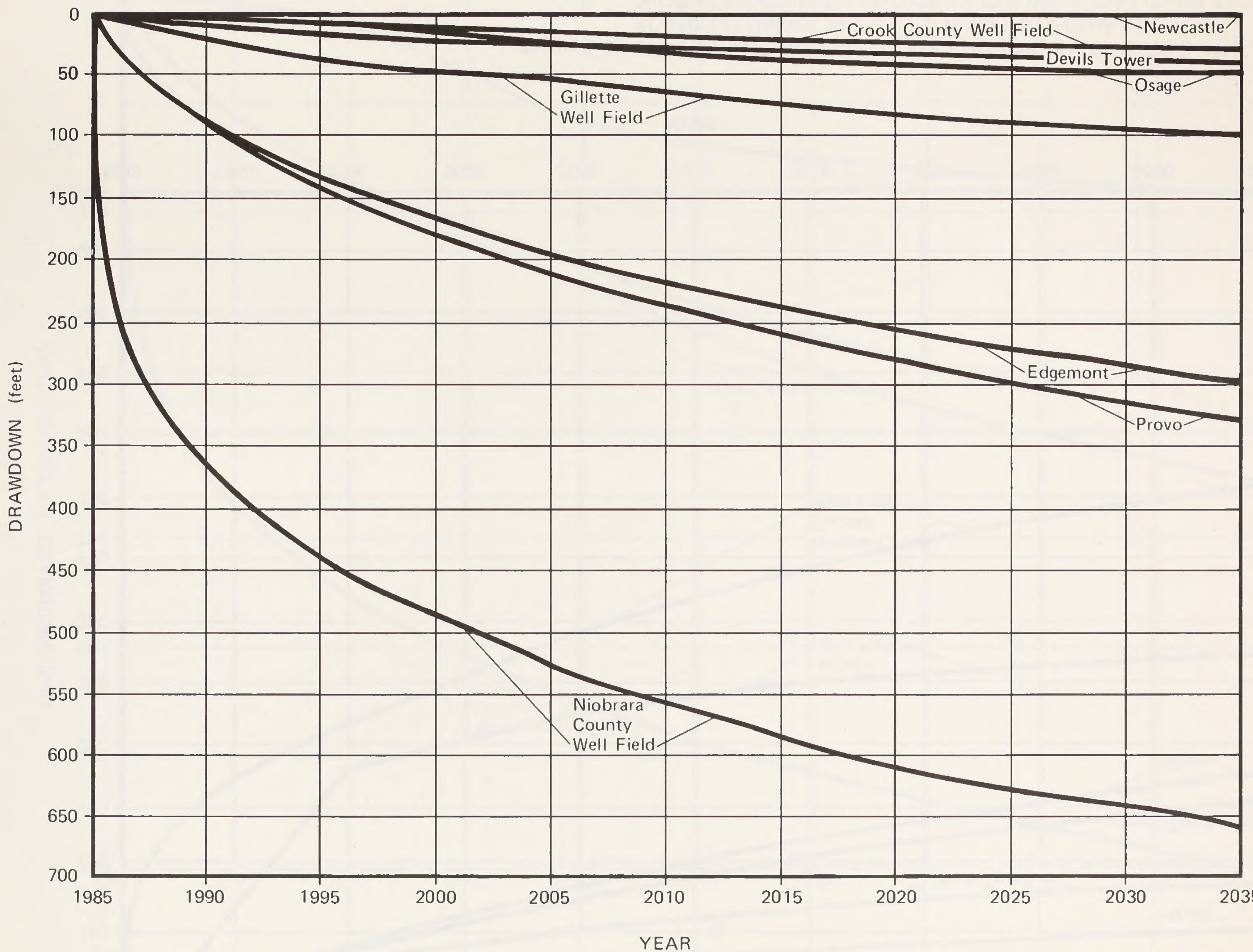


Figure 5-1. TIME-DRAWDOWN PLOT FOR PUMPING BY EXISTING AND PLANNED USERS, WITH ETSI PUMPING FROM NIOBRARA COUNTY WELL FIELD ONLY (PLAN 1)

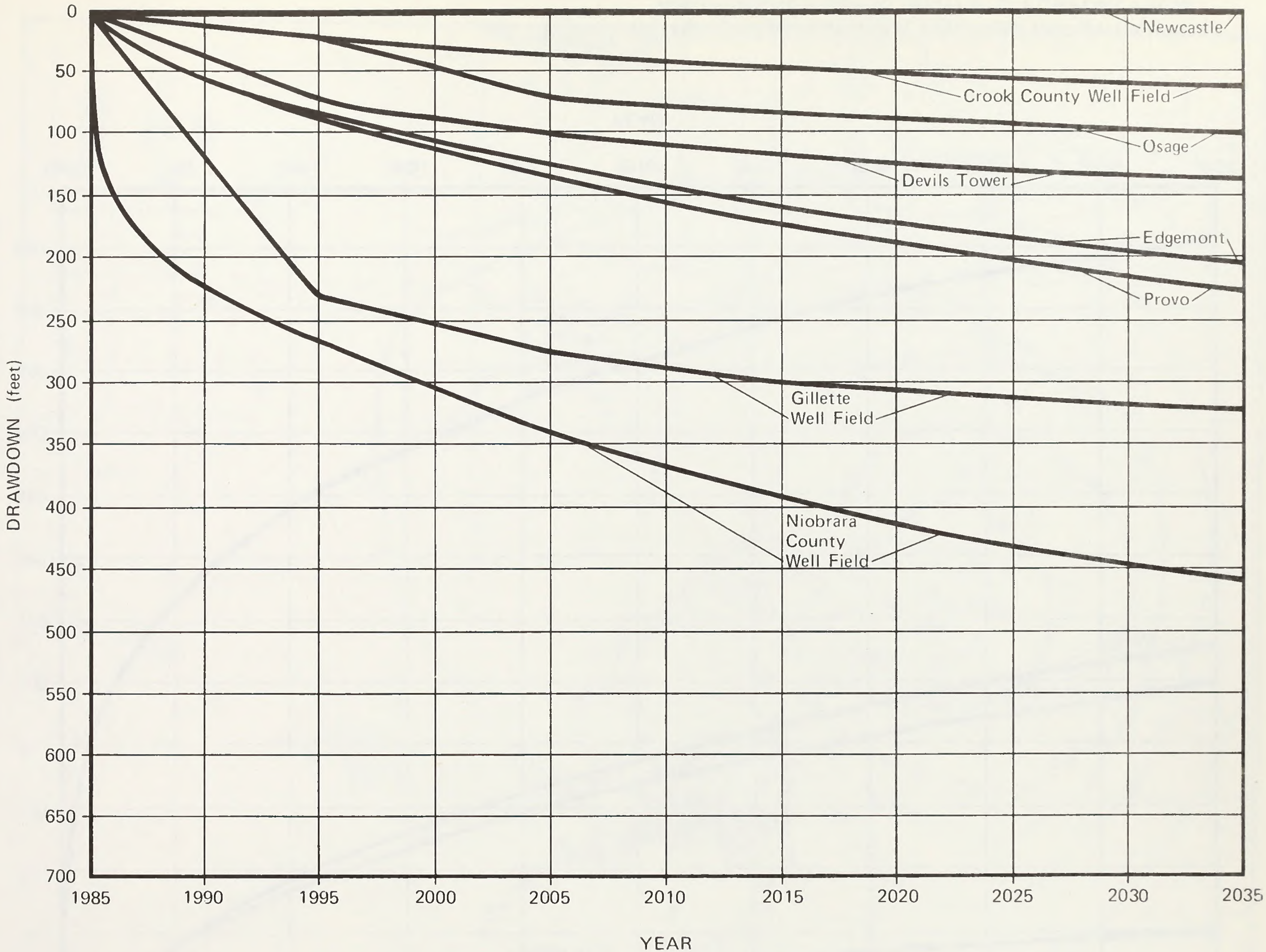


Figure 5-2. TIME-DRAWDOWN PLOT FOR PUMPING BY EXISTING AND PLANNED USERS, WITH ETSI PUMPING FROM BOTH NIOBRARA COUNTY AND GILLETTE WELL FIELDS (PLAN 2)

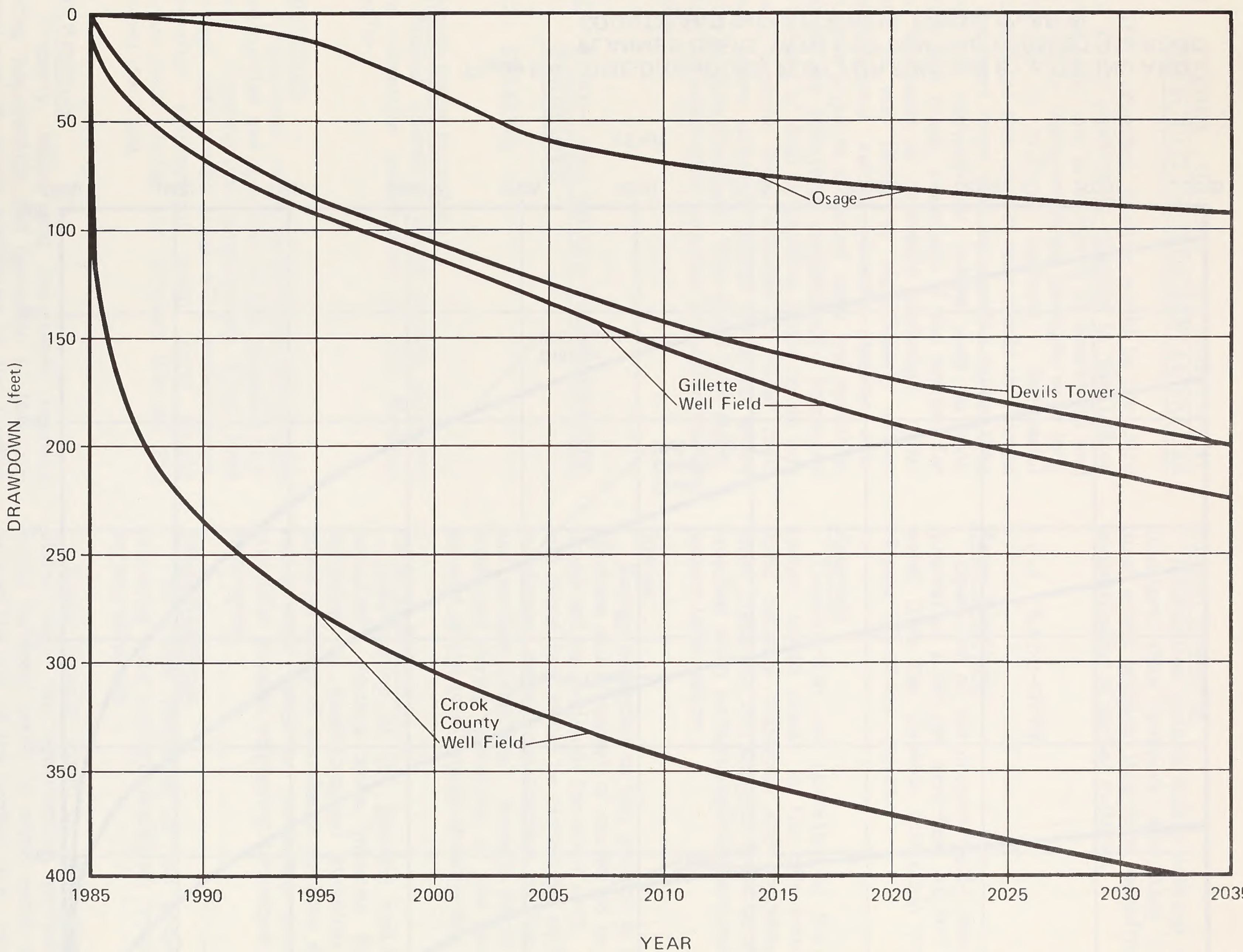


Figure 5-3. TIME-DRAWDOWN PLOT FOR PUMPING BY EXISTING AND PLANNED USERS, WITH ETSI PUMPING FROM CROOK COUNTY WELL FIELD ONLY (PLAN 3)

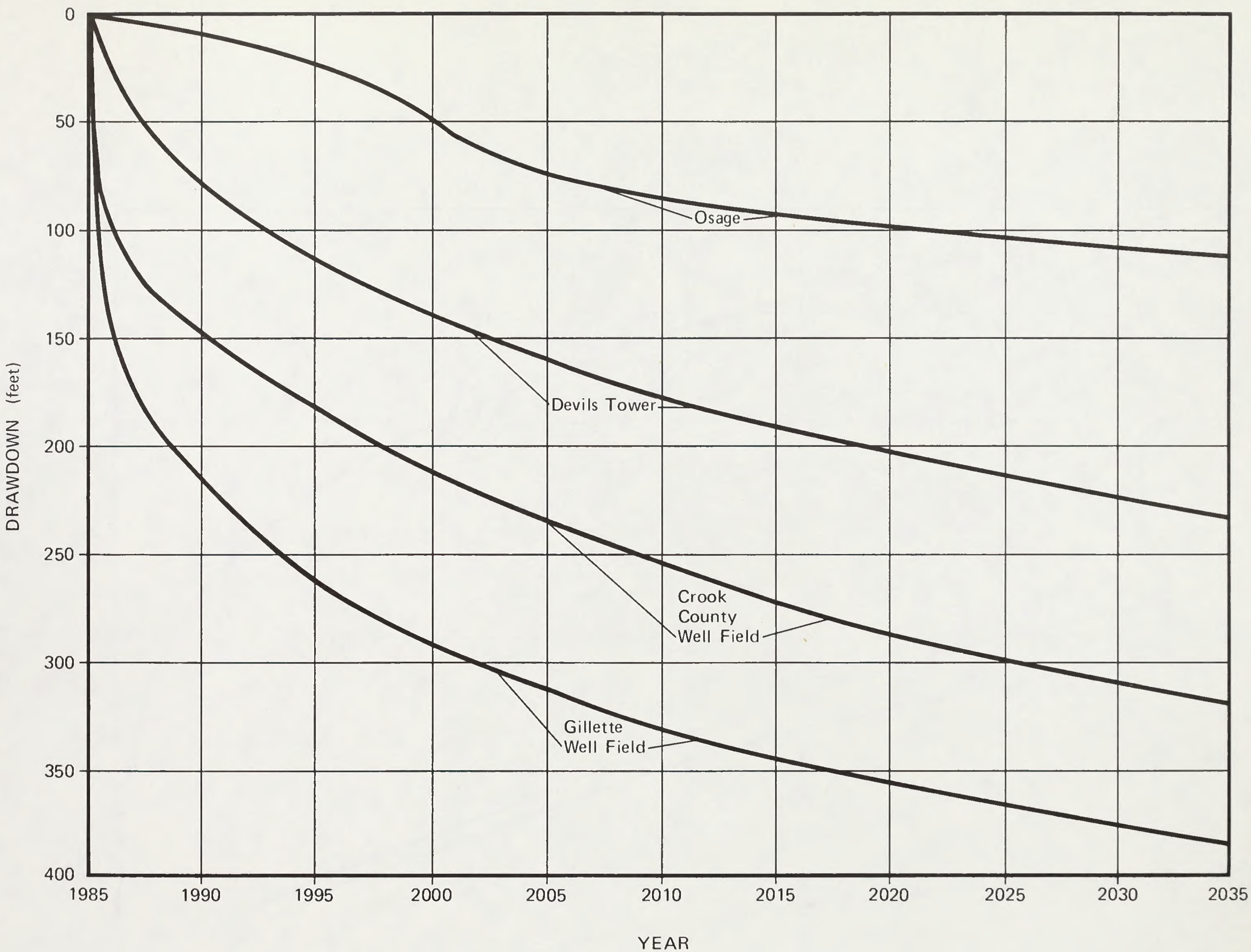


Figure 5-4. TIME-DRAWDOWN PLOT FOR PUMPING BY EXISTING AND PLANNED USERS, WITH ETSI PUMPING FROM BOTH CROOK COUNTY AND GILLETTE WELL FIELDS (PLAN 4)

5.B TRENDS HAVING A SIGNIFICANT IMPACT ON ENVIRONMENTAL VALUES

ETSI's proposed pipeline would be the third coal slurry pipeline to operate in the United States (only one is currently in operation) and the first to transport large tonnages over long distances to multiple markets. Successful operation of this project may result in a trend to transport more coal by pipeline rather than solely by conventional means such as rail, barge, and truck, especially if the demand for coal increases as presently projected. This trend is not likely to significantly affect environmental values because pipeline construction impacts are short term and operation impacts are relatively insignificant. Increased movement of coal by pipeline could result in a trend to move large volumes of water from areas where water is scarce to areas where water is more abundant. This could have significant, undetermined impacts on water-scarce areas.

5.C LONG- AND SHORT-TERM BENEFITS, TRADEOFFS

5.C.1 BENEFITS

Ground-Water Hydrology

Project operation would provide extensive new scientific information on the Madison aquifer.

Employment

Employment would be provided during both construction and operation of the proposed project. Construction employment from 1983 through 1989 would total 9712 worker-years. Operation employment would total 37,650 person-years during the 50-year life of the project (53 X 50).

Tax Revenues

Property, sales, and use taxes imposed during construction and operation of the proposed project would contribute to the funding of government services in the counties crossed by the pipeline project.

Cultural Resources

Information gained during cultural resource inventory, data recovery, and other investigations would provide long-term benefits to the understanding of earlier cultures.

5.C.2 TRADE-OFFS

Water Resources

Operation of the project would result in the removal of 1,025,000 acre-feet (20,500 x 50) of water from the Madison formation during the 50-year life of the project.

Materials

Construction and operation of the pipeline system would result in the one-time use of some building materials and supplies. Many other materials and supplies could be reused or recycled when surface facilities are removed at project termination.

Energy

Energy expended on this project in the manufacture and transport of materials to the site would not be available for other uses. Gasoline and diesel fuel would be burned by vehicles and machinery during construction of the pipeline and surface facilities. Energy would also be consumed during operation, at the rate of 4.0 percent of the total energy transported.

Cultural Resources

Construction of the pipeline system could potentially destroy some unknown subsurface historical or archaeological remains. There could be a loss of knowledge because any excavated sites could be precluded from future scientific studies employing techniques not yet developed.

Visual Resources

The visual resources in the project area, primarily near surface facilities, would be adversely affected.

Some impacts would be short term (associated with the construction period), others would be long term, in some cases extending beyond the life of the project (e.g., recovery of the Madison Group potentiometric surface, and re-establishment of woodland areas).

beyond the life of the project (e.g., recovery of the Madison Group potentiometric surface, and re-establishment of woodland areas).

5.D COMMITMENT OF RESOURCES

Construction and operation of the proposed project would result in the commitment of some environmental resources and energy. Environmental resources that would be committed include:

- Vegetation. Loss of 6389 acres of woodland would be a long-term commitment of resources.
- Wildlife. Some wildlife and aquatic life would be irretrievably lost during project construction (short term). These would consist primarily of small terrestrial animals lost during right-of-way clearing and fish and aquatic invertebrates lost during construction at stream crossings. Production of wildlife habitat (vegetation) would also be lost until disturbed areas are reclaimed. At surface facilities, these losses would constitute a long-term commitment of resources.
- Cultural. Some subsurface sites may be irretrievably and permanently damaged or destroyed during construction. Mitigation through recovery of data requires the commitment of a resource to a use that may preclude future scientific studies employing techniques not yet developed.
- Steel. Since the pipeline would be left in the ground at the time of project abandonment, the 725,000 tons of steel used to form the pipeline would be a permanent commitment of this resource.
- Concrete. The estimated 90,000 cubic yards of concrete used to construct this project would be a permanent, irreversible commitment of this resource.
- Fuel. The fuel used in vehicles and other machinery during construction and operation would be a permanent, irreversible commitment of the resource.
- Energy. The proposed action would also consume energy at the rate of 664,000 Btu/ton of coal, which would be equivalent to 4.0 percent of the total energy (coal) transported.
- Paleontology. Destruction of paleontological resources would be an irreversible, permanent commitment of the resource.

5.E RELATIONSHIP OF PROPOSAL TO NATIONAL ENVIRONMENTAL POLICY ACT GOALS

The proposed project would contribute to energy production in a manner that minimizes the environmental impacts. (See Tables 2-3 and 2-4 for a comparison of environmental impacts for the proposed action and alternatives.) Slurry-pipeline transportation of coal allows the continued use of a variety of surface resources and results in minimal risks to human health and safety and minimal degradation in the quality of life (Table 5-4).

Risks to Health and Safety

Accidents During Construction. Precautions would be taken to minimize the number of accidents and injuries during construction of the project. Access to construction sites would be restricted to avoid injuries to the public.

Accidents During Operation. The likelihood of pipeline operation resulting in any injuries to pipeline personnel or to the public is considered remote for two reasons: (1) the pipeline would be buried, and (2) the coal slurry mixture is nonexplosive, nonflammable, and essentially nontoxic.

Thus even if a rupture or leak were to occur (see the Ruptures and Spills Technical Report [WCC 1980j]), the spilled material would not be hazardous if contacted by the skin, would not form harmful vapors, and would actually tend to extinguish any fires since the slurry would consist of approximately 50 percent water.

TABLE 5-4

RELATIONSHIPS BETWEEN IDENTIFIED PROPOSED ACTION IMPACTS AND NEPA GOALS

NEPA Goal	Transportation of 37.4 MMTA of Coal Via Slurry Pipeline	Decline in Groundwater levels near ETSI Well Field and Use of Groundwater as a resource	Decline in Groundwater Quality near ETSI Well Field	Decline in Spring Flow and Stream Flow near ETSI Well Field	Additional Revenues to Counties Along Pipeline Route	Loss of Vegetation	Loss of Wildlife Habitat	Loss of Some Archaeological Sites Not Visible from Surface	Loss of Prime Agricultural Land
1. Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations		Long-term impact affecting one or more generations	Not significant	Relatively small		Temporary disturbance except in woodland areas	Temporary disturbance, except in woodland areas	Loss would be permanent but not significant	Loss would be insignificant
2. Assure for all Americans safe surroundings	Pipeline is safe means of transportation								
3. Assure for all Americans healthful surroundings	Pipeline transportation maintains healthful surroundings								
4. Assure for all Americans productive surroundings	Contributes to energy production				Benefits most local economies	Slight loss in productivity	Slight loss in productivity of wildlife		Slight loss of productivity
5. Assure for all Americans aesthetically pleasing surroundings									
6. Assure for all Americans culturally pleasing surroundings								Some loss of cultural resource	
7. Attain the widest range of beneficial uses of the environment without degradation	Buried pipeline causes little degradation	Impact relatively small, except close to well field	No significant impact	Relatively small impact in limited area		Loss would not be significant	Loss of habitat would not be significant	Loss of sites may degrade future knowledge of culture	Loss would not be significant
8. Attain the widest range of beneficial uses of the environment without risk to health	Pipeline would cause little risk to health	No effects on health	No effects on health	No effects on health		Habitat disturbance and loss is undesirable			
9. Attain the widest range of beneficial uses of the environment without risk to safety of people	Pipeline would cause little risk to safety								

TABLE 5-4 Concluded

NEPA Goal	Transportation of 37.4 MMTA of Coal Via Slurry Pipeline	Decline in Ground-water levels near ETSI Well Field and Use of Ground-water as a resource	Decline in Ground-water Quality near ETSI Well Field	Decline in Spring Flow and Stream Flow near ETSI Well Field	Additional Revenues to Counties Along Pipeline Route	Loss of Vegetation	Loss of Wildlife Habitat	Loss of Some Archaeological Sites Not Visible from Surface	Loss of Prime Agri-cultural Land
10. Attain the widest range of beneficial uses of the environment without undesirable consequences	Buried pipeline allows other surface uses to continue	Little or no use is made of ground-water resource at the present time	No significant impact	Relatively small impact in limited area			Habitat distur-bance and loss is undesirable		Loss is undesirable
11. Attain the widest range of beneficial uses of the environment without unintended consequence								No way to mitigate potential loss	Loss would not have an unintended consequence since it would be widely scattered
12. Preserve important historic aspects of our national heritage	Historic resources would be avoided								
13. Preserve important cultural aspects of our national heritage	Cultural resources would be avoided wherever possible							Knowledge would be gained by inventory	
14. Preserve natural aspects of our national heritage	Width of distur-bance is narrow and generally temporary					Most habitat would not be permanently lost	Most habitat would not be perma-nently lost		
15. Maintain an environment which supports diversity	Pipeline right-of-way would be reclaimed						Habitat loss would not decrease diversity	No loss of signifi-cant sites anticipated	
16. Maintain environment which supports variety of individual choice		Would lessen desir-ability of developing deep ground-water supplies close to well field	No significant impact	Relatively small impact in limited area					
17. Achieve a balance between population and resource use which will permit high standards of living	Minimum resource loss to maintain standard of living	Use would be made of resource which presently is little used or unused			Benefits most local economies				Loss would not alter standard of living
18. Achieve a balance between population and resource use which will permit a wide sharing of life's amenities		Limited loss of resource, except close to well field		Small loss restricted to limited area				Knowledge gained from sites	
19. Enhance the quality of renewable resources						Most habitat maintained for long term	Most habitat main-tained for long term		
20. Approach the maximum attainable recycling of depletable resources	Usable equipment salvaged at project termination	Slurry water used for cooling at power plants, as well as transport medium							

Quality of Life

Transportation of coal in slurry pipelines is not expected to cause a degradation in the quality of life since the pipeline would be underground and the right-of-way would be reclaimed. Some degradation in the quality of life would occur in the area near Gillette, Wyoming, during project construction as a result of an increase in population related to the presence of construction workers. Tax payments to counties along the route would create new revenues that could be used to improve the quality of life. Some new services would be required that would somewhat offset the increase in tax revenues.

5.F CONFLICTS WITH LAND USE PLANS, CONTROLS, AND CONSTRAINTS

The proposed action and alternatives would cross areas under the jurisdiction of planning authorities responsible for preparation and documentation of plans for a variety of resources. These plans range from State Comprehensive Outdoor Recreation Plans (SCORP) to the plans of local, special-purpose districts. Numerous federal plans, including those developed for Bureau of Land Management (BLM) and Forest Service lands, also exist.

Rural lands designated by a state or federal agency for a special use, such as wilderness, recreation, agriculture, or grazing, have been reviewed and conflicts noted under the appropriate section. Specifically, the project plans present no conflicts with either BLM Management Framework Plans in Wyoming (Bessinger 1980) or Forest Service land-use plans for the Thunder Basin National Grassland (Olsen 1980).

City, county, and regional land-use plans have been collected and anticipated conflicts noted by local authorities. These plans serve generally as guidelines for development rather than as legally restrictive documents and have been found to accommodate utility-related development as a necessary element in the urban infrastructure.

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In order to help the reader locate copies of these references, symbols are used to indicate the following:

[a] Available through public libraries loan system.

[b] Available from Bureau of Land Management, Office of Special Projects, 555 Zang Street, Third Floor East, Denver, Colorado 80228.

[c] Available for inspection at Woodward-Clyde Consultants, Three Embarcadero Center, Suite 700, San Francisco, California 94111.

[d] Available for inspection at Bureau of Land Management State Offices.

[e] Available from Energy Transportation Systems Inc., P.O. Box 7598, San Francisco, California 94120.

The appropriate symbols will appear at the end of each citation.

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GLOSSARY

Acre-foot - the volume of water that would cover one acre to a depth of one foot, equivalent to 43,560 cubic feet. One cubic foot per second (cfs), flowing for 24 hours, is equivalent to 1.983 acre-feet.

Air quality standard - any state or national ambient air quality concentration limit not to be exceeded more than a specified number of times per year. Each standard is based on measurements over a given time period.

Air quality standards, primary - standards intended to protect the health of most people with a margin of safety.

Air quality standards, secondary - standards intended to protect property and other human welfare values, including aesthetics.

Ambient - in the case of air quality, the portion of the atmosphere external to buildings.

Ancillary facilities - those structures (pump stations, power and communications lines, cathodic protection systems) which are necessary for the continuous operation or maintenance of the pipeline.

Anticline - a convex fold, the core of which contains the older rocks.

Applicant - in this environmental impact statement, applicant refers to Energy Transportation Systems Inc. (ETSI).

AQCR (Air Quality Control Region) - The United States is divided into AQCRs for designating jurisdictional boundaries in measuring and maintaining air quality.

Aquifer - one or more formations that contain sufficient permeable material to yield significant quantities of water to wells and springs.

Aquifer test - see Pumping Test.

Artesian - see confined aquifer.

As-mined coal - coal that has not been processed (cleaned) to remove the impurities and noncombustible components such as rocks and gravel.

Authorizing action - granting of a permit, easement, license, or similar legal privilege that is needed before a proposed project can proceed.

Average, one-hour - the average of all measurements made in a one-hour period; other averages for three hours, twenty-four hours, and one year are used in air quality monitoring.

Backfill - earth that is replaced after a construction excavation.

Base flow - that part of a stream flow derived from ground water.

Baseline - air quality, water quality, or meteorological data used as a starting point in estimating the impact of new emissions.

Basin - a general term for a depressed or concave, downward, sediment-filled area.

Benthic macroinvertebrate - an animal that can be seen with the naked eye, that does not have a backbone, and lives in or on the bottom of a body of water.

Biological diversity - the variety of plants or animals; the more diverse a system is, the more kinds of plants and/or animals it contains.

Biological production - the quantity of organic matter produced by a living system (i.e., by an organism, a group of organisms, or an ecosystem). Two types of production are recognized: Primary production is the quantity of organic matter produced by green plants through photosynthesis; secondary production is the quantity of animal material produced.

Biological productivity - the rate of production of organic matter by living organisms (i.e., the amount per unit time).

Biota - the plant and animal life in an area.

Blanketed - covering an area to be blasted with heavy mats to reduce the extent of flying debris from the blasting.

Blue-green algae - microscopic aquatic plants that belong to the phylum Cyanophyta.

Caddisfly - the adults are slender insects with four wings, sometimes with hair-like scales which give them a mothlike appearance. The larvae live in water and often build cases of sand, small pebbles, leaves, etc.

Capital-intensive - in this instance, refers to a project in which the major operating cost component is attributed to fixed charges on the capital investment.

Cathodically protected - protected against corrosion by means of a weak electric current applied to the pipeline to offset the galvanic action causing metal corrosion.

Centrifuge - a machine that separates solids from liquids by means of a rapidly rotating chamber.

Chiseling - loosening the soil, without inverting and with a minimum of mixing of the surface soil, to shatter restrictive layers below normal plow depth that inhibit water movement or root development (called "chiseling" when the restrictive layers are less than 16 inches deep).

Clariflocculator - a physical-chemical process to remove suspended solids from a liquid.

Clastic - consisting of rock or organic fragments or structures that have been moved from their place of origin.

Coating - a field operation for preparing a pipeline to be lowered into the ditch. The line is coated with an inert material, then spiral-wrapped with a tough, inert wrapper. Machines ride the pipe, and coat and wrap in one continuous operation. This process protects the pipeline from corrosion. For some pipeline jobs the pipe may be coated and wrapped at a mill or construction yard site. Any damage to the coating from transportation or handling can be corrected before the pipe is installed.

Concentration - the relative content of a component (as dissolved or dispersed material); measured by weight or volume of material per unit volume of the medium.

Cone of depression - the roughly conical shape produced in a potentiometric surface by pumping.

Confined aquifer - an aquifer containing confined ground water. In a confined aquifer, the water level in a well usually rises above the top of the aquifer. If it does, the well is called an artesian well and the aquifer is said to exist under artesian conditions. In some cases the water level may rise above the ground surface, in which case the well is known as a flowing artesian well and the aquifer is said to exist under flowing artesian conditions. The water level in a well in an unconfined aquifer rests at the water table.

Copepod - small aquatic crustaceans.

Cultural resources - remains of human activity, occupation, or endeavor, as reflected in sites, buildings, artifacts, ruins, etc.

Criteria pollutant - an air pollutant for which a national ambient air quality standard exists.

Critical habitat - habitat essential to the conservation of an endangered or threatened species.

Crustacean - invertebrate (animals without backbones) with body divided into two sections, two pairs of antennae, often have jointed appendages and often have gills. Crayfish, prawn and river shrimp are common forms.

Decibel - a unit for expressing the relative intensity of sounds on a scale from 0 (for the average least perceptible sound) to about 130 (for the average pain level).

Diatom - microscopic aquatic plants that belong to the phylum Bacillariophyta.

Diffusion model - graphs, formulas, or equations which estimate the dilution of an air pollutant as it is transported by the wind.

Drawdown — the decline in the potentiometric head in an aquifer at a specified period of time. Drawdown is also defined as the difference between the elevation of the water level in a well under non-pumping (static) conditions and the elevation under pumping conditions.

Ecotone - blurred, indefinite transition area between two communities.

Emission - A substance, whether gaseous or particulate, released by human activity into the air or water.

Endemic - restricted to a particular geographical area.

Ephemeral stream - a stream which flows only in direct response to precipitation in the immediate watershed or in response to the melting of a cover of snow and ice, and which has a channel bottom that is always above the local water table.

Forb - a broad-leaved flowering plant, as distinguished from the grasses, sedges, etc.

Front - in meteorology, the boundary zone between two dissimilar air masses.

Fugitive dust - particulate matter composed of soil which is uncontaminated by pollutants resulting from industrial activity.

Headwaters - small streams that are the sources of a river.

High-gradient streams - characterized by the majority of the stream having a moderate to fast current.

Host - an organism which is a source of food for a parasite. The parasite may live on the outside or inside of the host and may be harmful or harmless.

Hydrostatic testing - filling a pipeline with water under pressure to test for tensile strength (its ability to hold pressure without rupturing).

Intake - the place at which a liquid (primarily water) is taken into a pipe, channel, etc.

Intermittent stream - (a) A stream or reach of a stream that drains a watershed of at least one square mile, or (b) A stream or reach of a stream that is below the local water table for at least some part of the year, and obtains its flow from both surface runoff and ground-water discharge.

Larval - an immature stage for an animal that is intermediate between the egg and the adult. The larva is different in appearance from the adult.

Lineament - straight or gently curved lengthy features of the earth's surface, frequently expressed topographically as depressions or lines of depression. Some express valid structures such as faults, aligned volcanoes, and jointing; the meaning and origins of others are obscure.

Lithic artifact - a man-made object relating to a specific stage in man's use of stone as a cultural tool.

Loessial soil - bluff-colored, wind-blown deposit of fine silt or marl, usually unstratified, which is often exposed in the bluffs with steep to vertical faces.

Low gradient streams - characterized by the majority of the stream having a moderate to slow current.

Madison Group - a water-bearing geologic formation extending under portions of Wyoming, South Dakota, Nebraska, Montana, North Dakota, and Canada.

Mainstem - the river or stream proper, not referring to any of its tributaries.

Market configuration - the route taken to transport coal by pipeline to terminals listed for the market alternative.

Mayfly - also known as shad flies, salmon flies, and June bugs. The adults are sluggish insects with slender filaments at the tail end of the body and have large triangular wings. The immature mayfly lives in the water, while the adult lives on land. The adult may live for only a few days, while the immature stage may last for several years.

Microgram - one millionth of a gram.

Monitoring, air quality - measurements of instantaneous or average ambient air pollutant concentrations.

Monitoring well - a well used to collect hydrologic data.

Monocline - a unit of strata that dips or flexes from the horizontal in one direction only and is not part of an anticline or a syncline.

Mussel - an aquatic invertebrate two-shelled animal; a clam.

Nitrogen dioxide - a molecule of one nitrogen and two oxygen atoms - NO_2.

Nonresurgent spring -- a spring whose flow does not originate from upgradient streamflow losses. Resurgent springs are associated with disappearing streams.

Oxidant - a mixture of chemically oxidizing compounds formed from reactions in the atmosphere.

Ozone - a molecule of three oxygen atoms: O_3.

Paleontology - a science that deals with the life of past geological periods and is based on fossil remains.

Particulate matter - pulverized material or droplets, typically averaging one micron or smaller in diameter.

Perennial stream - a stream or part of a stream that flows continuously during all of the calendar year as a result of ground-water discharge or surface runoff. The term does not include intermittent stream or ephemeral stream.

Periphyton - microscopic organisms that are attached to objects under water.

Petroglyph - figures, symbols, or scenes pecked or etched in rock.

Phytoplankton - microscopic plant life suspended in the water of aquatic habitats.

Plankton - microscopic aquatic plants or animals.

Potentiometric surface - a surface that represents the static water level or head in an aquifer. In a confined aquifer, it is defined by the levels to which water will rise in tightly cased wells. The water table is a particular potentiometric surface.

Pumping test - a test made by pumping a well and observing the change in hydraulic head in the aquifer.

Raptor - predatory bird, such as the eagle, hawk, and owl.

Reproductive potential - the potential number of offspring that could be produced.

Riparian - relating to or living on the bank of a river or stream.

Riprap - a foundation or sustaining wall of stones (as on an embankment slope) to prevent erosion.

Slurry - a mixture containing a fine, insoluble material (such as coal) and a fluid (such as water).

Spread - a group of construction personnel and equipment assembled to do a major construction job. The workers and equipment are dispersed along the right-of-way.

Stipulation - a legal requirement.

Stringing pipe - placing joints of pipe end-to-end along a pipeline right-of-way in preparation for welding the joints together to form a pipeline.

Subsoiling - loosening soil to depths greater than 16 inches (see "Chiseling").

Substrate - soil, organic, and/or rock materials found on the bottom of aquatic habitat.

Throughput - in this report, the amount of coal delivered by means of the slurry pipeline.

Transmissivity - the rate at which water moves through a unit.

Turbid - muddy or cloudy from having the sediment stirred up and suspended in the water column.

Unit train - a train whose entire cargo is loaded from one source and delivered to only one customer.

Vascular plants - plants that have specialized tissues that move water and food throughout the plant.

Watershed - the area drained by a river or river system.

Wind rose - A 360-degree circle broken into 16 equal sectors used for displaying frequency distributions of wind speed and direction.

Zooplankton - small microscopic animals suspended in the water of aquatic habitats.

ABBREVIATIONS

AR	Arkansas
ac-ft/yr	acre-feet per year
AT&SF	Atchison, Topeka, and Santa Fe railroad
BN	Burlington Northern railroad
BLM	Bureau of Land Management
BOD_5	biochemical oxygen demand
Btu	British thermal unit
C&NW	Chicago and North Western railroad
CFR	Code of Federal Regulations
CO	Colorado
CO_2	carbon dioxide
COE	U.S. Army Corps of Engineers
CTC	Centralized Traffic Control Systems
cfs	cubic feet per second
EIS	environmental impact statement
ETSI	Energy Transportation Systems Inc.
FS	U.S. Forest Service
FWS	U.S. Fish and Wildlife Service
ft	foot
gpm	gallons per minute
GPA	Gillette Planning Area
HCRS	Heritage Conservation and Recreation Service

KCS	Kansas City Southern railroad
KS	Kansas
kV	kilovolts
Kwh	kilowatt hours
LA	Louisiana
lb	pound
MMTA	million (short) tons annually
MKT	Missouri-Kansas-Texas railroad
MO	Missouri
mi	miles
MP	milepost
mg/l	milligrams per liter
MT	Montana
NE	Nebraska
NNL	National Natural Landmark
NPDES	National Pollutant Discharge Elimination System
NTSA	National Trails System Act
O.D.	outside diameter
OK	Oklahoma
ppm	parts per million
pci/l	picocuries per liter
SD	South Dakota
SMSA	Standard Metropolitan Statistical Area
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer

TDS	total dissolved solids
tph	tons per hour
TSP	total suspended particulates
T&E	threatened and endangered
UP	Union Pacific railroad
USGS	U.S. Geological Survey
WCC	Woodward-Clyde Consultants
WY	Wyoming

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APPENDIX A

(Maps located in separate volume)

APPENDIX B

CONSULTATION AND COORDINATION

APPENDIX B-1
PUBLIC INVOLVEMENT IN EIS SCOPING PROCESS

The first step in preparing an environmental impact statement (EIS) is called "scoping." The scope of an EIS is the range of actions, alternatives, and impacts to be included in the document. The purpose of scoping is to determine the significant issues related to a proposed action which should be included in the EIS. Scoping is designed to reduce some of the past inefficiencies associated with EIS preparation. Its basic goal is to make environmental impact statements more meaningful and useful to persons in the federal government who must make decisions on the proposal, as well as to the people who may be affected by approval or disapproval of the proposal or its alternatives.

The Bureau of Land Management (BLM) sponsored public meetings designed to involve interested citizens and groups in the scoping process. They were held in nine communities in seven states (Table B-1). The communities were generally located near the route of the proposed pipeline or an alternative.

An announcement about the meetings was published in the August 1, 1979, Federal Register and was distributed to newspapers and radio and television stations in and near the selected communities. Information on the sessions was also sent to federal and state government organizations and to other groups that were potentially interested in the EIS process.

Average attendance at the meetings was 52. There was, however, great variation in the attendance at the various locations. Total attendance for all nine sessions was 469. See Table B-1 for specific attendance figures for each meeting.

The question considered at each meeting was "What are the major issues associated with the proposed coal slurry pipeline that should be examined in an environmental impact statement." The object was not to seek public support or

TABLE B-1

SCOPING MEETING LOCATIONS AND ATTENDANCE

Washington, D.C.	U.S. Department of the Interior Building (June 21, 1979)	28*
Cheyenne, Wyoming	Hitching Post Motel (August 7, 1979)	25
Gillette, Wyoming	Ramada Inn (August 9, 1979)	34
Denver, Colorado	Denver Community Progress Center (August 20, 1979)	21
Ponca City, Oklahoma	Public Safety Center (August 21, 1979)	12
Pryor, Oklahoma	Graham Community Building (August 22, 1979)	27
Little Rock, Arkansas	Arkansas Game and Fish Commission Building (August 23, 1979)	34
Hernando, Mississippi	De Soto County Courthouse (August 27, 1979)	22
Vidalia, Louisiana	Concordia Parish Police Building (August 28, 1979)	9
Alliance, Nebraska	Alliance High School (August 29, 1979)	285
	Subtotal	469
Edgemont, South Dakota	Edgemont High School (October, 10, 1979)	230*
	Total	727

* The work group process was not part of this meeting.

opposition to the proposed pipeline, but rather to hear the concerns of interested citizens.

To facilitate discussion of the issues, attendees were divided into "work groups" after short introductory presentations by BLM and Energy Transportation Systems Inc. (ETSI) personnel. The work group format was used to ensure all attendees had an equal opportunity to express their views. Each group member listed issues of concern on a sheet of paper. The group-appointed leader then gave each person an opportunity to identify the issues he/she had listed. These issues were written on a large sheet of paper and discussed. Finally, each person listed, on a secret ballot, the three issues he/she felt were most significant. These ballots and the group issue sheets were collected at the conclusion of the meeting.

In addition to the nine meetings sponsored by BLM, scoping meetings were held in Washington, D.C., on June 21, 1979, and in Edgemont, South Dakota, on October 10, 1979. The meeting in Washington involved 28 persons from federal agencies; no private citizens were included. The South Dakota meeting was sponsored and conducted by the South Dakota Department of Water and Natural Resources, although BLM, Woodward-Clyde Consultants (a contractor helping BLM to prepare the EIS) and ETSI personnel made presentations at this meeting. Approximately 230 people from Edgemont and surrounding areas attended. Although no work group sessions or balloting were included in either of these meetings, major issues raised during the general discussion period were recorded and considered in scoping the EIS.

After all the scoping meetings had been held, BLM personnel analyzed the issues sheets and ballots from the meetings. Issues were categorized and the number of votes for issues included within each grouping was tabulated. A summary of this data is found in Table B-2.

Later, the scope of the EIS was determined by the key participants involved in preparing the EIS based on discussions of the data gathered at the nine scoping meetings, notes from the South Dakota and Washington meetings, and letters received by BLM which identified specific issues of concern. Those involved

were BLM, U.S. Department of the Interior, U.S. Fish and Wildlife Service, Woodward-Clyde Consultants, and ETSI.

A detailed report on the EIS scoping process, "ETSI Coal Slurry Pipeline Proposal: A Report on Public Involvement of the Issues," can be obtained from the Bureau of Land Management, Office of Special Projects, Third Floor East, 555 Zang Street, Denver, Colorado 80228. Among other things, it includes the list of issues raised by each work group, tabulation of work group ballots, scoping meeting participants, and a discussion of the procedures used to analyze the scoping meeting data.

TABLE B-2

SUMMARY OF WORK GROUP BALLOTING

Issue	Votes
WATER ISSUES	
Subsurface Water	142
General	(78)
Effects in Nebraska and South Dakota	(48)
Subsurface-Surface Water Relationships	(11)
Effects in Wyoming	(5)
General	26
Water Rights	25
Alternative Sources of Water	23
Water Recycling	19
Water Quality	19
At Delivery Points	(14)
At Source	(5)
Wetlands and Stream Crossings	9
Effects on Flood Control Structures	6
Interbasin Transfer of Water	5
Alternative Uses of Water	1
	270 Total
SOCIOECONOMIC ISSUES	
Employment Effects	48
Local Socioeconomic Concerns	51
Cost-Effectiveness	35
Landowner Rights and Eminent Domain	20
Construction Impacts	12
Slurry Proposal as Precedent-Setting	10
Slurry Proposal vs. Local Sources of Energy	9
Taxation and Revenues	5
Demand for Coal	4
	194 Total
ENVIRONMENTAL ISSUES	
General	32
Fish and Wildlife	21
Habitat	(9)
Populations	(8)
Threatened and Endangered Species	(4)
Reclamation	16
Agriculture	12
Archeology	6
Land Use	4
Coal Dust	4
Noise	1
	96 Total
PROJECT DESIGN ISSUES	
Description of Proposal	29
Alternative Routes	13
Economics of the Proposal	6
Health and Safety Considerations	4
Alternative Fluids	2
	54 Total
OTHER COAL TRANSPORTATION MODES ISSUES	
Slurry-Other Mode Comparisons	30
Slurry-Rail Comparisons	12
	42 Total
RUPTURE AND SPILL ISSUES	30 Total
ENERGY EFFICIENCY ISSUES	29 Total
ADMINISTRATIVE ISSUES	
Conduct of the Assessment	(5)
Legal Issues	(5)
	10 Total

APPENDIX B-2

CONSULTATION AND COORDINATION

The agencies, groups and individuals that will receive a copy of the DEIS for comment are as follows:

Federal Government Agencies

Department of the Interior
- National Park Service
- Geological Survey[a]
- Water and Power Resources Service
- Bureau of Indian Affairs
- Fish and Wildlife Service[a]
- Heritage Conservation and Recreation Service
- Denver Office of the Secretary
- Atlanta Office of the Secretary

Department of Agriculture
- Forest Service[a]
- Soil Conservation Service

Department of Energy

Department of Transportation
- Federal Highway Administration
- Federal Railroad Administration

Environmental Protection Agency
- Region 6
- Region 8

Interstate Commerce Commission

Department of Defense
- Corps of Engineers[a] (8 District Offices and 1 Division Office)
- Department of the Air Force, Warren AFB

Advisory Council on Historic Preservation

National Environmental Groups

American Fisheries Society
Audubon Society

Friends of the Earth
Natural Resources Defense Council
National Wildlife Federation
Sierra Club
Wilderness Society

State Governments and Agencies

Arkansas A-95 Clearinghouse
Colorado A-95 Clearinghouse
- Larimar Weld Regional Council of Governments
- Northeastern Colorado Council of Governments

Kansas A-95 Clearinghouse
- North Central Regional Planning Commission
- Northeast Kansas Planning and Development Commission
- Mid-State Regional Planning Commission
- Chikaskia Golden Belt and Indian Hill Regional Planning Commission
- Wichita-Sedgwich County Metropolitan Area Planning Commission

Louisiana A-95 Clearinghouse
- Central Regional Clearinghouse
- Capital Region Planning Commission
- Acadiana Regional Clearinghouse
- Southwest Regional Clearinghouse
- Imperial Calcasieu Regional Planning Commission
- Northwest Regional Clearinghouse
- Ouachita Council of Governments
- Teche Regional Clearinghouse

Nebraska A-95 Clearinghouse
Oklahoma A-95 Clearinghouse
South Dakota A-95 Clearinghouse
Wyoming A-95 Clearinghouse

Indian Nations Council of Governments

Local Governments

Various commissioners, mayors, and departments[b]

State Environmental and Industry Groups[b]

Arkansas	(15)
Colorado	(20)
Kansas	(15)
Louisiana	(17)
Nebraska	(36)
Oklahoma	(9)
South Dakota	(23)
Wyoming	(11)

National Industry Groups[b]

(62)

Federal and State Congressional[b]

Arkansas	(40)
Colorado	(12)
Kansas	(64)
Louisiana	(28)
Nebraska	(7)
Oklahoma	(21)
South Dakota	(14)
Wyoming	(4)

Individuals[b]

Outside 8-State Area	(27)
Arkansas	(24)
Colorado	(20)
Kansas	(2)
Louisiana	(5)
Nebraska	(154)
Oklahoma	(26)
South Dakota	(11)
Wyoming	(34)

Libraries[b]

Arkansas	(21)
Colorado	(4)
Kansas	(67)
Louisiana	(18)
Nebraska	(26)
Oklahoma	(15)
South Dakota	(8)
Wyoming	(10)

Copies may be inspected at the following Bureau of Land Management Offices:

Office of Special Projects, Washington D.C.
Office of Special Projects, Denver, Colorado
Colorado State Office, Denver, Colorado
Oklahoma Project Office, Oklahoma City, Oklahoma
Tuscaloosa Office, Tuscaloosa, Alabama
New Orleans OCS Office, New Orleans, Louisiana
Lake States Office, Duluth, Minnesota
Montana State Office, Billings, Montana

Miles City District Office, Miles City, Montana
New Mexico State Office, Santa Fe, New Mexico
Eastern States Office, Alexandria, Virginia
Casper District Office, Casper, Wyoming
Wyoming State Office, Cheyenne, Wyoming
Rawlins District Office, Rawlins, Wyoming

[a] Cooperating agencies.

[b] Detailed list available upon request from Richard E. Traylor, ETSI EIS Project Leader, 555 Zang Street, 3rd floor East, Denver, Colorado 80228, phone: (303) 234-6737.

APPENDIX C - PROJECT DESCRIPTION

APPENDIX C-1

GENERAL CONSTRUCTION, OPERATION, AND RECLAMATION PROCEDURES

Construction and operation of the proposed project would involve well-drilling operations, pipeline installation, and construction of numerous above ground facilities, including coal slurry preparation plants, pipeline pump stations, slurry dewatering facilities, communications networks, electric power transmission lines, and maintenance bases. Standard or general practices are discussed here, and detailed procedures for specific facilities are discussed in Section 1.F.5.

Site Selection

The location of the rights-of-way and systems facilities involved consideration of current land use patterns and environmental factors. For example, wherever feasible the pipeline route would follow existing or planned right-of-way corridors. Where new right-of-way corridors and system facilities would be located, the impacts of the installation would be fully considered. Emphasis would be placed on selecting locations where the right-of-way and facility structures would result in minimal impact to the landscape, vegetation, and fish and wildlife resources would be least noticeable from critical viewing areas.

Equipment Design

The design of all components of the proposed project would include an awareness of the need for energy conservation, emission control, noise suppression, safety, impacts on visual resources, and the use of existing roadways, rights-of-way, and transmission lines wherever feasible. All structures and foundations would also be designed to withstand seismic forces that might be expected in the region. To avoid or reduce the impact of landslides, either natural or those caused by the proposed action, the following measures would be implemented:

- Project facilities would not be located on known or mapped landslides.
- Project facilities would not be located in areas with a known potential for landsliding.
- Project facilities would not be located in known areas with unstable soils.
- Oversteepening or undercutting of existing natural slopes during development and construction would be avoided wherever feasible.
- Engineering solutions to reduce possible landsliding would be implemented.

Visual resource impacts would be minimized by locating and designing facilities so they would create minimal site disturbances and very little contrast with the existing landscape. Structural materials and configurations would repeat the forms, lines, colors, and textures of the surrounding landscape.

Equipment design would be in compliance with all standard codes, practices, and regulations. Safety of the work force would be given full consideration, with protective devices and operating manuals provided for each component.

In order to maintain continuity of operations, surface facilities will be protected from damage due to floods by taking the following steps:

1. Location: As far as possible, surface facilities will be located on high ground above known flood levels

2. Floor Elevation: This will be set where possible above flood levels

3. Dikes: Where flood levels are likely to above floor level, surface facilities will be protected by dikes

4. Design Criteria: This is set such that in case of loss of a pump station the system can continue to operate at a reduced capacity

5. Dewatering Plants: These are located inside the power plants boundary except for Cypress Bend and receive the same protection as the power plant. At Cypress Bend, flood protection measures, as indicated above, will be provided.

Construction

Standard construction procedures for all proposed installations would be followed and would include many measures designed to mitigate impacts, such as the following:

- Construction schedules for river crossings would be planned to avoid fish spawning seasons and to avoid periods of high stream runoff.
- Fugitive dust would be controlled by wetting down areas as necessary.
- Vegetation and adjacent resources would be protected whenever possible.
- Natural drainage would be maintained.
- Sidehill bench cuts would be kept to a minimum.
- Construction on steep slopes would be avoided where feasible.
- On-site environmental coordinators and archaeologists would be employed during construction.
- Above ground facilities would be painted in colors compatible with the surrounding landscape.
- Construction sites would be rehabilitated in an overall visually acceptable manner so that any changes would blend with the adjacent landscape.

Erosion Control and Revegetation

Standard procedures would include implementation of erosion control and revegetation measures to assure that lands disturbed by construction activities would be restored to a stable, productive, and aesthetically acceptable condition.

Because the proposed project right-of-way is composed of many types of terrain, soils, vegetation, land uses, and climatic conditions, the reclamation procedures would include techniques and measures tailored to each condition encountered. Local expertise and locally effective reclamation methods would be considered when the procedures are developed.

Detailed information regarding applicable techniques and technical assistance to private landowners concerning erosion control measures and reclamation procedures would be obtained from the Soil Conservation Service (SCS) through local soil conservation districts. Technical assistance for federal lands would be obtained from BLM and the Forest Service.

During the construction phase of the project, an on-site reclamation specialist would be employed to provide: (1) liaison with private landowners, federal agency officials, and local governments; (2) expertise to direct applicable restoration procedures, when special conditions are encountered, without causing construction delays; and (3) favorable public relations.

General erosion control and restoration measures have been developed for right-of-way and site clearing, trenching and preservation of topsoil, backfilling and grading, land preparation for seeding and cultivation, revegetation, maintenance and monitoring, and use of biochemicals, as discussed below.

Right-of-Way and Site Clearing. Emphasis would be placed on the protection of existing vegetation and measures to minimize disturbance of existing environment.

- Land grading would be done only on the area required for construction.
- Existing ground cover such as grasses, leaves, roots, brush, and tree trimmings would be conserved where feasible. Tree limbs and trees not usable or merchantable timber would be conserved and later shredded and chipped for use in restoration operations or disposed of at the discretion of the landowner.
- Trees and shrubs on the right-of-way that are not cleared would be protected from damage during construction.

- Where the right-of-way crosses streams and other bodies of water the banks would be stabilized to prevent erosion. Construction techniques would minimize damage to shorelines, recreational areas, and fish and wildlife habitat.

- Care would be taken to avoid oil spills and other types of pollution in streams and other bodies of water and in their immediate drainage areas.

- Design and construction of temporary roads would ensure proper drainage and minimize soil erosion. Upon abandonment, road areas would be restored to satisfaction of landowner and/or other regulatory officials.

- During adverse weather conditions, construction would be stopped when rutting or excessive tracking of soil and deterioration of vegetation occurs in the right-of-way area, as determined by the onsite reclamation specialist.

- During construction activities at preparation and dewatering plant sites, sedimentation (detention) basins and/or straw bale filters or other protective devices would be constructed to prevent suspended sediments from reaching downstream watercourses.

Trenching and Preservation of Topsoil. Trenching methods and techniques implemented would ensure that:

- Topsoil is removed from the trench area by double ditching (i.e., windrowed separately, protected, and replaced last during backfilling). This procedure would be followed unless otherwise specified by landowner or authorizing officer.

- Remaining unearthed materials are removed and stored in a manner that facilitates backfilling procedure, uses a minimum amount of right-of-way area, and protects the excavated material from vehicular and equipment traffic.

- Cofferdams or other diversionary techniques would be used where necessary to permit flow in one part of a stream while pipelaying construction occurs in another part.

- A specific trenching and excavated material stockpiling procedure would be used in steep-sloping and rough, broken terrain to ensure minimum disturbance.

Backfilling and Clean-up. The following backfilling and clean-up techniques would be used:

- Backfill would be replaced in a sequence and density similar to the preconstruction soil condition.

- Backfilling operations would be conducted in such a manner to minimize further disturbance of vegetation.

- The contour of the ground would be restored to permit normal surface drainage.

- In strongly sloping and steep terrain, erosion control structures such as water bars, diversion channels, and terraces would be constructed to divert water away from the pipeline trench and reduce soil erosion along the right-of-way and other adjoining areas disturbed during construction.

- All structures such as terraces, levees, underground drainage systems, irrigation pipelines, and canals would be restored to preconstruction conditions so that they would function as originally intended.

- The surface would be graded to conform to the existing surface of the adjoining areas except for a slight crown to compensate for natural subsidence. In cropland areas, especially border- and furrow-irrigated cropland, the crown would be smoothed to match the bordering area to allow surface irrigation.

- Topsoil would be uniformly replaced over the trench fill to restore productivity to its preconstruction condition.

- Materials unsuitable for backfilling or excess fill material would be disposed of in a waste area arranged by the landowner or other authorizing official.

Land Preparation for Seeding and Cultivation. Construction, backfilling, and clean-up activities may cause compaction and alter soil conditions that affect soil productivity and/or seeding success in the right-of-way area. The following practices and techniques would be used to improve these soil conditions, protect soil from erosion, and provide a favorable seedbed:

- In cropland areas, subsoiling or chiseling would be used, unless objected to by the landowner, to ensure that soil compaction is reduced and preconstruction soil permeability is restored.

- Chiseling would be used, unless objected to by the landowner, in rangeland areas to reduce compaction and improve soil permeability. Pitting and contour furrowing would be done on steeper slopes of disturbed areas to increase infiltration and to reduce runoff and erosion.

- Suitable mulches and other soil stabilizing practices would be used on all regraded and topsoiled areas to protect unvegetated soil from wind and water erosion and to improve water absorption.

- Special mulching practices or matting would be necessary in critical areas where wind and water are serious erosion hazards to protect seeding and seedlings after germination.

- Commercial fertilizers might be applied to soil areas with low inherent fertility to maintain crop yields and establish grass seedings. Application rates would be commensurate with annual precipitation and available irrigation water.

- Seedbed for areas seeded to grass would be prepared to provide a firm and friable condition suitable for the establishment of grass stands.

- Rock mulches would be used in steep-sloping rock outcrop areas to reduce erosion and promote vegetal growth.

- Cultivation and land preparation operations on steeply sloping areas would be done on the contour to minimize erosion.

Revegetation (Reseeding and Planting). The loss of vegetation from lands disturbed by pipeline construction can be mitigated only by satisfactory revegetation. To ensure a successful revegetation program, methods and procedures would be consistent with local climate and soil conditions and would follow recommendations of local experts. Revegetation efforts would be continued until a satisfactory vegetative cover is established. The following practices and techniques would be used:

- A firm seedbed would be prepared prior to seeding. This would include a mulch of plant residues or other suitable materials. A cover crop may be needed in larger disturbed areas.

- Seed would be planted by drilling, broadcasting, or hydroseeding. Drilling is the preferred method, because it is usually most successful.
  - Drill seeding with a grass drill equipped with depth bands would be used where topography and soil conditions allow operation of equipment.
  - Broadcast seeding would be used for inaccessible or small areas. Seed would be covered by raking or harrowing.
  - Hydroseeding would be done in critical areas.

- Only species adapted to local soil and climatic conditions would be used. Generally these would be native species;

however, introduced species may be considered for specific conditions when approved by the landowner and regulatory authority. Seeding rates in critical area plantings and generally throughout the right-of-way would be increased 100 percent over regular seeding rates to allow for seed mortality due to adverse growing conditions.

- Seeding would be done when seasonal or weather conditions are most favorable and as determined by the landowner or authorized agency official.
- Grazing or mowing would be delayed at least one season after seeding to provide time for vegetation to become established, especially in highly erodible areas, unless objected to by the landowner. Fencing may be necessary in special areas.

Maintenance and Monitoring. The right-of-way would be inspected to monitor the success and maintenance of erosion control measures and revegetation programs on native grazing lands for two growing seasons or for a period determined by the landowner on private land or the authorized agency official on state or federal land. The monitoring program would identify problem areas and corrective measures to ensure vegetation cover and erosion control. Certification of successful revegetation would be determined by the landowner or authorized agency official.

Use of Biochemicals. The use of biochemicals such as herbicides, fungicides, and fertilizers would comply with state and federal laws regarding the use of poisonous, hazardous, or persistent substances. State and federal wildlife agencies would be contacted if application of any of these substances would be on or near sensitive wildlife areas. Application of these substances would be by ground methods. Prior to use of such substances on or near the permit or grant area, ETSI would obtain approval of a written plan for such use from the authorizing officer, landowner, and appropriate wildlife agency. The plan would outline the kind of chemical, method of application, purpose of application, and other information as required, and would be considered as the authorized procedure for all applications until revoked by the authorizing officer, landowner, or appropriate wildlife agency.

Operation
Systems operation would include these standard practices:

- Compliance with all codes and regulations regarding personnel health and safety
- Development of operating manuals that detail safe operating procedures
- Use of proper fencing and warning signs around unsafe areas
- Development of contingency plans for use in emergency situations involving accidental spills
- The visual quality of areas rehabilitated after construction will be maintained.

Pump Station Ponds
Ponds associated with pump stations would be made available for various studies (limnobiological, hydrothermodynamic, photodynamic, waterfowl production, shore bird production) with the following stipulations:

a. Predesign proposal by study group must not interfere with pipeline operation.

b. Use of ponds would be subject to approval of grantee's District Manager.

c. Study group would demonstrate that study objectives could be met.

d. All studies would be subject to constraints and restrictions of the grantee's District Manager.

(ORIGINAL SIGNED BY
[illegible]SIDENT AND SPEAKER)
SIGNED BY GOVERNOR
DATE: 2-21-74
CHAPTER NO: 25

ORIGINAL SENATE
FILE NO. 14

APPENDIX C-2
ENROLLED ACT NO. 10 , SENATE

FORTY-SECOND LEGISLATURE OF THE STATE OF WYOMING
1974 SESSION

AN ACT to create section 41-10.5 and to repeal sections 41-1.4 and 41-151 of the statutes relating to use of Wyoming water outside of Wyoming; approving the proposal of Energy Transportation Systems Inc. to appropriate underground water subject to the approval of the state engineer; providing criteria upon which the approval of the state engineer is to be predicated; providing certain limitations on approving applications for permits for use of underground water; providing certain conditions on use to be stated in any permit issued; prohibiting the appropriation or transfer of water or water rights outside Wyoming without prior legislative approval; providing for a legislative study; providing for severability; and providing an immediate effective date.

Be It Enacted by the Legislature of the State of Wyoming.

Section 1. Section 41-10.5 of the statutes is created to read:

41-10.5. Applications for use of water outside the state.

(a) All water being the property of the state and part of the natural resources of the state shall be controlled and managed by the state for the purpose of protecting and assuring the maximum permanent beneficial use of waters within the state.

(b) None of the water of the state either surface or underground may be appropriated, stored or diverted for use outside of the state or for use as a medium of transportation of mineral, chemical or other products to another state without the specific prior approval of the legislature on the advice of the state engineer.

(c) No holder of either a permit to appropriate water or a certificate to appropriate water, nor any applicant for a right to appropriate the unappropriated water of this state, may transfer or use the water so appropriated, certificated or applied for outside the state of Wyoming without prior approval of the legislature of Wyoming, provided further, that as a prerequisite to any use or transfer any adjoining state in which any such water is used shall grant reciprocal rights for the use of water in Wyoming.

(d) Subject to the approval of the state engineer, and notwithstanding the provisions of section 41-10.5(b) of the statutes, the legislature hereby approves the proposal of Energy Transporation Systems, Inc., a Delaware corporation, to appropriate no more than twenty thousand (20,000) acre feet annually of the unappropriated underground waters of the state for use in a coal slurry pipeline extending from Wyoming to Arkansas. The state engineer, may in his discretion, issue permits to appropriate such underground water to the extent necessary not to exceed twenty thousand (20,000) acre feet annually to meet the requirements of that project and subject to such conditions as the state engineer may require, and provided that the state engineer determines to his satisfaction that such appropriations of the project meet his requirements, which requirements shall include, but are not limited to the following:

(i) That the water to be used is underground water, from the Madison or Bell Sand formations;

(ii) That such use will not interfere with domestic, municipal, stock watering or irrigation uses or other existing beneficial uses within Wyoming;

(iii) That the water is withdrawn from a source of supply located at a minimum of two thousand five hundred (2,500) feet below the ground surface, from wells constructed to a depth of more than two thousand five hundred (2,500) feet beneath the ground surface; and

(iv) That the wells are cemented or otherwise sealed off from the surface of the ground to the top of the formation or formations from which the water is withdrawn, in order to prevent any movement of water in the well outside the casing and to prevent the entry of water from overlying aquifers into said wells, and that the water so withdrawn will be used to develop other resources of Wyoming.

(e) Nothing in subsection (d) shall be construed as a directive for the state engineer to grant his approval.

(f) The permits shall contain the following requirements and provisions, and any others deemed necessary or desirable, for protection of Wyoming's water and other resources, ecology and environment, by the state engineer and environmental quality agency after mutual consultation:

(i) If at any time the permittee so operates his wells as to lower the water table so as to endanger the water supply of any domestic, municipal, stockwatering or irrigation use or other beneficial use of appropriated water within the state of Wyoming existing at the time the application underlying this permit was filed, permittee may be required by the state engineer at permittees own expense to either:

(A) Deepen the well and pay the additional costs of pumping water for any person whose water supply has been endangered by reason of permittee's pumping operation so that it is equal to the supply available prior to permittee's pumping; or

(B) Provide any person whose water supply is endangered that quantity of suitable water required to equal the amount available prior to permittee's pumping operation; or

(C) Obtain its water from another source that will not significantly affect or endanger the supply of water available to the beneficial users herein described.

(ii) Permittee will pay the costs of court and reasonable fees of attorneys and experts of any person who is required to enforce the terms of this permit by legal action, provided said person is successful in obtaining a final judgment in his favor and against permittee, and provided said fees are found by a court of competent jurisdiction to be both reasonable and necessary. Any such action must be brought in the courts of the state of Wyoming.

ORIGINAL SENATE
FILE NO. 14

ENROLLED ACT NO. 10, SENATE

FORTY-SECOND LEGISLATURE OF THE STATE OF WYOMING
1974 SESSION

(iii) If the state engineer finds reasonable cause to believe the permittee has endangered or is about to endanger the existing water table, an order to show cause why the permit should not be terminated or suspended may be issued. Any hearing held under this section shall conform with the provisions of the Wyoming Administrative Procedures Act.

Section 2. Sections 41-1.4 and 41-151 are hereby repealed.

Section 3. Excluding the applications referred to in subsection 41-10.5(d) of the statutes, and also excluding applications for permits to appropriate underground water for secondary recovery by water flooding of oil and gas fields, and also excluding test wells, no application or applications for the appropriation of undergound water in any one county for industrial purposes totalling more than six thousand (6000) acre feet per year, shall be approved by the State Engineer until April 1, 1975, unless authorized by the Legislature.

Section 4. The Joint Interim Mines, Minerals, and Industrial Development Committee and the Joint Interim Agricultural Public Lands and Water Resources Committee of the 42nd Legislature are hereby directed in conjunction with The Department of Economic Planning and Development, and the Office of the State Engineer to conduct a study of the use of underground water in Wyoming and report back to the 43rd session of the Wyoming Legislature in January 1975.

Section 5. If any provision of this act is held to be unconstitutional, such a ruling shall not affect other provisions of the act which can be given effect without the unconsititutional provision, and to this end the provisions of this act are severable.

ORIGINAL SENATE
FILE NO. 14

ENROLLED ACT NO. 10, SENATE

FORTY-SECOND LEGISLATURE OF THE STATE OF WYOMING
1974 SESSION

Section 6. This act is effective immediately upon passage.

(END)

President of the Senate

Speaker of the House

(ORIGINAL SIGNED BY PRESIDENT AND SPEAKER)

SIGNED BY GOVERNOR

DATE: 2-21-74

CHAPTER NO: 25

APPENDIX C-3
THIRD PARTY BENEFICIARY AGREEMENT BETWEEN OFFICE OF WYOMING STATE ENGINEER AND ETSI

This Agreement between the Office of the State Engineer of the State of Wyoming (State) and Energy Transportation Systems, Inc., a Delaware corporation qualified to do business in Wyoming (ETSI), dated September 24, 1974,

W I T N E S S E T H:

WHEREAS, ETSI has filed applications numbered ETSI P-1 through -26 and ETSI P-31 through -98 with the State Engineer of the State of Wyoming for permits to appropriate groundwater from certain lands in Niobrara County, Wyoming; and

WHEREAS, ETSI has entered into leases with the owners of land in Niobrara County giving ETSI the privilege of entering upon such land for the purpose of pumping water from the Madison Formation, memoranda of said leases being filed with the office of the County Clerk of Niobrara County, and also filed with the State Engineer of Wyoming as exhibits to the aforementioned applications; and

WHEREAS, ETSI has, in addition to its applications for permits to appropriate groundwater, applied for and

received permits from the Wyoming State Engineer to construct test wells on lands leased by ETSI in Niobrara County, and pursuant to which said permits ETSI has constructed test and observation wells into the Madison Formation, and has filed the results of its said testing program with the State Engineer; and

WHEREAS, the State Engineer conducted a public meeting in Lusk, Wyoming, on July 15, 1974, at which time ETSI publicly described how it intended to use the pumped groundwater for its coal slurry project, and at which meeting ETSI also described its geologic and hydrologic findings which were based on core drillings, test wells, and other available data; and

WHEREAS, ETSI has advised the State Engineer of Wyoming, as well as the public, that in the opinion of ETSI and on the basis of all the information ETSI has obtained concerning the effects of pumping water for its coal slurry project there will be no interference with the pumping of any preferred or existing user in the State of Wyoming; and

WHEREAS, ETSI intends to protect and the State intends to defend all preferred and existing users in the State of Wyoming against any interference resulting from ETSI's pumping, and to that end ETSI and the State have determined that this purpose can best be accomplished by an agreement between said parties made expressly for the benefit of such persons;

NOW, THEREFORE, in consideration of the promises herein contained, the parties do hereby agree as follows:

1. Definitions. As used in this Agreement, the following terms have the meanings ascribed to them, unless otherwise indicated:

(a) "Person" means a natural person, partnership, association, corporation, municipality, including those specific municipalities named herein, irrigation district, and the State of Wyoming or a political subdivision thereof.

(b) "Groundwater" means any water under the surface of the land or under the bed of any stream, lake, reservoir, or other body of surface water.

(c) "Madison Formation" means the underground geologic structure or formation in the Mississippian System having boundaries that may be ascertained or reasonably inferred and in which water stands, flows, or percolates, and for the purpose of this definition, includes the Bell Sand unit of the Minnelusa Formation.

(d) "Existing User" means any person having a permit to appropriate groundwater senior to any ETSI permit or any person who utilizes groundwater for domestic and stock watering purposes in Wyoming.

(e) "Preferred Users" means the Cities of Newcastle, Upton, Moorcroft, and Osage to the extent of

their pumping for preferred uses from the Madison Formation in Weston County, the Cities of Gillette and Sundance and the Devil's Tower National Monument to the extent of their pumping for preferred uses from the Madison Formation in either Weston, Crook, or Campbell County, and one "new city" to be designated by the State Engineer and located within the general vicinity of southeastern Campbell County, to the extent of its pumping for preferred uses from the Madison Formation in either Converse, Campbell, or Weston County.

(f) "Preferred Uses" means all of the existing and future use of groundwater pumped from the Madison by preferred users within their respective counties, but does not include industrial or irrigation use.

(g) "Interference" means such reduction in the quantity of water or degredation in quality of water so as to endanger the utilization of water by any preferred or existing user.

(h) "Pumping" means all withdrawals of water from the Madison Formation for beneficial uses for which said water was appropriated.

(i) "Project" or "Coal Slurry Project" means the coal slurry pipeline system owned and operated by ETSI, and which system will utilize 15,000 acre-feet of water on an average annual basis, and no more than

20,000 acre-feet of water per year. Such average annual use shall be computed on a basis of twenty consecutive years commencing with the year water is first used. Said average shall be computed annually for each twenty-year period following the year water is first used by ETSI, and ETSI shall use no more than 300,000 acre-feet of water in any such twenty-year period. Provided, however, that the State Engineer may, pursuant to application by ETSI and upon showing that additional water may be withdrawn and used from the Madison Formation without interference, permit ETSI to take no more than 20,000 acre-feet of water on an average annual basis.

2. Effective Date and Term.

This Agreement will become effective if and when the State Engineer issues permits to ETSI for the appropriation of groundwater for the coal slurry project, and will remain in effect until such time as the project is terminated or ETSI's permits are canceled from the records of the office of the Wyoming State Engineer.

3. Third-Party Beneficiaries.

All existing and preferred users as herein defined are hereby designated the beneficia[illegible]es of this contract.

then either party to this Agreement may request a Court of competent jurisdiction to enforce the provisions of this paragraph. The cost of arbitration as well as the cost of any investigation shall be paid for by ETSI. The State Engineer or the arbitrators shall utilize all relevant data, including available monitoring data provided by the United States Geological Survey, in making their findings and determination. If, after a public hearing and investigation, the State Engineer determines that interference with the complainant's pumping has been caused by ETSI, he shall find and determine what corrective measures shall be taken by ETSI, which measures shall include the following, or any combination thereof:

(a) An order requiring restoration of complainant's pumping so that complainant can extract from the Madison Formation a quantity of water equal to the amount pumped before such interference. If the complainant's pumps must be lowered, his well(s) deepened, or a new well or wells constructed in order to enable complainant to pump such equivalent quantity of water from the Madison Formation, ETSI shall pay any and all costs of deepening such well(s) and lowering the pump(s) or constructing a new well or wells and providing new pumps, and ETSI shall also pay such additional pumping costs as may be required by order of the State Engineer.

(b) An order requiring ETSI to supply to said complainant, in the event complainant's pump(s) cannot be lowered, his well(s) deepened, or a substitute well or wells and pumping plant constructed, substantially the same quantity and quality of water enjoyed by complainant prior to interference by ETSI pumping and at a cost to said complainant equivalent to the operation and maintenance costs paid by complainant prior to interference with his pumping. In the case of preferred users, ETSI may at its option, and with the concurrence of the State Engineer, appropriate the wastewater of any such preferred user and either (1) spread or inject said preferred user's wastewater into the underground in order to satisfy ETSI's substitute water supply requirement in whole or in part, or (2) utilize said preferred user's wastewater for ETSI's own benefit and use.

(c) In the event that ETSI's interference with any complainant's pumping cannot be corrected by any of the measures prescribed in Subsections (a) or (b) hereof, the State Engineer shall, before invoking the provisions of Subsection (d) hereof, permit ETSI to correct such interference by whatever supplies, means, or technology available at that time, subject, however to the approval of the State Engineer.

(d) An order of the State Engineer requiring ETSI to cease and desist all its pumping from the Madison, in the event that ETSI's interference with any person's pumping cannot be corrected by any of the measures prescribed in Subsections (a), (b), or (c) hereof. ETSI shall comply with such order to cease and desist no later than twenty-four months after receipt of said order.

5. Potential Interference.

The State Engineer may, on the basis of information developed by his office, the U. S. Geological Survey, or any other reliable source, investigate the possibility that ETSI's pumping will interfere with the rights of existing or preferred users. In such event, the State Engineer shall notify ETSI in writing of his proposed investigation and allow ETSI ninety days in which to submit evidence to the effect that either (1) no interference is threatened, (2) any possible interference can be corrected by any of the measures made available to it under the provisions of Subdivisions (a), (b), and (c) of Section 4, or (3) that any possible interference can be corrected by reduced pumping. The State Engineer will make a final determination that no interference will occur or issue an order requiring ETSI either to take any one or a combination of the corrective measures provided in Subdivisions (a), (b), and (c) of

Section 4, reduce pumping, or issue a cease and desist order as provided in Subdivision (d) of Section 4. Any order of the State Engineer under this Section shall be appealable to the Board of Control, and the final order of the Board of Control shall, in turn, be appealable in the manner provided in Section 41-216 of the Laws of Wyoming.

6. <u>Guaranty</u>.

Within thirty days after written demand by the State Engineer, ETSI shall post a bond in the face amount of One Million Dollars to guarantee compliance with the provisions of Section 4 hereof. Said bond shall be approved by the State Engineer, which said approval shall not be unreasonably withheld. Any order of the State Engineer to ETSI issued pursuant to Sections 4 or 5 other than an order under Subparagraph (d), shall be complied with within sixty days after such order becomes final. In the event ETSI does not so comply, the State Engineer may proceed against the surety under said bond. The rights of third parties under said bond shall remain enforceable even though ETSI, under some other legal, administrative, or legislative authority, is authorized to continue its pumping operations.

In the event ETSI for any reason cannot obtain a bond for the purposes herein prescribed, it may establish a line of credit in the amount of One Million Dollars with a bank approved by the State Engineer to guarantee compliance

with the provisions of Section 4 hereof. The conditions under which said line of credit will be implemented shall be negotiated and agreed upon between the parties.

7. <u>Appeal</u>.

ETSI may appeal any order of the State Engineer under this Agreement in the manner provided by Section 41-216 of the Laws of Wyoming, and the Wyoming Administrative Procedures Act.

8. <u>Conditions Precedent to Performance</u>.

ETSI's obligation to carry out the directives of any order of the State Engineer providing corrective measures prescribed in Sections 4 and 5 shall be dependent upon complainant's willingness to permit ETSI to enter upon said complainant's premises for the purpose of taking any such corrective measures as may be ordered by the State Engineer.

9. <u>Future Permits</u>.

In acting upon applications submitted by preferred users for permits to appropriate groundwater from the Madison Formation, the State Engineer shall consider whether or not a "water shortage" might occur or the area might be designated a "control area" under Wyoming law, in which event the State Engineer shall include in any new preferred user permits such terms and conditions, including the metering of well discharges and all other reasonable conservation measures, as will minimize the effects of pumping by said preferred users from the Madison Formation.

10. Successors.

This Agreement is binding on the successors and assigns of the parties signatory hereto.

11. Remedy Not Exclusive.

The bond or line of credit and procedure established for corrective measures shall be available only under this Agreement to those persons designated as beneficiaries of this Agreement pursuant to Section 3 hereof, and in no respect shall this Agreement constitute the exclusive remedy for any persons claiming interference as a result of ETSI's pumping.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed and attested by the proper officers

thereunto duly authorized, and their official seals to be hereto affixed as of the day and year first written.

THE OFFICE OF THE STATE ENGINEER
OF THE STATE OF WYOMING

By: Floyd A. Bishop
Floyd A. Bishop,
State Engineer

APPROVED AS TO FORM:

Attorney General

ENERGY TRANSPORTATION
SYSTEMS, INC.

By: E. J. Wasp
E. J. Wasp,
Vice-President

APPROVED AS TO FORM:

BEST, BEST & KRIEGER

By: James H. Krieger
James H. Krieger

APPENDIX C-4
SAMPLE ETSI WELL PERMIT

Form U.W. 5

NOTE: Do not fold this form. Use typewriter or ball point pen.

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO APPROPRIATE GROUND WATER

Temporary Filing No. U.W. 8-12-297

FILING FEE $2.00

PERMIT NO. U.W. 27867

NAME AND NUMBER OF WELL: ETSI-P-1

WATER DIVISION NO. 2 DISTRICT 1

U.W. DISTRICT Niobrara Co.

1. Name of applicant(s) Energy Transportation Systems, Inc. Phone: (415) 764-5787
2. Address of applicant(s) P.O. Box 3965, San Francisco, California Zip: 94119
3. Name & address of agent to receive correspondence and notices Mr. Lawrence Materi, P.O. Box 151, Upton, Wyoming 82730
4. Use to which the water will be applied: Irrigation ☐ Municipal ☐ Industrial ☒ Commercial ☐ Domestic ☐ Stock Watering ☐ Other ____
5. Location of the well: Niobrara County, Center of NW 1/4 of Sec. 21, T. 36 N., R. 62 W., or Lot ___, Block ___ of the ___ Subdivision (or Add'n) of ___, Sec. ___ T. ___ N., R. ___ W., of the 6th P.M. (or W.R.M.), Wyoming.
6. Estimated depth of the well is 3500 feet.
7. MAXIMUM quantity of water to be developed and beneficially used: 1000 gallons per minute.
   Note: If for domestic or stock use, this application will be processed for a maximum of 25 gallons per minute.
8. If for irrigation use,
   - ☐ Land will be irrigated from this well only.
   - ☐ Land is irrigated from existing water right(s) to be supplemented by this well. Describe existing water right(s) under REMARKS.
9. If for irrigation use, describe MAXIMUM acreage to be irrigated. Show number of acres to be irrigated in each 40-acre subdivision.

Township	Range	Sec.	NE¼				NW¼				SW¼				SE¼				TOTALS
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	

WATER WILL BE UTILIZED FOR INDUSTRIAL PURPOSES IN CAMPBELL COUNTY, WYOMING, IN A LOCATION NOT YET FINALLY DETERMINED

REMARKS: ____

Permit No. U.W. 27867   6-121   Book No. 141   Page No. 98

10. The well is to be constructed on lands owned by John E. DeGering and Kay DeGering (husband & wife) and Leonard L. DeGering and Helen L. DeGering (husband & wife)
(The granting of a permit does not constitute the granting of right of way. If any easement or right of way is necessary in connection with this application, it should be understood that the responsibility is the applicant's. A copy of the agreement should accompany this application, if the land is privately owned and the owner is not a co-applicant.)

11. The water is to be used xxxxxxxxxxxx for the industrial purposes of the applicant.
(If landowner is not the applicant, a copy of the agreement relating to usage of appropriated water on the land should be submitted to this office. If the landowner is included as a co-applicant on the application, this procedure need not be followed.) A memorandum of lease dated September 7, 1973, between the Owner and applicant is on file as an attachment to application ETSI-T-1 of applicant and is incorporated herein by reference theretc

THE LEGALLY REQUIRED FILING FEE MUST ACCOMPANY THIS APPLICATION.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

[signature], Vice President — Signature of Applicant or Authorized Agent
Energy Transportation Systems, Inc.

September 7, 19 73 — Date

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

THE STATE OF WYOMING } ss.
STATE ENGINEER'S OFFICE }

This instrument was received and filed for record on the 7 day of Sept., A. D. 19 73, at 4:00 o'clock P M.

Permit No. U.W. 27867

for [signature] State Engineer

THIS IS TO CERTIFY that I have examined the foregoing application and do hereby grant the same subject to the following limitations and conditions:

This application is approved subject to the condition that the proposed use shall not interfere with any existing rights to ground water from the same source of supply and is subject to regulation and correlation with surface water rights, if the ground and surface waters are interconnected. The use of water hereunder is subject to the further provisions of Chapter 169, Session Laws of Wyoming, 1957, and any subsequent amendments thereto.

Granting of a permit does not guarantee the right to have the water level or artesian pressure in the well maintained at any specific level. The well should be constructed to a depth adequate to allow for the maximum devlopment and beneficial use of ground water in the source of supply.

If the well is a flowing artesian well, it shall be so constructed and equipped that the flow may be shut off when not in use, without loss of water into surface formations or at the surface.

Approval of this application may be considered as authorization to proceed with construction of the proposed well.

Construction of well will begin within one (1) year from date of approval. A Statement of Completion will be filed within thirty (30) days of completion of construction, including pump installation.

Completion of construction and completion of the beneficial use of water for the purposes specified in Item 4 of this application will be made by December 31, 19 76.

The amount of appropriation shall be limited to the quantity to which permittee is entitled as determined at time of proof of application of water to beneficial use.

Witness my hand this 24th day of Sept., A. D. 19 74.

Floyd A. Bishop
State Engineer

FOR ADDITIONAL LIMITATIONS SEE THE FOLLOWING PAGES OF THIS PERMIT.

6-122

APPENDIX C-5
MEMORANDUM OF UNDERSTANDING BETWEEN CITY OF GILLETTE, WYOMING AND ETSI

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding, dated the 3 day of March, 1980, between the City of Gillette, Wyoming, (hereinafter referred to as the "City"), and Energy Transportation Systems Inc., a Delaware Corporation, (hereinafter referred to as "ETSI") records the intentions of the parties to negotiate a formal agreement between the City and ETSI under which the City will contract to sell the surplus waters produced from its Madison Formation Wells to ETSI.

1. The City is in the process of acquiring well permits to produce up to 11,200 acre-feet of water per year from the Madison Formation, such water to be used for municipal and industrial uses. Incident to the development of this water, the City will construct, own and operate a water pipeline and distribution system from the wells to Gillette which water system will be designed to meet the peak load demand of the City for municipal purposes through 1990 and the years thereafter. The City estimates that its capacity for water from the pipeline will be 7,000 gallons per minute (11,200 acre-feet per year), but its water requirements for municipal purposes will be significantly less until city growth reaches the designed capability and until then water not needed for its municipal requirements will be available for industrial uses.

2. ETSI plans to construct a coal slurry pipeline originating in Campbell County, Wyoming and extending to markets in the southeastern United States.

The obligation of the City to supply a minimum of 4,000 acre-feet per year shall be subject to emergencies, Acts of God, and short-term interruptions in service which will be defined in the agreement.

6. In consideration for delivery of this water, ETSI will pay the City the following sums:

(a) The proportional share of all operational costs based upon the ratio of the amount of water ETSI uses to the overall production of the system; and

(b) The proportional share of the principal retirement and interest cost amortized over thirty (30) years based upon the ratio of the amount of water ETSI uses to the actual production of the system. The calculation of the proportionate share of interest for which ETSI shall be responsible shall be calculated at the interest rate of an industrial bond rated AAA, provided that in no event shall the interest rate paid by ETSI be less than the interest rate paid by the City. To the extent that the interest rate paid by ETSI shall exceed that paid by the City these amounts would accrue to the City to lower the overall cost of water to the consumers.

7. The contract will include provisions for:

(a) Phased option payments to Gillette as their project progresses.

(b) Exchange of scientific and technical knowledge from ETSI's well field operation.

8. The parties shall assist one another during the negotiating process with respect to the engineering system, and the collection and analysis of all data regarding the capacity of the system and the needs of the parties.

3. The City projects that its municipal requirements will meet the design capacity of the system during peak load times so that surplus water would be available in nonpeak load times for industrial use throughout the life of the system. A contract with ETSI would permit the City to operate the system efficiently at its designed capacity and therefore lower the overall costs of water to consumers and significantly reduce the costs of capital and debt service in the early years of the project.

4. To permit the municipal and industrial use of the water produced pursuant to the permits which the City now has and which it is in the process of acquiring, the City agrees to take all action necessary, including the filing of new permits and enlargements of permits, and obtaining the necessary legal authority to provide for both municipal and industrial use and legal approval of the agreement by the requisite governmental authorities.

5. The agreement which the parties agree to negotiate shall provide that the City shall produce and deliver to ETSI all water in excess of the City's needs and other prior commitments up to the full designed capacity of the system. The City shall supply ETSI with a minimum of 4,000 acre-feet of water each year from 1983 through 2013; provided, however, that the City, in its sole discretion, shall designate the times at which this water will be made available and exercise its right to make this water available at nonpeak load times.

9. This is not a legally enforceable contract on the part of either party. Rather, it is a statement of the parties' intentions and the terms upon which the parties desire to negotiate a formal agreement.

DATED this 3 day of March, 1980.

CITY OF GILLETTE, WYOMING

By: Michael B. Enzi, Mayor

ATTEST:

Mildred Hurwitch

ENERGY TRANSPORTATION SYSTEMS INC.

By: ____________

ATTEST:

Mildred Hurwitch

CITY OF EDGEMONT

EDGEMONT, S. D., 57735

MINUTES OF PROCEEDINGS OF:

REGULAR COUNCIL MEETING
MUNICIPAL BUILDING
7;30 p.m. July 8, 1974

The council met in regular session on July 8, 1974 at 7:30 p.m,, with Mayor Nelson presiding and the following councilmen present: Mc Carthy, Honadel, Porter, Hatton and Vessberg. Fahy absent.

Moved by Mc Carthy seconded by Honadel that the City of Edgemont accept the offer of ETSI to install, for the City of Edgemont, South Dakota a combination production-observation well upon the following terms and conditions:

1. ETSI will construct the well at least one year prior to production by the proposal ETSI project in Niobrara County, Wyoming;
2. Title to the real estate will remain in Edgemont and title to all personal property in the form of pipes, casings, pumps, valves, and other assemblies essential to the operation of the well will be transferred from ETSI to the City of Edgemont upon completion of the well;
3. ETSI will be responsible for all installation costs of the well and in addition thereto will satisfy costs necessitated by the ESTI scientific information and data accumulation process while ETSI uses the well as an observation well;
4. ETSI will also be responsible for any operating costs of the well necessitated by the effects of the ETSI projection Niobrara County, Wyoming.
5. ETSI will be given a permanent use of the well by Edgemont for the purpose of obtaining scientific data or information and Edgemont will grant ETSI an easement for ingress and egress to the well site for purposes of maintaining the facility or gathering scientific data or information
6. Edgemont will provide ETSI with a suitable well location site.
7. ETSI agrees that the pumps to be installed will be at lease two hundred feet below the present drain down level of the Edgemont wells in the Madison formation;

Motion carried.

Jack R. Nelson, Mayor

Betty Wasserburger, City Auditor

LIMITATIONS
ETSI PRODUCTION PERMITS

The following conditions and limitations are applicable to Permit Nos. U. W. 27854 through U. W. 27893 issued to Energy Transportation Systems, Inc. (ETSI):

1. ETSI has on file with the State Engineer applications numbered ETSI P-1 through ETSI P-26 and ETSI P-31 through ETSI P-98 to appropriate ground water for processing coal, transporting coal in a coal slurry pipeline, and for related and appurtenant purposes, and these permits are issued subject only to application numbers 1, 19, 31, 33, 34, 35, 37, 39, 41, 43, 44, 46, 48, 50, 52, 53, 55, 56, 60, 64, 66, 68, 69, 71, 73, 76, 77, 78, 79, 83, 84, 85, 86, 88, 90, 91, 92, 94, 95, and 98, and the remainder of said applications are subject to further consideration by the State Engineer as hereinafter provided. These permits are designed to permit ETSI to pump 15,000 acre-feet of water on an average annual basis, and no more than 20,000 acre-feet of water per year. Such average annual pumping shall be computed on the basis of 20 consecutive years commencing with the year the water is first used. Said average shall be computed annually for each 20-year period following the year the water is first pumped by ETSI, and ETSI shall pump no more than 300,000 acre-feet of water in any such 20-year period; provided, however, that the State Engineer may, pursuant to application by ETSI, and upon a showing that additional water may be withdrawn and used from the Madison Formation without interference, permit ETSI to take no more than 20,000 acre-feet of water on a average annual basis. Accordingly, and subject to the approval of the State Engineer, ETSI may be granted additional permits to enable it to pump the quantities of water permitted herein.

2. Neither ETSI, its agents and employees, nor any independent contractor with whom ETSI, its agents or employees may contract or subcontract shall initiate construction or cause to be drilled, dug, or constructed any production well pursuant to any permit until such time as:

(a) The design of a monitoring and observation well system, consisting of five observation wells, one to be located in each of the following townships:

Section 28, T36N, R62W, West of the 6th P.M.
Section 16, T39N, R64W, West of the 6th P.M.
Section 16, T42N, R61W, West of the 6th P.M.
Section 4, T38N, R61W, West of the 6th P.M.
Section 8, T38N, R60W, West of the 6th P.M.

shall have been approved by the State Engineer, provided, the location(s) of any such well(s), as set forth above, may, prior to commencement of construction of any such well(s) and upon written notice from the State Engineer, be changed to any other location as the State Engineer may require; and

(b) ETSI has applied for and the State Engineer has granted permits for each of the said five monitoring and observation wells, and the State Engineer has endorsed on each such permit his approval of the monitoring and observation system. Provided that in no event shall water be produced from any production well under these permits within a period of one year from the date of completion of the final observation well, exclusive of such amounts as the State Engineer may allow to be produced for testing purposes during such period.

3. ETSI shall, at its own expense, install and maintain on each production well such monitoring or other measuring devices as may be required and approved by the State Engineer.

4. ETSI shall, at its own expense, purchase and install metering devices acceptable to the State Engineer on any or all of six wells to be designated by the State Engineer.

5. As a condition of continuing these permits in full force and effect, ETSI shall submit to the State Engineer monthly reports for a period of five years following the date water is first produced under any production well permit(s) indicating the quantity of water withdrawn from each operating well, as well as the cumulative withdrawals from all said wells in operation at any time during the reporting period, and the drawdown of the well levels, if any, on the five monitoring and observation wells required by Condition 2 hereof. Said reports shall be submitted on the first day of each month following commencement of the production of water by ETSI or on the first working day after the first day of each month if the filing date should fall on an official holiday or on a Saturday or Sunday.

If at any time during or prior to the expiration of the five-year reporting period the State Engineer should determine and ETSI and the State Engineer should mutually agree that a monthly reporting period is no longer necessary, ETSI may report to the State Engineer on a semi-annual basis, and said reports shall be submitted to the State Engineer on the second day of January of the year following the commencement of the production of water by ETSI, and the reports shall be filed on the first day of July and the second day of January semi-annually thereafter, or on the first working day after either said date if the filing date should fall on an official holiday or on a Saturday or Sunday. If the State Engineer so elects, he may engage a ground water hydrologist approved by ETSI to examine the data collection process and analyze the data itself for the benefit of the State Engineer, all of the costs of which shall be borne by ETSI.

6. ETSI shall test each production well drilled, dug, or constructed by it and at such times and in such manner as the State Engineer may require and the results of such testing shall be submitted to the State Engineer on a continuing basis, and in no event shall any test results be submitted later than seven days following completion of such tests as may be required.

7. All costs of data processing involved in testing the production wells during or following construction shall be borne by ETSI, and such test data shall include a cement bond log and such other geophysical logs and data as the State Engineer may require.

8. The State Engineer and any of his duly authorized agents or employees shall have the right at any and all times during the life of these permits and at the State's own expense, to run or conduct such independent tests and inspections of any or all of ETSI's wells as the State Engineer may require.

9. Each production well shall be cemented from the surface of the ground to the top of the Madison Formation and in no case shall any well be cased or cemented to a depth of less than 2500 feet below the ground surface.

10. In no case shall any production well constructed pursuant to these permits withdraw water from any formation or formations other than the Madison Formation and the Bell Sand unit of the Minnelusa Formation, provided that in no event shall any water be withdrawn from the Madison Formation or Bell Sand unit of the Minnelusa Formation where said formations shall occur at depths of less than 2500 feet below the ground surface.

11. In no case shall the total withdrawals by ETSI from all production wells exceed the maximum quantity set forth in Condition 1 hereof. Water withdrawn under these permits shall be used to process coal, transport coal in a coal slurry pipeline, and for related and appurtenant purposes, and no other use shall be made of such water without the express prior approval of the State Engineer or the Wyoming State Legislature, or both, if necessary.

12. If at any time ETSI so operates its wells as to lower the water table so as to endanger the water supply of any domestic, municipal, stockwatering or irrigation use, or other beneficial use of appropriated water within the State of Wyoming existing at the time the applications underlying these permits were filed, ETSI may be required by the State Engineer, at ETSI's own expense, to either:

(a) Deepen the well and pay the additional costs of pumping water for any person whose water supply has been endangered by reason of ETSI's pumping operation so that it is equal to the supply available prior to ETSI's pumping; or

(b) Provide any person whose water supply is endangered that quantity of suitable water required to equal the amount available prior to ETSI's pumping operation; or

(c) Obtain its water from another source that will not significantly affect or endanger the supply of water available to the beneficial users herein described.

13. In the event that ETSI should desire to abandon any production well, ETSI shall so inform and notify the State Engineer and state the reason or reasons for such proposed abandonment, and if such abandonment is thereafter allowed, ETSI shall comply with all requirements of the State Engineer in regard to the abandonment of any such well.

14. If and when ETSI, its successors, or assigns should desire to terminate the use of water under these permits for processing coal, transporting coal in a coal slurry pipeline, and related and appurtenant purposes, the State Engineer shall be so notified, and the State of Wyoming, through its duly authorized and appointed officers, shall succeed to ownership of these permits.

15. ETSI and the Office of the State Engineer of the State of Wyoming have entered into an agreement dated September 24, 1974, said agreement being intended to protect the third party beneficiaries named in Section 3 thereof. And in the event that a proper bond or line of credit is not established pursuant to Section 6 of said agreement, the permits herein granted may be cancelled or their operation suspended until such time as an arrangement or new agreement satisfactory to the State Engineer may be entered into or agreed upon between ETSI and the Office of the State Engineer of the State of Wyoming.

16. ETSI shall notify the State Engineer of the specific point(s) of injection of water produced under these permits into the pipeline operated by said ETSI.

17. The conditions and limitations of these permits are binding upon any and all successors and assigns of ETSI.

18. The permits granted herein shall be subject to cancellation at the end of the fifty-year period following the first production of water from the ETSI production wells, provided that ETSI and the State Engineer may mutually agree to extend such cancellation date.

19. The permits granted herein are subject to all other applicable requirements of State law not herein specifically stated.

APPENDIX C-7

DESIGN, CONSTRUCTION, AND OPERATING FEATURES FOR PREVENTING AND MINIMIZING COAL SLURRY SPILLS

Many features of design, construction, and operation of the proposed pipeline would prevent or reduce the likelihood of a spill. Others would minimize or contain coal which could possibly be released. Some of these features have been incorporated specifically for spill prevention or control, while others provide spill prevention in addition to their main function. The following discussion summarizes these features for the proposed slurry pipeline system. A spill contingency plan for the pipeline would be prepared prior to initiating pipeline operations.

Pump Stations

Pump stations along the pipeline would be fenced and lighted. Pressure alarms would be placed on pumping units, which would be monitored in the supervisory control center. A valve interlock system would assure proper operation of valves. Pump station valves would be remotely operated from the operations control center, and regular maintenance and inspection personnel would check potential leak sources, test equipment, and replace inoperative parts as necessary.

Design and fabrication of materials for the pump stations would be in accordance with the applicable codes and standards for the pipeline facility.

Pipeline Facility

The pipeline would be designed and constructed according to applicable codes and standards. Pipeline welds would be X-rayed according to Department of Transportation requirements. The pipeline would be hydrostatically pressure-tested at each point to at least 125 percent of the internal design pressure. The pipeline would be cathodically protected for its entire length, significantly reducing the likelihood of corrosion.

The main-line valves at pump stations and some river crossings would be located along the pipeline route, capable of significantly reducing potential drainage from the pipeline. These valves would be regularly checked for operation. Other features include:

- Pipeline route markers which would be placed at road crossings, water crossings, property boundaries, and other pipeline crossings
- Aerial markers, which would be placed on fence lines in cultivated areas and at intervals of 5 to 10 miles in open lands
- Contacts would be established and maintained with police and fire departments and with people in the vicinity of the pipeline route; this program would include persons to be contacted if unusual activity is observed
- Contacts with other pipeline operators so that notification is given if work is to be conducted close to the proposed pipeline

Design and fabrication would be in accordance with applicable codes, standards, and regulations. These currently are as follows:

- American National Standards Institute, American National Standard Code for Pressure Piping, Liquid Petroleum Transportation Piping Systems (ANSI B31.4)
- U.S. Department of Transportation, Office of Pipeline Safety, Title 49, Chapter 1, Subchapter B, Part 195; Transportation of Liquids by Pipeline
- American Petroleum Institute, Specification for Pipeline Valves

Slurry Storage Tanks

Slurry storage tanks would be designed in accordance with all applicable codes, standards, and regulations. Tanks would be hydrostatically tested before being placed in service and would be equipped with tank gauging alarm systems to prevent overfilling. Overflow piping would also be provided to channel overspills into a sump recovery system.

Maintenance, Inspection, and Monitoring

The maintenance and inspection program would include frequent inspection of potential leak sources, as well as periodic testing and replacement of equipment.

Identification of Potential Spills

Potential pipeline drainage calculations would be made when the final designs were completed.

Five primary means of detecting or identifying slurry spills would be incorporated into the design and operation of the proposed pipeline:

- Aerial reconnaissance
- Ground patrols
- Third-party reports
- Coal slurry metering systems
- Pipeline drainage

Each of these detection methods is discussed below, based on the pipeline operating and design parameters at this time.

Aerial Reconnaissance. Low-level aerial reconnaissance would be regularly conducted along the pipeline route as a part of normal pipeline operation. This reconnaissance would determine any activities along the route that might present a problem to pipeline operations, such as excavation by a third party, washouts, erosion, landslides, or slumping. Aerial reconnaissance reported by other pipeline operations in or near the proposed slurry pipeline would also be used to identify any activity that may affect slurry pipeline operations. Aerial reconnaissance would also be used to supplement ground patrols in checking for potential leaks indicated by the pipeline monitoring system.

Ground Patrols. Designated teams would patrol the pipeline route during regularly scheduled maintenance and inspection. Sensitive areas along the pipeline route, such as major and scenic stream crossings, very populous areas, and environmentally sensitive areas, would be patrolled frequently.

The maintenance bases, which would support pipeline operations, would direct normal ground reconnaissance and provide response for potential pipeline leaks, described in the spill contingency plan for the pipeline.

Third-Party Reports. Persons with activities along or near the pipeline route would be requested to report coal found on the ground or in the water along the pipeline route. These persons would also be requested to report activities or conditions in the vicinity of the pipeline that may possibly cause a spill.

Coal Slurry Metering Systems. Depending upon their role in pipeline integrity and operation, selected pump stations would have a capability to monitor various pipeline measurements that would indicate a leak. This monitoring system would be able to detect a leak and locate it between two consecutive metering stations. Three systems would be used to monitor the movement of coal slurry in the pipeline: flow rate metering, volume balance monitoring, and hydraulic gradient analysis. These systems would be monitored continuously in the operations control center. If a leak were indicated, the pipeline operator would be able to react quickly and initiate the proper operational and spill contingency plan actions. Each of these systems is discussed below, followed by a discussion of their combined use to detect leaks.

Flow Rate Metering (Station to Station). Stations possessing a flow rate metering capability would be able to monitor the pipeline continually and could detect potential losses with a minimum threshold of between 1 and 1.5 percent of throughput. This would be accomplished by installing a metering system that would constantly monitor the volume and flow rate of coal slurry passing through the station and then relay the readings to the master control station. Operations control would transmit readings from each metering station into a master computer, which would compare current readings with previous readings and correlate them with readings from other metering stations.

Volume Balance Monitoring (Total Mass Balance). Flow rate meters would regularly be simultaneously calibrated to ensure that the same amount of coal slurry entering the pipeline is being received at the pipeline terminals. This system would be capable of detecting losses in excess of 1.5 percent.

throughput and stations downstream from the same point began to show a decrease.

If the recorded decrease reached a steady state, or increased to its previous reading, and if it were recorded at all metering stations, it is likely that the decrease would be the result of either a slight change in input at the initial stations or a change in the operating temperature. If the decrease were monitored at only one metering station with no decrease monitored at downstream metering stations, it would indicate that the meters at the station recording the decrease were malfunctioning. However, if the decrease in throughput continued to drop off, and if it were more prominent at one metering station with smaller decreases being recorded at downstream metering stations, it would be likely that the decrease would indicate a leak. If the output from the central computer recorded a decrease less than 1 to 1.5 percent of throughput, the pipeline dispatcher would attempt to verify the loss before initiating changes in pipeline operations.

Recorded losses in excess of 1.5 percent would be treated differently by the pipeline dispatcher. Verification time would be considerably less for larger decreases in throughput. Not only would the metering stations record decreases in volume, but drops in pressure would also occur and pumps and pump station valves would automatically shut down. A leak that was discharging more than 1.5 percent of throughput would be noticeable within minutes of occurrence, and the spill contingency plan could be initiated immediately. The loss rate would vary with hole size and the operating pressure of the pipeline.

Pipeline Drainage. Drainage characteristics of a slurry pipeline are an important factor in determining the total volume of a pipeline spill. Coal slurry would begin to drain from the pipeline to equalize pressures in the ruptured pipeline section after shutdown. The coal solids would also begin to settle in the pipeline, and the concentration of coal in the spill would decrease with time. As coal settles into pipeline valleys and as the pipe drains, sections of the pipeline may close off and not permit further flow.

APPENDIX D - AUTHORIZING ACTIONS

APPENDIX D-1

SUMMARY LIST OF REQUIRED AUTHORIZING ACTIONS

I. Federal Authorizing Actions

- A. Bureau of Land Management (BLM)
  1. Right-of-way grant
  2. Temporary use permit
- B. Forest Service (FS)
  1. Special use permit
  2. Right-of-way grant
- C. Army Corps of Engineers (COE)
  1. Section 404 and Section 10 river and stream crossing permits. (A detailed list is included in Appendix D-6.)
- D. Federal Communications Commission (FCC)
  1. Approximately 66 licenses to operate repeater stations (FCC Form 402)
- E. Bureau of Indian Affairs (BIA)
  1. Right-of-way grant
  2. Easements

II. State Authorizing Actions

- A. Wyoming
  1. Separate approvals to construct three coal slurry preparation plants
  2. Separate permits to operate three coal cleaning and preparation plants
- B. Kansas
  1. Permits for stream crossings if stream flow is greater than 5cfs
  2. Permits for drilling of three water well sites
- C. Arkansas
  1. Water Quality permits
- D. Louisiana
  1. Class B Use permits to cross 3 natural and scenic rivers
  2. Permits for air, water, hazardous and solid waste effluents
  3. Pipeline authorization
  4. Rights-of-way authorization to cross state land

APPENDIX D-2

BUREAU OF LAND MANAGEMENT GENERAL MEASURES

The grant of right-of-way and temporary use permit issued by the Bureau of Land Management (BLM) would include general and specific stipulations. These stipulations would include, but not be limited to, the following general measures:

1. The applicant shall conduct all activities associated with the project in a manner that will avoid or minimize degradation of air, land, and water quality. In the construction, operation, maintenance, and abandonment of the project, the applicant shall perform its activities in accordance with applicable air and water quality standards, related facility siting standards, and related plans of implementation, including but not limited to the Clean Air Act, as amended (42 U.S.C. 1321).

2. Access roads for operation and maintenance of the water and coal slurry pipelines will be clearly identified. These access roads will be ostensibly open for public use, including but not limited to off-road vehicular travel.

3. Roads required for access by the applicant will be maintained and/or rehabilitated by the applicant as necessary if damaged beyond normal wear and tear by the applicant's vehicles.

4. A reclamation and revegetation plan will be required for the approximately 5.5 miles of public lands crossing.

5. If a natural barrier used for livestock control is broken during construction, the applicant will adequately fence the area to prevent drift of livestock. In pronghorn antelope ranges, the fence may have to be constructed to allow passage of antelope. Fence specifications will be determined on a case-by-case basis.

APPENDIX D-3

PROPOSAL TO THE ADVISORY COUNCIL ON HISTORIC PRESERVATION

FOR A MEMORANDUM OF AGREEMENT

BETWEEN

THE BUREAU OF LAND MANAGEMENT, WYOMING STATE OFFICE

THE FOREST SERVICE, ROCKY MOUNTAIN REGION

AND

THE STATE HISTORIC PRESERVATION OFFICERS OF

WYOMING, KANSAS, NEBRASKA, COLORADO, SOUTH DAKOTA, OKLAHOMA, ARKANSAS AND LOUISIANA

FOR THE

ENERGY TRANSPORTATION SYSTEMS INC. (ETSI) COAL SLURRY PIPELINE

STIPULATIONS

THE BLM AND THE FOREST SERVICE WILL CONDITION THEIR RIGHTS-OF-WAY ON THE FOLLOWING MEASURES TO ENSURE THAT THEY ARE CARRIED OUT:

1. ETSI will be required to allocate sufficient funds and time in advance of construction of any element of the pipeline system and its related facilities, to perform adequate BLM (Class I-III) cultural property inventories, to recover materials and document information, to prepare and disseminate to proper authorities resultant reports, and to implement the cultural properties management program in this Agreement.

2. The cultural property management program for the ETSI pipeline will cover the entire pipeline and all related surface disturbing activities, including all areas that could reasonably be considered affected by construction of the pipeline and its related facilities.

6. No gates or cattle guards on established roads on public land will be locked or closed by the applicant.

7. Garbage and other refuse will be disposed of in an authorized disposal site or landfill. Engine oil changed on the right-of-way will be caught in suitable containers and disposed of as refuse; no fuel, oil, or other hydrocarbon spills are permitted. If such a spill accidentally occurs, the contaminated soil is to be excavated and the authorized officer notified immediately.

8. Landowners, permittees, and other regular users of Public Lands in the right-of-way will be notified in advance of construction activities that may affect their business or operations. This will include signing of any temporary road closures in advance of construction. Ranchers will be advised of any fence openings, disturbances to range improvements, or other range use-related structures in advance of construction.

9. The applicant will meet all stipulations detailed in a Memorandum of Agreement (MOA) between the Advisory Council on Historic Preservation and the Bureau of Land Management, Wyoming State Office, to fulfill all federal and state cultural resource legal requirements. This document is not in final form as of this date (October 1980) but will finalized and signed prior to issuance of the final environmental impact statement. (A draft copy of the MOA is included in Appendix D-3.)

10. The applicant will meet all stipulations detailed in a Memorandum of Understanding (MOU) between the Bureau of Land Management and the United States Fish and Wildlife Service to fulfill all federal and state threatened and endangered legal requirements. This document is not in final form as of this date (October 1980) but will finalized and signed prior to issuance of the final environmental impact statement. (A draft copy of this MOU is included in Appendix D-4.)

3. The BLM will supervise the cultural property management program (BLM Manual 8100.03) to ensure quality control of all program elements and proper phasing of investigations with construction schedules, and to ensure that all cultural property investigations undertaken by ETSI are conducted under the appropriate Federal and State antiquities permits.

4. For the definitive and construction phases ETSI will be required to engage a professional archeologist, historical archeologist and historian as appropriate meeting, at minimum, professional qualifications outlined in BLM Manual Sections 8111.41 and 8111.42 (attached) and proposed regulations, 36 CFR Part 66 (F.R. 1.28.77 Vol. 42 F.R. 5382) to complete inventory, evaluation, salvage, mitigation and monitoring of cultural properties.

The BLM will approve and monitor the selection of ETSI field supervisory cultural personnel to ensure they meet these same qualifications.

5. Inventory reports and mitigation proposals will be sent to the Wyoming State Director for review and distribution to the appropriate BLM State Offices, the Rocky Mountain Region of the Forest Service, and the respective State Historic Preservation Officers. Final analytic reports on the results of all cultural property investigations will be sent to the Wyoming State Director for distribution to the above-named parties and other appropriate Federal and State agencies. Report and data recovery standards will conform to the proposed regulations 36 CFR Part 66 and appropriate Antiquities or Special Use Permit requirements.

6. ETSI will provide for the curation of all artifacts and other cultural materials recovered until their final analytic report for the cultural property has been completed and accepted by BLM. ETSI will assure that artifacts are

then curated at an appropriate repository unless the landowner requests their return. Proof of curation must be submitted with the final analytic report.

7. Prior to the notice to proceed with construction ETSI will inventory, and evaluate using National Register criteria (36 CFR Sec. 60.6) all cultural properties within project areas that could reasonably be considered directly and indirectly impacted by the pipeline project and its related facilities, as determined under Stipulation 8. The inventories will include but need not be limited to (a) a Class I--Existing Data Inventory (in accordance with BLM Manual Section 8111.12) which will include but not be limited to archival and literature search, ethnographic research, and museum research; (b) a Class III--Intensive field survey (BLM Manual Section 8111.14 A and B). All information from the inventory will become a part of the State Survey Data maintained by the respective SHPO or state repository. BLM will authorize the notice to proceed for the project area only after all intensive (Class III) field surveys are completed and the area is devoid of National Register eligible properties, or the protective steps detailed in stipulations 9, 10, 11, 12 and 13 of this MOA have been completed.

8. BLM in consultation with the appropriate SHPO will determine areas to be excluded from Class III survey. Excluded areas will include lands not likely to contain potentially eligible cultural properties as determined by Class I surveys and SHPO recommendations.

9. ETSI will avoid by project redesign or project relocation, where prudent and feasible, cultural properties included in or appearing to be eligible for inclusion in the National Register of Historic Places. When it is neither prudent nor feasible to avoid cultural resource properties, ETSI will provide a report documenting that fact and recommending mitigation measures.

10. All cultural properties identified in the project area that appear to be eligible for inclusion in the National Register of Historic Places will be recorded and documented on forms suitable for use in requesting a determination of eligibility in accordance with 36 CFR Part 63. National Register Nomination Forms (Form No. 10-300, 10-306), Bureau of Land Management Cultural Resources Inventory Record Forms (8110-1,2,3,4,5) or equivalent forms (SHPO) may be used.

11. Submissions of eligibility determinations for inclusion in the National Register of Historic Places will be made by the BLM, other land managing agency and ETSI's archeologist or historian, with the respective SHPO within 30 days of receipt of an acceptable inventory report from ETSI. The opinion of the landowner will be sought when involving submissions on their land. A completed inventory form, as described in Stipulation 10, for all properties appearing to meet the criteria for inclusion in the National Register of Historic Places will also be forwarded by the BLM to the Keeper of the National Register within 30 days with a written request for a consensus determination pursuant to 36 CFR Section 63.3. In situations where the participants disagree as to eligibility, the BLM will request a determination of eligibility in writing from the Secretary of the Interior in accordance with 36 CFR Sec. 63.2.

12. Within 30 days after receipt of an acceptable report from ETSI documenting that it is neither prudent nor feasible to avoid a cultural property that is included in or eligible for inclusion in the National Register of Historic Places (Stipulation 10), the BLM and permitted archeologists will consult with the respective SHPO, landowner or land managing agency and,....

A. If it is determined that the affected cultural properties are eligible for inclusion in the National Register of Historic Places principally because

they may be likely to yield information important in prehistory, and meet all of the criteria as detailed in Part I of the "Guidelines for Making 'Adverse Effect' and 'No Adverse Effect' Determinations for Archeological Resources in accordance with 36 CFR Part 800" (Guidelines) (copy attached) the BLM will ensure that ETSI institutes a data recovery program in consultation with the respective SHPO in accordance with Part II of the Guidelines and may at the Bureau's discretion afford the Council further opportunity to review and comment; or,

B. If it is determined that the affected cultural properties are eligible for inclusion in the National Register of Historic Places principally for some other reason, or if it is determined that they are eligible principally because they may be likely to yield information important in prehistory but that they do not meet criteria detailed in Part I of the Guidelines, the BLM and ETSI archeologists will consult with the appropriate SHPO, and other Federal land managing agencies to determine the nature of the undertaking's effect and pursuant to 36 CFR Sec. 800.4(d) the BLM will forward a request for Council comments, with a preliminary case report (as specified in 36 CFR Sec. 800.13(b)) to the Executive Director of the Council. The Director of the Council will comment within 60 days to BLM or recommend action.

13. During the implementation of any construction phase the BLM will ensure that ETSI or its Assignee will:

A. Assure that all project field employees are briefed on cultural property concerns as a part of their technical environmental briefing program;

B. Engage the qualified archeologist to:

1. Monitor areas of direct surface disturbance for sub-surface cultural materials,

2. Avoid indirect damage to cultural properties by construction activities. i.e. temporary facilities and services.

C. Report all previously unidentified subsurface or surface cultural properties the BLM and respective SHPO, and protect the property until compliance with Section 14 has been completed.

14. In emergency situations, as determined by the BLM in consultation with the respective SHPO (such as when the time to undertake adequate mitigation is short, where failure to act in a short time would result in project construction delays, when timely access has not been permitted by the landowner, or when previously unidentified cultural properties are discovered during implementation of any project-related undertaking) the following will apply:

Pipeline salvage plans, covering all potential emergency situations, will be developed by the BLM in consultation with each State Historic Preservation Officer, the Advisory Council on Historic Preservation, and presented to the ETSI Company within 60 days of the Secretary's route decision. The so developed emergency salvage plans will be applied under the above conditions.

15. It is the responsibility of the BLM and the Forest Service that the cultural property management program in this Agreement be incorporated into the right-of-way grant and temporary use permits associated with the ETSI Pipeline Project (Application #W-47191).

16. One year from the date of ratification of the agreement by the Chairman of the Council, and annually thereafter until the pipeline is completed, the BLM, respective SHPO and ETSI will review the program established by the Agreement and submit to the Council an assessment of the program operation and copies of the annual report prepared by ETSI. Unless modified, the Agreement will continue in effect until the end of the construction phase of the pipeline.

17. Failure to carry out the terms of this Agreement requires that the BLM again request the Council's comments in accordance with 36 CFR Part 800. If the BLM cannot carry out the terms of the Agreement, it shall not take or sanction any action or make any irreversible commitment that would result in an adverse effect with respect to National Register or eligible properties covered by the Agreement or would foreclose the Council's consideration of modifications or alternatives to the project that could avoid or mitigate the adverse effect until the commenting process has been completed.

18. If any of the signatories to this Agreement determine that the terms of the Agreement cannot be met or believes a change is necessary, that signatory shall immediately request the consulting parties to consider an amendment or addendum to the Agreement. Such an amendment or addendum shall be executed in the same manner as the original Agreement.

19. Within 90 days after carrying out the terms of the Agreement, the BLM shall provide a written report to all signatories to the Agreement on the actions taken to fulfill the terms of the Agreement.

DEFINITIONS

Cultural Property Management Program - A program, established by this memorandum of agreement to ensure identification, evaluation and appropriate protection of cultural properties (archeological, ethnohistoric and historic resources) prior to and during construction of surface and subsurface elements of the ETSI pipeline project. The program requires a consistent approach to hiring qualified people, reporting, consultation, determining eligibility of properties for inclusion in the National Register, curation, project redesign where appropriate, data recovery, and emergency salvage.

Annual Report - A progress report by the proponent company including, but not limited to a status report on inventory work completed (%), a listing and brief description of those sites found, a listing of those found to be eligible for the National Register, a listing of those to be avoided, a listing of sites where it was not prudent or feasible to avoid. The report should itemize current expenditures, i.e., overhead, contracts, and salvage costs. The company's regular annual report will not satisfy this requirement.

Definitive phase for the ETSI project extends from January 1, 1980 to July 1, 1983. Activities associated with this phase are the Environmental Impact Statement, route definition, procurement of final right-of-way, compliance with the Statement and the acquisition of the environmental permits, final engineering design, shipper contracts, and financing.

Construction phase is scheduled to start July 1983 and continue through July 1985. Activities in this phase are environmental compliance, planning, contractor procurement awards, budget and schedule control, construction, pre-operational testing, and start-up.

Final Analytic Report - A report that is professionally researched and written to the standards outlined in BLM Manual 8111 and proposed regulations 36 CFR Part 66 (F.R. 1/28/77 Vol. 42 F.R. 5382).

APPENDIX D-4

A Draft Proposal to the U.S. Fish and Wildlife Service
For a Memorandum of Agreement
Between
The Bureau of Land Management, Wyoming State Office
and
The U.S. Fish and Wildlife Service
For the
Energy Transportation Systems Inc. (ETSI)
Coal Slurry Pipeline

Authority

The Bureau of Land Management (BLM) is required to identify, evaluate, protect and provide habitat for threatened or endangered species on lands under its jurisdiction and to ensure that BLM initiated or authorized actions do not inadvertently harm or destroy threatened or endangered species. These requirements are mandated by the Taylor Grazing Act of 1934, Fish and Wildlife Coordination Act of 1958, Public Lands Administration Act of 1960, National Environmental Policy Act of 1969 and as amended the Endangered Species Act of 1973. None of these mandates for the management and protection of these species can be properly carried out without adequate inventories which is the purpose of this agreement.

Introduction

This Memorandum of Understanding (MOU) is written to assure compliance with the Endangered Species Act and the Section 7 consultation requirements for the Energy Transportation System Inc. (ETSI) Coal Slurry Pipeline which is being designed to carry coal slurry from Gillette, Wyoming, to markets in Arkansas, Oklahoma, and Louisiana. The proposed line, or its alternatives, cross Wyoming, Nebraska, Kansas, Oklahoma, Arkansas, Louisiana, Colorado, and South Dakota.

The Bureau of Land Management (BLM) is the lead Federal agency for the project and is responsible for issuing an environmental impact statement, rights-of-way permits on Federal lands, the Notice to Proceed and is responsible for compliance with the Endangered Species Act.

Several Threatened or Endangered (T&E) species that could occur along the pipeline route have been identified by the Fish and Wildlife Service (FWS) by letters dated 12/20/79 and 6/2/80 (attached). Of the T&E species lists submitted by the FWS, 8 of the 13 species have been categorized by BLM as not being affected by the ETSI project. Five species, however, have been determined by BLM to be in a "may affect" category. Those five species are: black-footed ferret, red-cockaded woodpecker, bald eagle, American alligator and whooping crane.

To reach these conclusions, BLM's contractor (Woodward-Clyde Consultants), supervised by BLM, contacted several FWS offices, various endangered species recovery teams and concerned state wildlife agencies. Information on life histories, areas of occurrence, and potential impacts from the pipeline project were collected. Where possible, proposed pipeline alignments were rerouted to minimize conflicts with T&E species.

The contractor has compiled all the information collected on the T&E species into a technical report, Threatened and Endangered Species Technical Report, ETSI Coal Slurry Pipeline Project (attached). This technical report will serve as the basis for BLM's Biological Assessment which will be submitted to FWS.

Of the five T&E species in the "may affect" category, BLM has determined that the bald eagle, American alligator and whooping crane are adequately addressed in the Biological Assessment which includes the description of potential conflicts and methods to deal with the conflicts to ensure that the three species and essential habitat are not adversely impacted. If additional stipulations to preclude jeopardy are needed, they will be in the Biological Opinion which will be prepared by FWS.

For the two remaining T&E species (black-footed ferret and red-cockaded woodpecker), expected impacts are not known at this time. Surveys are required for both species to identify the extent of any conflicts. Once these conflict areas are known, procedures can be prescribed to ensure that these two T&E species are not adversely impacted.

The remainder of this MOU describes the procedures to be followed by BLM and the FWS concerning any listed species occurring along the pipeline route.

A notice to proceed can be issued for any construction spread where no T&E species problems exist or where T&E species problems have been resolved. However, before BLM issues a Notice to Proceed in areas where T&E species problems are not resolved, it will ensure that the following measures are carried out.

1. ETSI will be required to allocate sufficient funds and time in advance of construction of any element of the pipeline system and its related facilities to perform FWS approved inventories on any BFF and RCW or other listed species so determined by FWS' biological opinion.

2. The authorized officer (State Director, Wyoming BLM) and the FWS will establish standards for survey personnel so that endangered species inventories, evaluations and reporting procedures are of suitable quality to ensure compliance with the Endangered Species Act.

   ETSI will be required to prepare and disseminate to the Authorized Officer the inventory reports and all supporting data.

   The Authorized Officer will initiate consultation requirements providing all the inventory data to FWS.

3. For the duration of the construction phase, the BLM will ensure that ETSI or its assignee will:
   a) Employ a trained biologist to ensure compliance, to avoid impacts to threatened or endangered species by construction activities and to monitor any problem areas identified by field surveys.

   b) Report all threatened or endangered species previously unidentified to the BLM and the FWS and protect the species until a biological opinion can be rendered.

c) Assure that all project field employees are briefed on threatened or endangered species concerns.

4. If ETSI is unable to complete construction in a spread within one year after a T&E survey, BLM will reconsult with FWS prior to continuing construction.
   a) Construction of the pipeline should begin between start of the survey and May 15 the following year to eliminate any need for resurveys for black-footed ferrets.

5. The prescribed survey methodologies are described in Appendix 1 for black-footed ferret and Appendix 2 for red-cockaded woodpecker. For black-footed ferret, alternate method number 2 will be used for the ETSI project since the Notice to Proceed will not be issued until the surveys are completed and any identified conflicts are resolved.

6. The FWS is responsible for: (1) setting survey standards for T&E species, (2) reviewing qualifications of survey personnel, (3) setting up procedures for emergency situations, and (4) expeditious review of materials and return of comments to BLM.

APPENDIX 1

DRAFT
RECOMMENDED CRITERIA AND PROCEDURES FOR BLACK-FOOTED FERRET SURVEYS ON AREA AND LINEAR SURFACE DISTURBANCES

Federal agencies are continually reviewing the suitability of lands for surface developments throughout much of the black-footed ferret's historic range. These developments include surface mining, linear pipelines, roadways, dams, and many other energy and related activities. The National Environmental Policy Act requires that an assessment of the environmental disturbance be made for any major Federal action that significantly affects the quality of the human environment. As a part of this assessment, wildlife surveys and inventories of a reliable nature, performed on an adequate land area, are needed to help document the impact that development will have. The Endangered Species Act requires Federal agencies to ensure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any threatened or endangered species. The following criteria and procedures are recommended as standards for black-footed ferret surveys on major surface disturbance sites where prairie dogs exist.

AREA DEVELOPMENT

Proposed developments such as coal lease lands, power plant sites, well fields, dam sites, and other major, block-type developments should be surveyed for prairie dogs before the project is approved. If prairie dogs are found on the proposed site, or within a 1/8-mile wide strip outside the perimeter, colonies should be mapped on topographic maps and each colony surveyed using recommended Black-footed Ferret Survey Procedures (Attachment A). All colonies should be surveyed in their entirety to a maximum distance of 1/2 mile outside the perimeter. Ferret searches should be scheduled between May 15 and October 30, but as close to actual 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.

If a multi-year project is involved, such as on a coal site, additional annual surveys for black-footed ferrets are recommended. Each year between May 15 and October 30, survey prairie dog colonies on the area to be impacted (plus the 1/8-mile strip) by May 15 the following year.

If a ferret is found, enter formal consultation or immediately consult with the Endangered Species Office of the appropriate U.S. Fish and Wildlife Service Region.

LINEAR DEVELOPMENTS

Linear developments such as pipelines, roadways, and transmission lines extend long distances and may cross a number of prairie dog colonies. Two methods of ferret survey on prairie dog colonies are recommended for linear developments. Either method can be selected, but Alternative 1 is preferred if project construction and other considerations permit.

Linear Developments Except for Permanent Roads, Railroads, or Transmission Lines

Alternative 1 (Simultaneous survey and construction)

A. Survey that portion of each prairie dog colony lying within an area from the project centerline out to 1/16 mile each side of the centerline, using Black-footed Ferret Survey Procedures.

B. If black-footed ferret sign is found, the entire prairie dog colony will be surveyed out to 1/2 mile each side from the project centerline, using Technique I of Black-footed Ferret Survey Procedures. Sign justifying the preceding action is described as fresh trenching activity, the presence of numerous freshly covered burrows, or the sighting of green eyeshine from what is believed to be a black-footed ferret.

C. If a ferret is found, enter formal consultation or immediately consult with the Endangered Species Office of the appropriate U.S. Fish and Wildlife Region.

Alternative 2 (Survey preceding construction)

A. Survey between May 15 and October 30. Construction should take place between the start of survey and May 15 the following year.

B. Survey all prairie dog colonies found within an area from project centerline out to 1/8 mile each side of centerline, using Survey procedures. Large colonies extending beyond this corridor will be surveyed out to 1/2 mile on either side of the centerline. If black-footed ferret sign is found, use Technique I of the Survey procedures. Sign justifying this action is identified in Alternative 1, Part B.

C. If a ferret is found, enter formal consultation or immediately consult with the Endangered Species Office of the appropriate U.S. Fish and Wildlife Service Region.

Permanent Roads and Railroads

Either of the above two alternatives can be utilized; however, substitute "outside boundary of right-of-way" for "project centerline" and "centerline."

Transmission Lines

Alternative 1 (Simultaneous survey and construction)

A. Survey that portion of each prairie dog colony lying within the right-of-way, using Black-footed Ferret Survey Procedures.

B. If black-footed ferret sign is found, the entire prairie dog colony will be surveyed out to 1/4 mile each side from the project centerline, using Technique I of Black-footed Ferret Survey Procedures. Sign justifying this action is identified above in Alternative 1, Part B.

C. If a ferret is found, enter formal consultation or immediately consult with the Endangered Species Office of the appropriate U.S. Fish and Wildlife Region.

Alternative 2 (Survey preceding construction)

A. Survey between May 15 and October 30. Construction should take place between start of survey and May 15 the following year.

B. Survey all prairie dog colonies found within an area from the project centerline out to 1/8 mile each side of centerline, using Survey procedures. Large colonies extending beyond this corridor will be surveyed out to 1/4 mile on each side of the centerline. If black-footed ferret sign is found, use Technique I of the Survey procedures. Sign justifying this action is identified above in Alternative 1, Part B.

C. If a ferret is found, enter formal consultation or immediately consult with the Endangered Species Office of the appropriate U.S. Fish and Wildlife Service Region.

SOURCE OF THE CRITERIA PROCEDURES

The preceding recommendations were developed by the Division of Wildlife Research, Denver, and the Endangered Species Offices in Regions 2, Albuquerque, and 6, Denver, of the U.S. Fish and Wildlife Service with the cooperation of the Black-footed Ferret Recovery Team and the concurrence of State Natural Resource Departments throughout the historic range of this animal.

Below is a list of States within the range of the black-footed ferret whose requirements for black-footed ferret surveys would be satisfied if the preceding criteria and attached procedures are followed:

Arizona	North Dakota
Colorado	New Mexico
Kansas	South Dakota
Montana	Utah
Nebraska	Wyoming

Attachment A

Black-Footed Ferret Survey Procedures

A. Conduct search of literature and other potential sources of information indicating historic recent use of project area by black-footed ferrets.

B. Identify area proposed for survey.

C. Locate all prairie dog colonies within the area using aerial photographs, ground searches, and other information that may be available from natural resource or cooperative agencies.

D. Plot all prairie dog colonies on 7.5-minute series topographic maps if available from the U.S. Geological Survey. If not available, use 15-minute maps.

E. Divide colonies into workable marked segments in preparation for systematic searching.

F. Start surveys in the early morning with 1 or more hours of spotlight searching on previously selected areas of high burrow density.

G. Prior to conducting daytime surveys, scan colonies for black-footed ferrets and fresh diggings using binoculars and spotting scopes.

H. Conduct daytime surveys on the colony, examining every hole which is 6 cm or more in diameter while looking for black-footed ferrets or the following sign:

1. Trenches or stringers of soil 15-20 cm wide, 5-cm deep, and from .3-3.5 m long with a groove in the center.

2. Prairie dog burrows plugged with soil.

3. Skeletal material: (1) skulls of prairie dogs that have been chewed or show small tooth marks near the base, (2) skulls of black-footed ferrets. If found, photograph in place and mark location prominently.

4. Fecal droppings from mustelid-type animals. Usually marked by segmentation and twisting when composed of hair, varying from dark brown to black in color, approximately 6 mm in diameter and 25-100 mm long.

5. Prairie dog behavior: upright posture and alarm chatter in response to predators.

I. In areas where possible ferret sign is found, three consecutive night surveys are recommended, using the following procedures:

   1. Locate and mark area to be spotlighted during the daytime survey and locate access roads to area.

   2. Arrive at the search area in the dark, park vehicle, and wait 5 minutes before starting searches with spotlight. Using a 100,000 candle-power spotlight (hand-held or vehicle-mounted), sweep the light slowly back and forth across the colony, looking for green eyeshine. Use the spotlight for a minimum of 1 hour per stop in intervals of 5 minutes on and 5 minutes off. Conduct spotlighting from 1-3 hours prior to sunrise and from 1-3 hours after sundown.

   3. When green eyeshine is observed, attempt to identify the animal. If identification is not possible, mark the location with flagging for future day and night surveys.

   Note: It would be desirable to have available to surveyors reference photos of a black-footed ferret, weasel, European ferret, ferret skulls, scats, and any other visual aids that would be helpful.

J. Documentation of search and survey will include: dates of surveys, man-days of efforts, acres of prairie dog colonies surveyed, number of colonies surveyed, number of burrows checked, hours of spotlighting conducted, ferret sign encountered, and location of ferret sign.

APPENDIX 2

RED-COCKADED WOODPECKER

SURVEY TECHNIQUES

The red-cockaded woodpecker may be present along the proposed route through portions of Arkansas and Louisiana. The first phase of work to reduce potential impacts to this woodpecker will include contacting additional federal and state agency personnel and other knowledgeable individuals (e.g., recovery team members, university ornithologists, etc.) in an attempt to delineate all areas presently used. The proposed alignments then will be adjusted to miss such areas, where feasible.

The second phase of work will involve defining additional areas of potentially suitable habitat. A portion of this will be completed during the first phase since all personnel contacted will be asked to define any such habitat. In addition, available vegetation type maps and aerial photography will be reviewed in an attempt to define other suitable habitat.

If suitable habitat does exist along the route and re-alignment of the route appears to be impractical, the third phase of work would involve field surveys to document the presence or absence of the red-cockaded woodpecker and to attempt to realign the right-of-way to avoid as much impact as is practical. The procedures to be followed are briefly described below:

1) A team of two to four biologists will walk the staked right-of-way through the areas of suitable habitat; each would walk approximately 50 feet on either side of the staked line thereby covering a minimum belt of 100 feet between them plus as much or more habitat on the outside;

2) as the team walks through the suitable habitat, red-cockaded woodpeckers and their sign etc.) will be noted;

3) the team will listen for calling individuals;

4) any individuals or colonies located would be mapped on topographic maps; and

5) if any colonies are located, surveys will be conducted in adjacent areas in an attempt to relocate the right-of-way in an area of potentially less impact.

APPENDIX D-5

FOREST SERVICE GENERAL MEASURES

The special use permit and easement for right-of-way issued by the Forest Service (FS) would include general and specific stipulations. These stipulations would include the following general measures:

1. The FS will conduct a field review of the right-of-way that crosses the Thunder Basin National Grasslands with the applicant prior to survey work.

2. Prior to beginning construction on the right-of-way, the applicant shall prepare a Development and Construction Plan for FS lands for approval by the Forest Supervisor. Approval will be conditional upon requirements deemed necessary by the Forest Supervisor for proper management of the right-of-way.

3. In cooperation with the Forest Supervisor, the applicant will provide a schedule for the development and construction of all facilities within the water and coal slurry pipelines right-of-way. The schedule shall include a list of planned improvements and the scheduled date for completion. The applicant may accelerate the schedule date for construction of any improvement authorized, provided the other scheduled priorities are met and that all authorized priority installations are completed to the satisfaction of the Forest Supervisor prior to the scheduled due date. All required plans and specifications for site improvement and structures included in the construction schedule shall be submitted to the District Ranger at least 45 days before the construction date stipulated in the development schedule.

4. The applicant will make no substantial change or alternation in the design, location, or construction of the water and coal slurry pipelines or their facilities until the change is approved by the Forest Supervisor.

5. In cooperation with the Forest Supervisor, the applicant will prepare a Fire Protection Plan that details the fire prevention, presuppression, and

suppression measures that will be taken by the applicant, its employees, contractors, and subcontractors and their employees in all operations during the construction stage. The fire plan shall be made available to all bidders prior to letting the contract. The applicant shall ensure its contractors comply with all provisions of the fire plan and burning permits issued for disposal of flammable materials.

6. In cooperation with the Forest Supervisor, the applicant will prepare an Erosion Control, Landscaping, and Revegetation Plan for controlling soil erosion on the easement right-of-way and adjacent lands during construction, operation, and maintenance of the water and coal slurry pipelines. The applicant will revegetate all ground where the soil has been exposed and shall maintain all terracing, water bars, load-off ditches, and other preventive works that may be required by the Erosion Control, Landscaping, and Revegetation Plan.

7. In cooperation with the Forest Supervisor, the applicant will prepare an Improvements Construction and Relocation Plan. This plan will designate the location and standards of all gates, crossings, cattle guards, fences, water wells, corrals, sheds, reservoirs, and other improvements to property owned by the United States that will be constructed to mitigate impacts on wildlife, livestock, ranchers, recreationists, and other grassland users. The plan shall specify the mutually agreed upon time frame for relocating, replacing, and maintaining the improvements.

8. If items of archaeological or paleontological value are found or disturbed during excavation, excavation in the affected area will cease. The applicant will then notify the District Ranger and will not resume work until written approval is given by the District Ranger.

9. The applicant will take reasonable precautions to protect all Public Land survey monuments, private property corners, and National Grassland boundary markers. If any such land markers or monuments are destroyed, the applicant shall see that they are reestablished or referenced in accordance with (1) the procedures outlined in the "Manual of Instruction for the Survey of the Public Land of the United States," (2) the specifications of the county surveyor, or (3) the specifications of the Forest Service. The applicant will amend any official survey records as required by law.

10. The applicant will assign an environmental inspector who will assure that all environmental matters referred to in the Development and Construction Plan; Fire Protection Plan; Erosion Control, Landscaping and Revegetation Plan; Improvements Construction and Relocation Plan are followed. The applicant shall inform the Forest Supervisor, Laramie, Wyoming, in writing of the name and address of the environmental inspector. If a substitute inspector is appointed, the applicant shall immediately inform the Forest Supervisor.

11. The Forest Supervisor will be provided an opportunity to review any plans involving the use or protection of land administered by the FS or adjoining FS land. All design, construction, and maintenance features involving the use or protection of land administered by the FS will be approved by the Forest Supervisor.

12. The applicant shall comply with the regulations of the Department of Agriculture and with all federal, state, county, and municipal laws, ordinances, or regulations which are applicable to the right-of-way or to operations within it. The applicant will maintain the right-of-way and all improvements in a condition which conforms with standards of repair, orderliness, neatness, sanitation, and safety acceptable to the FS.

13. The applicant will pay the United States for all damage to federal property or resources and for all federal fire-suppression costs resulting directly or indirectly from the applicant's use and occupancy of the area covered by easement, regardless of whether the applicant is negligent or otherwise at fault. However, liability for damages that may be incurred by the applicant is subject to a maximum limitation on damages as set forth in Public Law (P.L.) 94-579. Until the limitation required by P.L. 94-579 is effective "... liability in excess of $1,000,000 shall be determined by ordinary rules of negligence."

14. Chemical materials may not be used to control undesirable vegetation, aquatic plants, insects, rodents, fish, etc., without the prior written approval of the FS. A report of planned pesticide use will be submitted

annually by the applicant on a date established by the Forest Supervisor. The report will cover a 12-month period of planned use beginning 3 months after the established date. Information essential for review will be provided in the form specified. Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the annual report was submitted. Only those materials approved and registered by the U.S. Department of Agriculture for the specific purpose planned will be considered for use on these lands. Label instructions for preparing and applying pesticides and disposing of excess materials and containers will be strictly followed.

15. The FS reserves the right of occupancy and use by the United States, its grantees, permittees, or lessees, without charge and without the consent of the applicant, of any part of the right-of-way across lands of the United States within the exterior boundaries of a National Grassland not actually occupied by the applicant's pipelines or associated facilities. The FS reserves the right to permit free and unrestricted access in, through, and accross the right-of-way for officers and employees of the United States in the performance of their official duties and for authorized users of National Grassland products, when consistent with the right-of-way priveleges of the applicant.

16. The applicant will not assign or transfer the right-of-way across lands of the United States except on condition that the assignees or transferees have agreed in writing to fulfill and perform all duties and obligations of the applicant arising from this easement.

17. This easement may be terminated by the FS upon surrender by the applicant and approval by the FS, upon abandonment, or upon 60-day notice to the applicant that the FS has determined the right-of-way is not being used for the purpose for which it was granted, or for failure to comply with the terms of the grant.

18. Unless terminated or revoked in accordance with the provision of the easement, this easement shall expire and become void upon issuance of a

new authorization or one year after publication of regulations by the Secretary of Agriculture under the provisions of Title V, P.L. 94-579, whichever comes first. A new authorization to occupy and use the same National Grasslands will be issued provided the applicant will comply with the then-existing rules and regulations governing the occupancy and use of National Grasslands.

19. Upon the abandonment, termination, or forfeiture of the right-of-way, and in absence of an agreement to the contrary, the applicant will remove within 2 years all structures and facilities which it has placed or caused to be placed on lands of the United States within the exterior boundaries of the National Grassland. If the applicant fails to remove any structures and facilities within that period, they shall become the property of the United States and the applicant shall remain liable.

APPENDIX D-6
RIVER AND STREAM CROSSINGS REQUIRING CORPS OF ENGINEERS SECTION 10 AND SECTION 404 PERMITS

The river and stream crossings that require Department of the Army permits under provisions of Section 10 of the Rivers and Harbor Act of 1899 and/or Section 404 of the Clean Water Act of 1977 that are issued by the U.S. Army Corps of Engineers are identified for the proposed action, market alternative, Cypress Bend pipeline-barge alternative, Colorado alternative, and Oahe alternative water supply system in Tables D-1 through D-5. Energy Transportation Systems Inc. (ETSI) may obtain special construction contracts for the crossings listed if pipeline construction were approved.

TABLE D-1

RIVERS AND STREAMS REQUIRING PERMITS: PROPOSED ACTION

Waterway Name	Type Permit	State	Corps District
1. North Platte River	404	Nebraska	Omaha
2. South Platte River	404	Nebraska	Omaha
3. Republican River	404	Nebraska	Omaha
4. Walnut Creek	404	Kansas	Albuquerque
5. Arkansas River	404	Kansas	Albuquerque
6. Chikaskia River	404	Oklahoma	Tulsa
7. Salt Fork/Arkansas River	404	Oklahoma	Tulsa
8. Arkansas River	404	Oklahoma	Tulsa
9. Verdigris River	404	Oklahoma	Tulsa
10. Neosho (Grand) River	10	Oklahoma	Tulsa
11. Arkansas River-M.K.N.S.	10	Oklahoma	Tulsa
12. Spaniard Creek	10	Oklahoma	Tulsa
13. Arkansas River-M.K.N.S.	10	Oklahoma	Tulsa
14. Lee Creek	10	Arkansas	Little Rock
15. Frog Bayou	404	Arkansas	Little Rock
16. Little Mulberry	404	Arkansas	Little Rock
17. Mulberry River	10	Arkansas	Little Rock
18. White Oak Creek	404	Arkansas	Little Rock
19. Spadra	404	Arkansas	Little Rock
20. Little Piney	404	Arkansas	Little Rock
21. East Fork Horse Creek	404	Arkansas	Little Rock
22. Horsehead Creek	404	Arkansas	Little Rock
23. Gum Log Creek	404	Arkansas	Little Rock
24. Piney Creek	404	Arkansas	Little Rock
25. Illinois Bayou	404	Arkansas	Little Rock
26. Point Remove Creek (2)	10	Arkansas	Little Rock
27. Arkansas River	10	Arkansas	Little Rock
28. West Fork Point Remove Creek	404	Arkansas	Little Rock
29. East Fork Point Remove Creek	404	Arkansas	Little Rock
30. North Fork Cadron Creek	404	Arkansas	Little Rock
31. Greers Ferry Lake	10	Arkansas	Little Rock

TABLE D-1 (continued)

Waterway Name	Type Permit	State	Corps District
32. Little Red River	404	Arkansas	Little Rock
33. Big Creek	404	Arkansas	Little Rock
34. White River (Newport terminal)	10	Arkansas	Little Rock
35. Cypress Creek	404	Arkansas	Little Rock
36. Fourche La Fave River	10	Arkansas	Little Rock
37. Harris Brake Lake	404	Arkansas	Little Rock
38. Big Maumelle River	404	Arkansas	Little Rock
39. Fourche Creek	404	Arkansas	Little Rock
40. Saline River	10	Arkansas	Vicksburg
41. Saline River	10	Arkansas	Vicksburg
42. *Bayou Bartholomew	10	Louisiana	Vicksburg
43. Ouachita River	10	Louisiana	Vicksburg
44. *Little River	10	Louisiana	Vicksburg
45. Red River	10	Louisiana	New Orleans
46. Bayou Boeuf	10	Louisiana	New Orleans
47. Bayou Boeuf and Cocodrie Diversion Channel	10	Louisiana	New Orleans
48. *Spring Creek	10	Louisiana	New Orleans
49. Bayou Cocodrie	10	Louisiana	New Orleans
50. Calcasieu River	10	Louisiana	New Orleans
INDEPENDENCE LATERAL			
51. White River	10	Arkansas	Little Rock
NEW ROADS-WILTON LATERAL			
52. Bayou des Glaises Diversion Channel	404	Louisiana	New Orleans
53. Atchafalaya River	10	Louisiana	New Orleans
54. Bayou Fordoche	404	Louisiana	New Orleans
55. Gulf Intracoastal Waterway-Port Allen Canal	10	Louisiana	New Orleans
56. Bayou Plaquemine	10	Louisiana	New Orleans

TABLE D-1 (concluded)

Waterway Name	Type Permit	State	Corps District
57. Bayou Lafourche	10	Louisiana	New Orleans
58. Mississippi River	10	Louisiana	New Orleans

*Scenic river.

TABLE D-2

RIVERS AND STREAMS REQUIRING PERMITS: MARKET ALTERNATIVE

Waterway Name	Type Permit	State	Corps District
1. North Platte River	404	Nebraska	Omaha
2. South Platte River	404	Nebraska	Omaha
3. Republican River	404	Nebraska	Omaha
4. Saline River	404	Kansas	Kansas City
5. Verdigris River	404	Oklahoma	Tulsa
6. Neosho (Grand) River	404	Oklahoma	Tulsa
7. *Barren Fork River	404	Oklahoma	Tulsa
8. *Illinois River	10	Oklahoma	Tulsa
9. Lee Creek	10	Arkansas	Little Rock
10. Frog Bayou	404	Arkansas	Little Rock
11. Little Mulberry	404	Arkansas	Little Rock
12. Mulberry River	10	Arkansas	Little Rock
13. White Oak Creek	404	Arkansas	Little Rock
14. Spadra	404	Arkansas	Little Rock
15. Little Piney	404	Arkansas	Little Rock
16. East Fork Horsehead Creek	404	Arkansas	Little Rock
17. Horsehead Creek	404	Arkansas	Little Rock
18. Gum Log Creek	404	Arkansas	Little Rock
19. Piney Creek	404	Arkansas	Little Rock
20. Illinois Bayou	404	Arkansas	Little Rock
21. Point Remove Creek (2)	10	Arkansas	Little Rock
22. Arkansas River	10	Arkansas	Little Rock
23. West Fork Point Remove Creek	404	Arkansas	Little Rock
24. East Fork Point Remove Creek	404	Arkansas	Little Rock
25. North Fork Cadron Creek	404	Arkansas	Little Rock
26. Greers Ferry Lake	10	Arkansas	Little Rock
27. Little Red River	404	Arkansas	Little Rock
28. Big Creek	404	Arkansas	Little Rock
29. White River (Newport terminal)	10	Arkansas	Little Rock
30. Cypress Creek	404	Arkansas	Little Rock
31. Fourche La Fave River	10	Arkansas	Little Rock

TABLE D-2 (concluded)

Waterway Name	Type Permit	State	Corps District
32. Harris Brake Lake	404	Arkansas	Little Rock
33. Big Maumelle River	404	Arkansas	Little Rock
34. Fourche Creek	404	Arkansas	Little Rock
35. Saline River	10	Arkansas	Vicksburg
36. Saline River	10	Arkansas	Vicksburg
37. *Bayou Bartholomew	10	Louisiana	Vicksburg
38. Ouachita River	10	Louisiana	Vicksburg
39. *Little River	10	Louisiana	New Orleans
40. Red River	10	Louisiana	New Orleans
41. Bayou Boeuf	10	Louisiana	New Orleans
42. Bayou Boeuf and Cocodrie Diversion Channel	10	Louisiana	New Orleans
43. *Spring Creek	10	Louisiana	New Orleans
44. Bayou Cocodrie	10	Louisiana	New Orleans
45. Calcasieu River	10	Louisiana	New Orleans
INDEPENDENCE LATERAL			
46. White River	10	Arkansas	Little Rock
NEW ROADS-WILTON LATERAL			
47. Bayou des Glaises Diversion Channel	404	Louisiana	New Orleans
48. Atchafalaya River	10	Louisiana	New Orleans
49. Bayou Fordoche	404	Louisiana	New Orleans
50. Mississippi River	10	Louisiana	New Orleans
51. Gulf Intracoastal Waterway-Port Allen Canal	10	Louisiana	New Orleans
52. Bayou Plaquemine	10	Louisiana	New Orleans
53. Bayou Lafourche	10	Louisiana	New Orleans
54. Mississippi River	10	Louisiana	New Orleans

*Scenic river.

TABLE D-3

RIVERS AND STREAMS REQUIRING PERMITS: CYPRESS BEND PIPELINE-BARGE ALTERNATIVE

Waterway Name	Type Permit	State	Corps District
1. North Platte River	404	Nebraska	Omaha
2. South Platte River	404	Nebraska	Omaha
3. Republican River	404	Nebraska	Omaha
4. Saline River	404	Kansas	Kansas City
5. Verdigris River	404	Oklahoma	Tulsa
6. Neosho (Grand) River	404	Oklahoma	Tulsa
7. *Barren Fork River	404	Oklahoma	Tulsa
8. *Illinois River	10	Oklahoma	Tulsa
9. Lee Creek	10	Arkansas	Little Rock
10. Frog Bayou	404	Arkansas	Little Rock
11. Little Mulberry	404	Arkansas	Little Rock
12. Mulberry River	10	Arkansas	Little Rock
13. White Oak Creek	404	Arkansas	Little Rock
14. Spadra	404	Arkansas	Little Rock
15. Little Piney	404	Arkansas	Little Rock
16. East Fork Horsehead Creek	404	Arkansas	Little Rock
17. Horsehead Creek	404	Arkansas	Little Rock
18. Gum Log Creek	404	Arkansas	Little Rock
19. Piney Creek	404	Arkansas	Little Rock
20. Illinois Bayou	404	Arkansas	Little Rock
21. Point Remove Creek (2)	10	Arkansas	Little Rock
22. Arkansas River	10	Arkansas	Little Rock
23. West Fork Point Remove Creek	404	Arkansas	Little Rock
24. East Fork Point Remove Creek	404	Arkansas	Little Rock
25. North Fork Cadron Creek	404	Arkansas	Little Rock
26. Greers Ferry Lake	10	Arkansas	Little Rock
27. Little Red River	404	Arkansas	Little Rock
28. Big Creek	404	Arkansas	Little Rock
29. White River (Newport terminal)	10	Arkansas	Little Rock

TABLE D-3 (Concluded)

Waterway Name	Type Permit	State	Corps District
30. Cypress Creek	404	Arkansas	Little Rock
31. Fourche La Fave River	10	Arkansas	Little Rock
32. Harris Brake Lake	404	Arkansas	Little Rock
33. Big Maumelle River	404	Arkansas	Little Rock
34. Fourche Creek	404	Arkansas	Little Rock
<u>CYPRESS BEND LATERAL</u>			
35. Mississippi River, Barge Loading Facility	10	Arkansas	Vicksburg

*Scenic river.

TABLE D-4

RIVERS AND STREAMS REQUIRING PERMITS: COLORADO ALTERNATIVE

Waterway Name	Type Permit	State	Corps District
1. North Platte River	404	Wyoming	Omaha
2. South Platte River	404	Colorado	Omaha
3. Arkansas River	404	Kansas	Albuquerque

TABLE D-5

RIVERS AND STREAMS REQUIRING PERMITS:
OAHE ALTERNATIVE WATER SUPPLY SYSTEM

Name	Type Permit	State	Corps District
Willow Creek	404	South Dakota	Omaha
Deep Creek	404	South Dakota	Omaha
Cheyenne River	404	South Dakota	Omaha
Elk Creek	404	South Dakota	Omaha
Whitehead Creek	404	South Dakota	Omaha
False Bottom Creek	404	South Dakota	Omaha
Spearfish Creek	404	South Dakota	Omaha
Sand Creek*	404	Wyoming	Omaha
Rocky Ford Creek	404	Wyoming	Omaha
Sundance Creek	404	Wyoming	Omaha
Inyan Kara Creek	404	Wyoming	Omaha
Belle Fourche River	404	Wyoming	Omaha

* State of Wyoming Blue Ribbon Trout Stream

APPENDIX D-7

CORPS OF ENGINEERS GENERAL MEASURES

The U.S. Army Corps of Engineers (COE) has prescribed management practices that should be followed to the maximum extent practical, for discharges covered by the Nationwide Permit (items 1-8 below). Additionally, certain conditions must be met under the Nationwide permit authority (items 9-17 below). A detailed list of crossings to which these measures will be applicable is found in Appendix D-6.

1. Discharges of dredged or fill material into waters of the United States should be avoided or minimized through the use of other practical alternatives;

2. Discharges in spawning areas during spawning seasons should be avoided;

3. Discharges should not restrict or impede the movement of aquatic species indigenous to the waters, impede the passage of normal or expected high flows, or cause the relocation of the waters (unless the primary purpose of the fill is to impound waters);

4. If the discharge creates an impoundment water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow should be minimized;

5. Discharges in wetland areas should be avoided;

6. Heavy equipment working in wetlands should be placed on mats;

7. Discharges into breeding and nesting areas for migratory waterfowl should be avoided;

8. All temporary fills should be removed in their entirety;

9. There cannot be any change in preconstruction bottom contours (excess material must be removed to an upland disposal area);

10. The discharge cannot be located in the proximity of a public water supply intake;

11. The discharge cannot occur in areas of concentrated shellfish production;

12. The discharge cannot destroy a threatened or endangered species as identified under the Endangered Species Act, or endanger the critical habitat of such species;

13. The discharge cannot disrupt the movement of those species of aquatic life indigenous to the waterbody;

14. The discharge must consist of suitable material free from toxic pollutants in other than trace quantities;

15. The fill created by the discharge must be properly maintained to prevent erosion and other non-point sources of pollution;

16. The discharge must not occur in a component of the National Wild and Scenic River System or in a component of a state wild and scenic river system; and

17. No access roads, fills, dikes, or other structures can be constructed below the ordinary high water mark of the streams under the Nationwide Permit (these structures would require separate Section 404 permits).

In addition, the COE will require an easement for those portions of the pipeline crossing the federal government's fee ownership. A consent to easement will be required for those portions crossing lands over which the United States acquired only an easement interest. Processing would be concurrent with that of the permit application.

BUREAU OF INDIAN AFFAIRS GENERAL MEASURES

General conditions would have to be agreed to by ETSI before the Bureau of Indian Affairs (BIA) would grant a right-of-way:

(a) To construct and maintain the right-of-way in a workmanlike manner.

(b) To pay promptly all damages and compensation, in addition to the deposit made pursuant to Sec. 161.4, determined by the Secretary to be due the landowners and authorized users and occupants of the land on account of the survey, granting, construction, and maintenance of the right-of-way.

(c) To indemnify the landowners and authorized users and occupants against any liability for loss of life, personal injury, and property damage arising from the construction, maintenance, occupancy, or use of the lands by the applicant, his employees, contractors, and their employees, or sub-contractors and their employees.

(d) To restore the lands as nearly as may be possible to their original condition upon the completion of construction to the extent compatible with the purpose for which the right-of-way was granted.

(e) To clear and keep clear the lands within the right-of-way to the extent compatible with the purpose of the right-of-way; and to dispose of all vegetative and other material cut, uprooted, or otherwise accumulated during the construction and maintenance of the project.

(f) To undertake soil and resource conservation and protection measures, including weed control on the land covered by the right-of-way.

(g) To do everything reasonably within its power to prevent and suppress fires on or near the lands to be occupied under the right-of-way.

(h) To build and repair such roads, fences, and trails as may be destroyed or injured by construction work and to build and maintain necessary and suitable crossings for all roads and trails that intersect the works constructed, maintained, or operated under the right-of-way.

(i) That upon revocation or termination of the right-of-way, the applicant shall, so far as is reasonably possible, restore the land to its original condition.

(j) To at all times keep the Secretary informed of its address, and in case of corporations, of the address of its principal place of business and of the names and addresses of its principal officers.

(k) That the applicant will not interfere with the use of the lands by or under the authority of the landowners for any purpose not inconsistent with the primary purpose for which the right-of-way is granted.

APPENDIX D-9
STATE OF WYOMING AIR QUALITY PERMITS

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

AIR QUALITY DIVISION

HATHAWAY BUILDING   CHEYENNE, WYOMING 82002   TELEPHONE 777-7391

January 15, 1980

Mr. Frank B. Odasz
Energy Transportation Systems, Inc.
212 Petroleum Building
111 W. 2nd Street
Casper, WY 82601

Permit No. CT-276

Dear Mr. Odasz:

The Division of Air Quality of the Wyoming Department of Environmental Quality has completed final review of Energy Transportation Systems, Inc.'s application to construct coal slurry preparation facilities for the processing of 5 million tons of coal per year in Section 15, T.14N., R.70W., at the North Antelope Mine in Campbell County, Wyoming. Following this agency's tentative approval of the request as published December 7, 1979, and in accordance with Section 21(m) of the Wyoming Air Quality Standards and Regulations, the public was afforded a 30-day period in which to submit comments concerning the proposed new source, and an opportunity for a public hearing. No comments have been received. Therefore, on the basis of the information provided to us, approval to construct coal slurry preparation facilities as described in the application is hereby granted pursuant to Sections 21 and 24 of the regulations with the following conditions:

1. That authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or is being constructed or installed for purpose of investigating actual or potential sources of air pollution, and for determining compliance or non-compliance with any rules, regulations, standards, permits or orders.

2. That all access roads and generally trafficked areas be treated with asphalt, oil or other suitable chemical dust suppressants in addition to water to control fugitive dust emissions. Permanent access roads not subject to travel by over weight haul trucks or mining equipment shall be surfaced with a semi-permanent material. As a minimum, access roads shall have a stabilized base topped with a chip and seal surface. All treated road surfaces shall be maintained on a continuous basis to the extent that surface treatment remains viable as a control measure.

3. That particulate emissions from processing units shall not exceed indicated amounts:

SOURCE	NUMBER OF EMISSION POINTS	ALLOWABLE EMISSIONS lb/hr	ALLOWABLE EMISSIONS tons/yr
Feed conveyor, sampling point, screens	1	1.29	5.5
Clean coal conveyor, sample station, shuttle conveyor to top of surge bins	1	2.57	11.0
Discharge from surge bins and variable speed conveyors	1	2.57	11.0
Cage mills, primary slurry tank	6	51.42 (8.57 ea)	220.8 (36.8 ea)
Boiler - 68.8 x 10^6 BTU/hr	1	1.72	4.0
TOTAL		59.57	252.3

It must be noted that this approval does not relieve you of your obligation to comply with all applicable local, county, state and federal standards, regulations or ordinances. Special attention must be given to Section 21 of the Wyoming Air Quality Standards and Regulations. Section 21(a) requires that a permit to operate is required in order to operate a facility after a 120-day start-up period, Section 21(i) requires notification of initial start-up, and Section 21(j) requires that performance tests be conducted within 90 days of initial start-up.

If we may be of further assistance to you, please feel free to contact this office.

Sincerely,

Randolph Wood
Administrator
Air Quality Division

Robert E. Sundin
Director
Dept. of Environmental Quality

REGISTERED PROFESSIONAL ENGINEER ROBERT E. SUNDIN NO. 2?? STATE OF WYOMING

RW:RES/ct

THE STATE OF WYOMING

ED HERSCHLER
GOVERNOR

Department of Environmental Quality

AIR QUALITY DIVISION

HATHAWAY BUILDING CHEYENNE, WYOMING 82002 TELEPHONE 777-7391

January 15, 1980

Mr. Frank B. Odasz
Energy Transportation Systems, Inc.
212 Petroleum Building
111 W. 2nd Street
Casper, WY 82601

Permit No. CT-275

Dear Mr. Odasz:

The Division of Air Quality of the Wyoming Department of Environmental Quality has completed final review of Energy Transportation Systems, Inc.'s application to construct coal slurry preparation facilities for the processing of 10 million tons of coal per year in Section 11, T.43N., R.70W., at the Jacob's Ranch Mine in Campbell County, Wyoming. Following this agency's tentative approval of the request as published December 7, 1979, and in accordance with Section 21(m) of the Wyoming Air Quality Standards and Regulations, the public was afforded a 30-day period in which to submit comments concerning the proposed new source, and an opportunity for a public hearing. No comments have been received. Therefore, on the basis of the information provided to us, approval to construct coal slurry preparation facilities as described in the application is hereby granted pursuant to Sections 21 and 24 of the regulations with the following conditions:

1. That authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or is being constructed or installed for purpose of investigating actual or potential sources of air pollution, and for determining compliance or non-compliance with any rules, regulations, standards, permits or orders.

2. That all access roads and generally trafficked areas be treated with asphalt, oil or other suitable chemical dust suppressants in addition to water to control fugitive dust emissions. As a minimum, access roads shall have a stabilized base topped with a chip and seal surface. All treated road surfaces shall be maintained on a continuous basis to the extent that surface treatment remains viable as a control measure.

3. That particulate emissions from processing units shall not exceed indicated amounts:

SOURCE	NUMBER OF EMISSION POINTS	ALLOWABLE EMISSIONS lb/hr	tons/yr
Feed conveyor, sampling point, screens	1	1.29	5.5
Clean coal conveyor, sample station, shuttle conveyor to top of surge bins	1	2.57	11.0
Discharge from surge bins and variable speed conveyors	1	2.57	11.0
Cage mills, primary slurry tank	6	51.42 (8.57 ea)	220.8 (36.8 ea)
Boiler - 68.8 x 10^6 BTU/hr	1	1.72	4.0
TOTAL		[illegible].57	252.3

It must be noted that this approval does not relieve you of your obligation to comply with all applicable local, county, state and federal standards, regulations or ordinances. Special attention must be given to Section 21 of the Wyoming Air Quality Standards and Regulations. Section 21(a) requires that a permit to operate is required in order to operate a facility after a 120-day start-up period, and Section 21(j) requires that performance tests be conducted within 90 days of initial start-up.

If we may be of further assistance to you, please feel free to contact this office.

Sincerely,

Randolph Wood
Administrator
Air Quality Division

Robert E. Sundin
Director
Dept. of Environmental Quality

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THE STATE OF WYOMING

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GOVERNOR

Department of Environmental Quality

AIR QUALITY DIVISION

HATHAWAY BUILDING CHEYENNE, WYOMING 82002 TELEPHONE 777-7391

January 15, 1980

Mr. Frank B. Odasz
Energy Transportation Systems, Inc.
212 Petroleum Building
111 West 2nd Street
Casper, WY 82601

RE: Permit No. CT-274

Dear Mr. Odasz:

The Division of Air Quality of the Wyoming Department of Environmental Quality has completed final review of Energy Transportation Systems, Inc.'s application to construct coal slurry preparation facilities for the processing of 10 million tons of coal per year in Section 12, T.51N., R.72W., at the Carter North Rawhide Mine in Campbell County, Wyoming. Following this agency's tentative approval of the request as published December 7, 1979, and in accordance with Section 21(m) of the Wyoming Air Quality Standards and Regulations, the public was afforded a 30-day period in which to submit comments concerning the proposed new source, and an opportunity for a public hearing. Comments were received and evaluated in reaching a final decision. Therefore, on the basis of the information provided to us, approval to construct coal slurry preparation facilities as described in the application is hereby granted pursuant to Sections 21 and 24 of the regulations with the following conditions:

1. That authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or is being constructed or installed for purpose of investigating actual or potential sources of air pollution, and for determining compliance or non-compliance with any rules, regulations, standards, permits or orders.

2. That all access roads and generally trafficked areas be treated with asphalt, oil or other suitable chemical dust suppressants in addition to water to control fugitive dust emissions. As a minimum, access roads shall have a stabilized base topped with a chip and seal surface. All treated road surfaces shall be maintained on a continuous basis to the extent that surface treatment remains viable as a control measure.

3. That particulate emissions from processing units shall not exceed indicated amounts:

SOURCE	NUMBER OF EMISSION POINTS	ALLOWABLE EMISSIONS lb/hr	tons/yr
Feed conveyor, sampling point, screens	1	0.77	3.3
Clean coal conveyor, sample station, shuttle conveyor, surge bins, variable speed conveyors	1	2.57	11.0
Cage mills, primary slurry tank	3	25.71 (8.57 ea)	110.4 (36.8 ea
Boiler - 34.4 x 10^6 BTU/hr	1	0.86	2.0
TOTAL		29.91	126.7

It must be noted that this approval does not relieve you of your obligation to comply with all applicable local, county, state and federal standards, regulations or ordinances. Special attention must be given to Section 21 of the Wyoming Air Quality Standards and Regulations. Section 21(a) requires that a permit to operate is required in order to operate a facility after a 120-day start-up period, Section 21(i) requires notification of initial start-up, and Section 21(j) requires that performance tests be conducted within 90 days of initial start-up.

If we may be of further assistance to you, please feel free to contact this office.

Sincerely,

Randolph Wood
Administrator
Air Quality Division

Robert E. Sundin
Director
Dept. of Environmental Quality

REGISTERED PROFESS ROBERT E. NO. 285 STATE OF WY

RW:RES/ct

Appendix E

ENERGY EFFICIENCY

E.1 INTRODUCTION

This appendix summarizes the methodology and assumptions used in the calculation of energy consumption components and the energy consumption and efficiency matrices described in Chapter 2. In addition, a reference section is included to identify sources of data for the calculations. The sections that follow are identified by the following energy consumption component descriptions:

- Slurry preparation and coal cleaning
- Weight loss and heat value improvement
- Slurry pipelines and pump stations
- Slurry dewatering, drying, and cooling
- Boiler feed moisture correction
- Water treatment at dewatering plants
- Railroad loading, unloading, and unit trains
- Railroad windage losses
- Barge loading and transportation
- Niobrara well field and pipelines
- Crook County well field and pipelines
- Oahe Reservoir pipelines
- Water recycle pipeline
- Gillette water supply and pipelines
- Coal consumption at Cypress Bend

Table E-1 summarizes energy consumptions for the components listed above. Water supply energy debits are summarized in Table E-2. These component energy consumptions were used to determine the overall energy consumption figures for the alternate scenarios as displayed in Table 2-1 of Chapter 2.

Component energy consumption was totaled at the raw energy level (i.e., the quantitity of coal entering the power plant boiler for generating electrical energy, or crude oil entering the refinery to produce diesel fuel for locomotives and tugboats). The raw energy level was used to establish a consistent basis for comparison with other energy efficiency studies (Banks 1977, pp. 6-2, 6-4; Cucek and Wasp 1977, pp. 7, 8), and to give a truer picture of the raw resources needed to supply the energy consumed in transport. Crude oil was chosen as the diesel fuel source because no positive information or decisive political policies stating

TABLE E-1

SUMMARY OF COMPONENT AND ENERGY CONSUMPTION

Component	Energy Consumption (Btu/ton)
Slurry preparation	23,775
Slurry cleaning	24,329
Cleaning weight loss - Btu's lost	427,049
Cleaning weight loss adjustment	a
Slurry pipelines and pump stations	
Proposed action	244,869
Proposed action - Colorado route	249,499
Market alternative	259,828
Market alternative - Colorado route	267,308
Pipeline-barge alternative	201,238
Slurry dewatering, drying, cooling	
Proposed action scenarios	251,768
Market alternative scenarios	251,802
Pipeline-barge alternative	339,944
Boiler feed moisture correction	109,175
Water treatment at dewatering plants	994
Railroad loading and unloading	19,094
Railroad transportation	
No-action (all rail) alternative	534,434
No-action (railroad-barge) alternative	481,311
Railroad windage losses	16,660
Barge loading	
No-action (railroad-barge) alternative	4,925
Pipeline-barge alternative	5,121
Barge transportation	
No-action (railroad-barge) alternative	175,114
Pipeline-barge alternative	70,413
Coal consumption at Cypress Bend	b

[a]Multiply preparation, pumping, dewatering, boiler feed moisture, and water treatment components by 0.974.

[b]Multiply all components except boiler feed moisture component by 1.008.

TABLE E-2

SUMMARY OF WATER SUPPLY ENERGY CONSUMPTIONS (Btu/ton)

	Niobrara	Crook County	Oahe Reservoir	Recycle
1. Proposed action scenarios	33,911	28,154	48,123	218,273
2. Market alternative scenarios	33,821	23,567	43,536	218,183
3. Pipeline-barge alternative	35,620	19,969	39,938	219,982

Note: Gillette water supply is for emergency or surplus purposes, supplementing the other supply systems, and therefore is not included in the analysis.

that coal would be the dominating diesel fuel source for the lifetime of the ETSI project could be found (Traylor 1980). However, in order to put the energy consumption figures on an equivalent basis for comparison purposes (both electrical energy and diesel fuel having the same raw energy source - coal) a coal-to-crude oil conversion factor was used in determining the figures in parentheses in Table 2-1 of Chapter 2.

Table E-3 shows the Btu equivalents and conversion efficiencies used to determine the energy consumptions of the components.

TABLE E-3

ENERGY CONVERSION FACTORS

Coal, as-mined, 29.49% moisture	16.7×10^6 Btu/ton
Coal, cleaned, 29.49% moisture	17.1×10^6 Btu/ton
Crude oil	5.8×10^6 Btu/bbl
Electrical energy (input)[a]	10.4×10^3 Btu/kWh
Electrical energy (output)[b]	3414 Btu/kWh
Crude oil-to-diesel conversion thermal efficiency[c]	0.85
Coal-to-crude oil conversion thermal efficiency[d]	0.52

[a]Electric energy (input) has been converted to theoretical inputs based on average heat rates for fossil-fueled steam electric plants (EPRI 1979).

[b]Electric energy (output) is the mean physical equivalent, disregarding any thermal losses in conversion.

[c]Based on calculations from API data (API 1974, Tables 2 and 4).

[d]From "H-Coal" synthetic oil process (Bechtel 1980).

E.2 SLURRY PIPELINE

Slurry Preparation and Coal Cleaning

The following are the items included in the slurry preparation and coal cleaning operations:

Preparation	Cleaning
Receiving hopper with feeder	Separators
Reclaim conveyor	Coarse coal cleaning jig
Cage mills	Hammer mill
Mixing tank	Cyclones
Screens	Fine coal cleaning jig
Rod mill	Dewatering screen centrifuges
Feed conveyors	Thickener
Miscellaneous loads	Clarifier
	Drum filter
	Miscellaneous loads

ETSI has determined that approximately 427.5×10^6 kilowatt-hours (kWh) annually are required in the preparation plants, and that 85.3×10^6 kWh annually are required in the cleaning plants for a throughput of 37.4 million (short) tons annually (MMTA) (ETSI 1980a).

The preparation energy consumption is converted to Btu/ton units using the following calculation based on the electrical energy input conversion factor.

$$\text{Preparation energy} = \frac{(427.5 \times 10^6 \text{ kWh})(10{,}400 \text{ Btu/kWh})}{(37.4 \times 10^6 \text{ tons})} = 118{,}887 \text{ Btu/ton}$$

However, an estimated 80 percent of the energy used for slurry preparation is required for the rod and cage mills during the coal grinding operations (Banks 1977, p. 6-5; Weston 1980a,b). Because equal grinding is also required for the railroad- and barge-transported coal before it can be fed into the power plant boiler, grinding energy cannot be charged to the pipeline alone. For the purpose of equal comparison grinding is excluded from the analysis:

Preparation energy, less grinding = (0.20) (118,887 Btu/ton) = 23,775 Btu/ton

The cleaning energy consumption is calculated using the electrical input conversion factor as follows:

$$\text{Cleaning energy} = \frac{(85.3 \times 10^6 \text{ kWh})(10{,}400 \text{ Btu/kWh})}{(37.4 \times 10^6 \text{ tons})} = 23{,}720 \text{ Btu/ton}$$

However, this figure must be corrected for weight loss and heat value improvement.

Weight Loss And Heat Value Improvement

It is estimated by ETSI that an average of 5 percent of the original weight of as-mined coal is lost during the coal cleaning process (Weston 1980c). With cleaning, however, the dry basis heat value is improved from 11,814 Btu/lb to 12,125 Btu/lb (Bechtel 1979a).

The Btu content of one ton of the mined coal (29.49 percent total moisture) before cleaning is:

Btu as-mined coal = (1.0 - 0.2949) (2000 lb/ton) (11,814 Btu/lb) = 16,660,103 Btu

If 95 percent of the original coal weight undergoes an improvement in heat value from 11,814 Btu/lb to 12,125 Btu/lb, this cleaned coal has a Btu content of:

Btu cleaned coal = (0.95) (1.0 - 0.2949) (2000 lb/ton) (12,125 Btu/lb) = 16,243,741 Btu

The total Btu's lost in cleaning one ton of coal is then:

Btu_{loss} = 16,660,103 - 16,243,741 = 416,362 Btu/ton

This energy is irretrievable with present or future commercial technology.

To transport the equivalent Btu's as contained in 37.4 MMTA of contracted as-mined coal, the mining and cleaning throughputs must be increased to:

$$\frac{16{,}660{,}103 \text{ Btu}}{16{,}243{,}741 \text{ Btu}} (37.4 \text{ MMTA}) = 38.36 \text{ MMTA}$$

The cleaning energy consumption shown above is then increased:

$$(23{,}720 \text{ Btu/ton}) \frac{38.36 \text{ MMTA}}{37.4 \text{ MMTA}} = 24{,}329 \text{ Btu/ton}$$

Likewise, the Btu_{loss} figure must be increased:

$$(416{,}362 \text{ Btu/ton}) \frac{38.36 \text{ MMTA}}{37.4 \text{ MMTA}} = 427{,}049 \text{ Btu/ton}$$

But downstream from the cleaning plant the throughput is less: (0.95) (38.36 MMTA) = 36.44 MMTA. Hence, all energy consumptions downstream, except for water supply, must be adjusted by a factor of: (36.44/37.4) = 0.974.

The components to be adjusted are: slurry preparation, slurry pumping, slurry dewatering, boiler feed moisture, and water treatment. The rationale for not adjusting the water supply energy consumption is that although less water is required for slurry preparation, more water is required in the plant for coal cleaning. These offsetting differences will have an overall balancing effect on the water supply.

These corrections on the component energy consumptions bring the overall summed Btu/ton figure for the coal cleaning scenarios to a basis of 37.4 MMTA of as-mined specification coal (29.49 percent moisture and 11,814 Btu/lb).

It should be noted that the Btu's of lost coal in the high-ash, high-sulfur refuse may be offset by some indirect and undetermined energy benefits, such as reduced solid waste disposal energy requirements and reduced flue gas treatment energy requirements at the power generating plant. Although studies have been performed that examine the cost effects of coal cleaning (Buder and Clifford 1979), the energy trade-offs have not yet been fully explored.

Slurry Pipelines and Pump Stations

The following items are included in the slurry pumping energy requirement (Sandhu 1980a):

Main-line slurry pumps	Slurry tank agitators
Slurry centrifugal charge pumps	Inhibitor tank agitators
Inhibitor pumps	Motorized valve operators
Small-horsepower auxiliary pumps	Miscellaneous loads and heating

ETSI (1980b) has supplied the slurry pumping horsepowers for the different scenarios, as listed below:

Scenario	Operating Horsepower
Proposed action	137,500
Proposed action - Colorado route	140,100
Market alternative	145,900
Market alternative - Colorado route	150,100
Pipeline-barge alternative	113,000

These operating horsepowers include the losses and mechanical efficiencies of the pumps and agitators. Energy consumption in units of Btu/ton is derived as follows:

$$\text{Slurry pumping energy} = (\text{horsepower})(0.98 \text{ availability})(8760 \text{ hr/yr})(0.746 \text{ kWh/hp-hr})$$

$$\times (10{,}400 \text{ Btu/kWh})\ 1/37.4 \times 10^6 \text{ tons/yr} = (1.780864)(\text{horsepower}) \text{ in Btu/ton}$$

For example, for the proposed action, the energy consumption would be:

$$(137{,}500 \text{ hp})(1.780864) = 244{,}869 \text{ Btu/ton}$$

The slurry pumping energies for the different scenarios are:

Scenario	Btu/ton
Proposed action	244,869
Proposed action - Colorado route	249,499
Market alternative	259,828
Market alternative - Colorado route	267,308
Pipeline-barge alternative	201,238

Slurry Dewatering, Drying, and Cooling

The following items are included in the slurry dewatering, drying and cooling operations:

Slurry transfer pumps	Conveyor motors
Water pumps	Vibrator motors
Screen bowl centrifuges	Standby steam boilers
Clariflocculator agitators	Disc coolers
Filter cake presses	

The proposed action scenarios, market alternative scenarios, and pipeline-barge alternative would include dewatering facilities at each of the pipeline terminals. ETSI has supplied the operating horsepowers for each facility (Bechtel 1979b). These are listed in Tables E-4, E-5, and E-6 for the three scenarios respectively. The operating horsepowers take into account the losses and mechanical efficiencies of all the dewatering and cooling equipment.

Given the total operating horsepower, the Btu/ton consumption is calculated using the same formula as the slurry pumping energy formula, e.g.:

$$(\text{horsepower})(1.780864) = \text{Btu/ton}$$

The dewatering and cooling Btu/ton energy intensities are shown in Tables E-4, E-5, and E-6.

The steam requirements for the drying facilities have been supplied by ETSI (1980a) and are also listed in Tables E-4, E-5, and E-6. It has been stated that except at Cypress Bend, all steam requirements would be supplied by the

TABLE E-4

DEWATERING, DRYING, AND COOLING ENERGY
PROPOSED ACTION SCENARIOS

Facility	Volume (MMTA)	Dewatering & Cooling Horsepower	Drying Steam (Btu/hr x 10^8)
Ponca City	6.6	8,240	2.5
Pryor	3.0	4,330	1.1
Muskogee	5.0	6,330	1.9
Independence	5.0	6,330	1.9
White Bluff	5.0	6,330	1.9
Boyce	1.8	3,250	0.7
Lake Charles	4.0	5,360	1.5
New Roads	2.0	3,360	0.8
Wilton	5.0	6,330	1.9
TOTAL		49,860	14.2
Btu/ton		88,794	162,974

Total Btu/ton: 251,768

Sample Calculation:

Horsepower -

(49,860 hp) (1.780864) = 88,794 Btu/ton

Drying Steam -

(14.2×10^8 Btu/hr) (8760) (0.98)(1/2) ($1/37.4 \times 10^6$) = 162,974 Btu/ton

Total -

88,794 + 162,974 = 251,768 Btu/ton

TABLE E-5

DEWATERING, DRYING, AND COOLING ENERGY
MARKET ALTERNATIVE SCENARIOS

Facility	Volume (MMTA)	Dewatering & Cooling Horsepower	Drying Steam (Btu/hr x 10^8)
Oologah	3.5	4,845	1.3
Pryor	5.3	6,720	2.0
Independence	5.0	6,330	1.9
White Bluff	5.0	6,330	1.9
Boyce	1.8	3,250	0.7
Lake Charles	4.0	5,360	1.5
New Roads	2.0	3,360	0.8
Baton Rouge	5.8	7,354	2.2
Wilton	5.0	6,330	1.9
TOTAL		49,879	14.2
Btu/ton		88,828	162,974

Total Btu/ton: 251,802

TABLE E-6

DEWATERING, DRYING, AND COOLING ENERGY
PIPELINE-BARGE ALTERNATIVE

Facility	Volume (MMTA)	Dewatering & Cooling Horsepower	Drying Steam (Btu/hr x 10^8)
Oologah	3.5	4,845	1.3
Pryor	5.3	6,720	2.0
Independence	5.0	6,330	1.9
White Bluff	5.0	6,330	1.9
SUBTOTAL		24,225	7.1
Cypress Bend	18.6	22,088	6.9
TOTAL		46,313	14.0
Btu/ton		82,477	257,467[a]

Total Btu/ton: 339,944

[a]Calculated as follows:

Drying Steam Annual Consumption at Power Plant Locations:

$$(7.1 \times 10^8 \text{ Btu/hr})(8760)(0.98)(1/2) = 3.0476 \times 10^{12} \text{ Btu/yr}$$

Cypress Bend Drying Steam Annual Consumption:

$$(6.9 \times 10^8 \text{ Btu/hr})(8760)(.98/.9) = 6.5817 \times 10^{12} \text{ Btu/yr}$$

Total Drying Steam Energy Intensity:

$$\frac{(3.0476 + 6.5817) \times 10^{12} \text{ Btu/yr}}{37.4 \times 10^6 \text{ tons/yr}} = 257{,}467 \text{ Btu}$$

utilities receiving the coal causing an incremental increase in power plant coal consumption under normal generating loads. The effect of the dewatering steam load on the power plants is to increase their fuel requirement by 59 Btu/kWh (ETSI 1980c). Said another way, since the dewatering plant can use heat that would otherwise be wasted by the power plant, the power plant need only consume an additional 1 Btu to provide 2 Btu for dewatering steam. Because all drying steam is supplied by the power plants in the proposed action and market alternative scenarios their required Btu/ton input energy is:

$$(\text{steam Btu/hr})(8760 \text{ hr/yr})(0.98 \text{ availability})(1/37.4 \times 10^6 \text{ tons/yr})(1 \text{ Btu coal}/1 \text{ Btu steam})$$

The pipeline-barge alternative must be calculated in a different manner to account for the steam generated by ETSI at Cypress Bend. Calculating the energy consumption on an annual basis, the Btu consumption for the power plant locations is determined by:

$$(\text{steam Btu/hr})(8760 \text{ hr/yr})(0.98 \text{ availability})(1 \text{ Btu coal}/2 \text{ Btu steam})$$

The energy consumed at Cypress Bend must all be debited and corrected for a boiler efficiency of 0.9 (Holleran 1980). The Btu/yr consumption is calculated by:

$$(\text{steam Btu/yr})(8760 \text{ hr/yr})(0.98 \text{ availability}/0.9 \text{ boiler efficiency})$$

To obtain the Btu-per-ton energy intensity, the annual energy consumptions are added and divided by 37.4 MMTA.

The Btu/ton results of these calculations are shown in Tables E-4, E-5, and E-6.

Boiler Feed Moisture Correction.

The coal delivered by the railroads to the power plants is assumed to have a composite total moisture content of 29.49 percent, while the pipeline coal would be fed to the power plant boilers with a 32.73 percent total moisture content. The higher moisture content of the pipeline coal would cause a reduction in the boiler steam efficiency due to energy losses in vaporizing the unwanted moisture to steam. The difference in energy consumed can be found by using steam tables. If we assume a 72°F entering temperature and a 280°F stack gas exit (Banks 1977, p. 6-4), the change in enthalpy of the water is:

(1173.7 Btu/lb at 280°) - (40.0 Btu/lb 72°) = 1133.7 Btu/lb water

The energy required for moisture correction to maintain constant boiler efficiency then is calculated:

(1133.7 Btu/lb water) (additional lbs water in dewatered coal/ton of as-mined coal) = Btu/ton

Using 1 ton of as-mined coal as a basis, the additional pounds of water in dewatered coal is:

(lbs of water in dewatered coal) - (lbs of water in as-mined coal)

Pounds of water in dewatered coal is calculated as follows:

(1.0 - 0.2949) (2000) = 1410.2 lb bone dry (bd) coal

(1410.2 lb bd coal) + (0.3273) (X total lbs wet coal) = X

$X = \frac{1410.2}{0.6727}$ = 2096.3 total lb wet coal

(0.3273) (2096.3) = 686.1 lb water in dewatered coal

Pounds of water in as-mined coal is:

(0.2949) (2000) = 589.8 lb water in as-mined coal

Additional water in dewatered coal is then:

(686.1 - 589.8) = 96.3 lb additional water

Hence, the boiler feed moisture correction energy consumption becomes:

Boiler efficiency energy correction = (1133.7) (96.3) = 109,175 Btu/ton

Water Treatment At Dewatering Plants

The energy required to provide secondary water treatment for the effluent of the slurry dewatering plants is estimated to be 95,600 kWh per million tons of as-mined coal (Plummer 1980). This is converted to Btu/ton by the formula:

Water treatment energy = (95,600 kWh/10^6 tons)(10,400 Btu/kWh) = 994 Btu/ton

The elements included in water treatment are aeration equipment, sludge pumps, and settling basin mechanisms.

E.3 TRANSPORTATION

Railroad Loading, Unloading, and Unit Trains

A typical unit train consists of several diesel-powered locomotives pulling 100 hopper cars, each having a capacity of 100 net tons, giving a total of 10,000 net tons per unit train. Transportation energy debited to the railroad scenarios begins at the railroad car loading facility and includes the fuel consumed by the unit trains and the energy required to unload the trains upon arrival at the final market destination or barge loading facility.

The major equipment required for loading and unloading of railroad unit trains consists of conveyor belts, coal stockpile stacker/reclaimers, and coal feeders for transferring coal to the loading/unloading conveyor belts. The energy required to load and unload coal is expected to be small in relation to the energy required for transportation. An estimate of 153,000 kWh per month for each two million tons will be used to determine the BTU's required for loading and unloading each ton of coal (Meece Marine Enterprises, Inc. 1979):

$$\underbrace{153{,}000\ \text{kWh/(mo} - 2 \times 10^6\ \text{tons)}}_{\text{loading}} + \underbrace{153{,}000\ \text{kWh/(mo} - 2 \times 10^6\ \text{tons)}}_{\text{unloading}}$$

$$\times\ (10{,}400\ \text{Btu/kWh})\ (12\ \text{mo/yr}) = 19{,}094\ \text{Btu/ton}$$

Leilich et al. (1976, p. 4-28) have estimated the railroad energy intensity for coal transportation to be 366 Btu per net ton-mile. Burlington-Northern's published fuel requirement for coal transportation (Williams 1980) is 387 net ton-miles per gallon. Assuming 145,000 Btu per gallon of diesel fuel yields an energy intensity of:

$$(145{,}000\ \text{Btu/gal})\ 1/387\ \text{net ton-mile/gal} = 375\ \text{Btu/net ton-mile}$$

which is in close agreement with Leilich et al.'s estimate. These figures include allowances for the empty return trip and idling times. For this report, an average energy intensity of 370 Btu/net ton-mile will be used.

Rail transportation energy consumption in units of Btu/ton is calculated as follows, after calculating and summing the net ton-miles (miles x tons):

$$\text{Railroad transportation energy} = \text{total net ton-miles}\ (370\ \text{Btu/net ton-mile})\ \frac{1}{\text{total tonnage}}\ \frac{1}{0.85}$$

The 0.85 factor in the above equation is the conversion efficiency for refining crude oil into diesel fuel (see Table E-3).

Tables E-7 and E-8 show the unit train energy intensities for the no-action all rail and no-action railroad-barge alternatives, respectively.

Railroad Windage Losses

It has been suggested that a unit train can lose 1 percent of its coal on a haul of 1000 miles (Faddick 1979), but this loss has not been substantiated or quantified by any complaints from buyers of railroad-shipped coal (OTA 1978, pp. 116, 117; Rogozen and Margler 1978, p. 22). It is the opinion of others that a coal "windage" loss of less than 1 percent would be undetectable within the accuracy of existing belt scales (Meece 1980).

However, the Office of Technology Assessment has estimated a "rough approximation" of 0.1 percent (OTA 1977, p.88), which seems reasonable. On this basis, the amount of energy consumed through losses is:

$$\frac{0.1}{100}\ (16{,}660{,}103\ \text{Btu/ton of as-mined coal}) = 16{,}660\ \text{Btu/ton}$$

Barge Loading and Transportation

Barge loading and transportation is a component in both the pipeline-barge alternative and no-action (railroad-barge) alternative. In the pipeline-barge alternative 18.3 MMTA of coal would be shipped from a barge loading facility at Cypress Bend. In the railroad-barge alternative 18.3 MMTA of coal would be shipped from a barge loading facility in St. Louis. The barge delivery destinations and one-way mileages from the barge loading facilities are shown in Table E-9.

TABLE E-7

UNIT TRAIN TRANSPORTATION ENERGY
NO-ACTION (ALL RAIL) ALTERNATIVE

Origin	Market	Miles[a]	Tonnage (MMTA)	Net Ton-Miles ($x 10^6$)
N. Rawhide	Pryor	934	3.0	2,802
Black Thunder	Ponca City	999	6.6	6,593
Black Thunder	Muskogee	983	5.0	4,915
Jacobs Ranch	White Bluff	1137	5.0	5,685
N. Antelope	Independence	1260	5.0	6,300
Jacobs Ranch	Boyce	1559	1.8	2,806
Jacobs Ranch	Lake Charles	1474	4.0	5,896
Buckskin	New Roads	1578	2.0	3,156
Antelope	Wilton	1553	5.0	7,765
	TOTAL		37.4	45,918
			Btu/ton	534,434

[a]Fleischauer undated.

Sample Calculation:

N. Rawhide to Pryor, net ton-miles -

(934 miles)(3 MMTA) = $2,802 \times 10^6$ net ton-miles

Railroad Transportation Energy, Total -

($45,918 \times 10^6$ net ton-miles) (370) ($1/37.4 \times 10^6$ tons/yr) (1/0.85) = 534,434 Btu/ton

TABLE E-8

UNIT TRAIN TRANSPORTATION ENERGY
NO-ACTION (RAILROAD-BARGE) ALTERNATIVE

Origin	Market/ Barge Facility	Miles(a)	Tonnage (MMTA)	Net Ton-Miles ($x 10^6$)
N. Rawhide	Pryor	934	5.3	4,950
Jacobs Ranch	Oologah	968	3.5	3,388
Jacobs Ranch	White Bluff	1137	5.0	5,685
N. Antelope	Independence	1260	5.0	6,300
Buckskin	St. Louis(b)	1133	2.0	2,266
N. Rawhide	St. Louis(c)	1133	11.3	12,803
Antelope	St. Louis(d)	1126	5.0	5,630
	TOTAL		37.1	41,022
			Btu/ton	481,311

[a]Rand McNally and Co. 1978; Fleischauer undated; Fleischauer 1980.

[b]Via barge to New Roads.

[c]Via barge to Baton Rouge.

[d]Via barge to Wilton.

TABLE E-9

BARGE DELIVERY MILEAGES

Destination	One-way Miles from Cypress Bend	One-way Miles from St. Louis
New Roads, LA	328	892
Baton Rouge, LA	338	902
Wilton, LA	407	971

Source: American Continental Barge Line Co. undated.

The major energy-consuming items of a barge loading facility and transportation system are:

Conveyors
Stacker/reclaimer
Barge loader
Diesel-powered tugboats (5,600 hp)

Barge loading facilities for pipeline-delivered and railroad-delivered coal are assumed to be similar in design. The estimated energy consumption is 80,000 kWh/mo for each million tons of coal loaded (Meece Marine Enterprises, Inc., 1979). This consumption translates into a Btu/ton energy intensiveness of:

$$\frac{(80{,}000 \text{ kWh/mo} - 10^6 \text{ tons})(18.3 \times 10^6 \text{ tons loaded})(12 \text{ mo/yr})(10{,}400 \text{ Btu/kWh})}{37.1 \times 10^6 \text{ tons/yr}}$$

= 4925 Btu/ton for the no-action (railroad-barge) alternative

and

(4925 Btu/ton) (37.1/37.4) = 4886 Btu/ton for the pipeline-barge alternative

because all figures are initially calculated on a 37.4 MMTA basis and later corrected (see Coal Consumption at Cypress Bend).

However, dewatered coal from the pipeline has more moisture than as-mined coal. The additional 96.3 lb of water per as-mined ton of coal is also loaded and shipped. Hence, this figure must be further corrected by (see Boiler Moisture Feed Correction):

$$\frac{2096.3}{2000} (4886 \text{ Btu/ton}) = 5121 \text{ Btu/ton for the pipeline-barge alternative}$$

A typical barge tow would consist of 20 barges carrying 1500 tons each, yielding a total capacity of 30,000 tons of coal per tow. Thus each delivery site would have the following number of tows per year:

New Roads, LA	2.0 MMTA - 30,000 = 66.67 tows/yr
Baton Rouge, LA	11.3 MMTA - 30,000 = 376.67 tows/yr
Wilton, LA	5.0 MMTA -30,000 = 166.66 tows/yr

Excluding delays incurred at the river locks, tow speed downstream is estimated at 8 mph and upstream, at 6 mph, yielding an average round-trip speed of 7 mph (Meece Marine Enterprises, Inc. 1979).

Leilich et al. (1976, pp. C-28, C-30) have estimated a lock delay of one hour and lock density of 0.0026 lock per mile on the lower Mississippi. Assuming one gallon of diesel fuel per horsepower per day (Meece Marine Enterprises, Inc. 1979) and 145,000 Btu/gallon of diesel fuel, the formula for calculating the annual Btu consumption for each barge transportation segment is:

$$(\text{tows/yr})\ (1 \text{ gal/hp-day})\ (145{,}000 \text{ Btu/gal})\ (5600 \text{ hp})\ (\text{day/24 hr})$$
$$\times\ (2 \times \text{one-way miles})\ \frac{1}{7 \text{ mph}} + (0.0026 \text{ lock/mi})\ (1 \text{ hr/lock})$$
$$= (\text{tows/yr})\ (\text{one-way miles})\ (9{,}842{,}600) \text{ in Btu/yr}$$

This calculation allows for the return trip by virtue of the (2 x one-way miles) factor.

The energy-intensiveness is found by simply dividing the above Btu result by the annual total tonnage of 37.4 MMTA for the pipeline-barge alternative and 37.1 MMTA for the no-action (railroad-barge) alternative. A correction for the increased tons of dewatered coal is made for the pipeline-barge alternative, however. As mentioned for barge loading, this factor of (2096.3/2000) = 1.048 is multiplied by the crude oil figure for the pipeline-barge alternative to get the actual energy consumption.

Table E-10 lists the energy-intensiveness of the barge transportation system for both diesel and unrefined crude oil, using the 0.85 crude oil-to-diesel fuel conversion efficiency.

Although it has been suggested that some coal may be lost during barge handling, the results of an inquiry indicate that these losses are negligible and not detectable within the accuracy of existing belt scales (Meece 1980).

TABLE E-10

ENERGY-INTENSIVENESS OF BARGE TRANSPORTATION (Btu/ton)

	Pipeline-Barge Alternative		No-Action (Railroad-Barge) Alternative	
Destination	Diesel Fuel	Crude Oil[a]	Diesel Fuel	Crude Oil[a]
New Roads, La.	5,754	6,770	15,777	18,561
Baton Rouge, La.	33,505	39,418	90,137	106,044
Wilton, La.	17,851	21,000	42,933	50,509
TOTAL	57,110	67,188	148,847	175,114
		(x 1.048)		
		= 70,413		

[a]Conversion efficiency = 0.85.

Sample Calculation:

Pipeline-Barge Alternative, Cypress Bend to New Roads -

(66.67 tows/yr) (328 one-way miles) (9,842,600) = 2.15×10^{11} Btu/yr

(2.15×10^{11} Btu/yr) (1/37.4×10^{6} tons/yr) = 5754 Btu/ton (diesel fuel)

(5754 Btu/ton) (1/0.85) = 6770 Btu/ton (crude oil)

Pipeline-Barge Alternative, Total Energy Consumption -

(crude oil) 6,770 + 39,418 + 21,000 = 67,188 Btu/ton

(67,188) (1.048 dewatered coal correction) = 70,413 Btu/ton

E.4 WATER SUPPLY ALTERNATIVES

Five different water supply cases were considered:

1. Niobrara well field to Jacobs Ranch and then further distribution from there to North Rawhide and North Antelope.

2. Crook County well field to North Rawhide, then to Jacobs Ranch, and then to North Antelope.

3. Oahe Reservoir to North Rawhide, then to Jacobs Ranch, and then to North Antelope.

4. Water recycle from the Mississippi River following the coal slurry pipeline route to Niobrara, and from there a pipeline system identical to the Niobrara supply case.

5. City of Gillette well field supply tying into one of the other cases. This is for emergency or surplus purposes only.

The overall water supply quantities differ slightly for the various scenarios, but the differences are insignificant. Hence, 20,000 acre-feet per year (ac-ft/yr) was used for the first four water supply cases.

For the first three cases, the following horsepowers were furnished (Weston 1980c):

Niobrara Supply:

Well field - 40 wells, 200 hp each	8,000	hp
Niobrara to Jacobs Ranch	10,200	
Total	18,200	hp

Crook County Supply:

Well field - 20 wells, 180 hp each	3,600	hp
Crook County to North Rawhide	4,600	
Total	8,200	hp

Oahe Reservoir Supply:

Oahe to North Rawhide	19,300	hp

The water distribution horsepowers for the different scenarios were also furnished (Sandhu 1980b):

	Jacobs Ranch to N. Rawhide	Jacobs Ranch to N. Antelope	North Rawhide to Jacobs Ranch
Proposed Action Scenarios	200	450	7000
Market Alternative Scenarios	200	400	4500
Pipeline-Barge Alternative	1200	400	2500

From these and a calculation of the recycle line horsepower, the energy intensities for the alternate water supply cases are determined according to the formula:

(horsepower) (8760 hr/yr) (0.99 availability) (0.746 kWh/hp-hr)
x (10,400 Btu/kWh) 1/37.4 x 10^6 tons/yr = (1.799) (horsepower) in Btu/ton

For summations of horsepowers in the water sections below, the following abbreviations are used:

Jacobs Ranch	= JR
North Rawhide	= NR
North Antelope	= NA
Niobrara	= Nio
Crook County	= CC
Oahe Reservoir	= Oahe
Well Field	= WF
Mississippi River	= Miss R.

Niobrara Well Field and Pipelines

Horsepowers are summed and energy consumptions are calculated as follows:

Proposed action scenarios:

Nio WF and to JR	18,200	hp
JR to NR	200	
JR to NA	450	
Total	18,850	hp

Energy consumption = (1.799) (18,850) = 33,911 Btu/ton

Market alternative scenarios:

Nio WF and to JR	18,200	hp
JR to NR	200	
JR to NA	400	
Total	18,800	hp

Energy consumption = (1.799) (18,800) = 33,821 BTU/ton

Pipeline-barge alternative:

Nio WF and to JR	18,200	hp
JR to NR	1,200	
JR to NA	400	
Total	19,800	hp

Energy consumption = (1.799) (19,800) = 35,620 Btu/ton

Crook County Well Field and Pipelines

Horsepowers and energy consumptions are as follows:

Proposed action scenarios:

CC WF and to NR	8,200	hp
NR to JR	7,000	
JR to NA	450	
Total	15,650	hp

Energy consumption = (1.799) (15,650) = 28,154 Btu/ton

Market alternative scenarios:

CC WF and to NR	8,200	hp
NR to JR	4,500	
JR to NA	400	
Total	13,100	hp

Energy consumption = (1.799) (13,100) = 23,567 Btu/ton

Pipeline-barge alternative:

CC WF and to NR	8,200	hp
NR to JR	2,500	
JR to NA	400	
Total	11,100	hp

Energy consumption = (1.799) (11,100) = 19,969 Btu/ton

Oahe Reservoir Pipelines

The Oahe Reservoir pipeline would originate at Oahe Reservoir in South Dakota and extend to the North Rawhide preparation plant. In addition to supplying the ETSI slurry pipeline with 20,000 ac-ft/yr of water, the Oahe pipeline would also deliver 10,000 ac-ft/yr of water to the residents of the state of South Dakota.

Proposed action scenarios:

Oahe to NR (debited to ETSI)	19,300	hp
NR to JR	7,000	
JR to NA	400	
Total	26,750	hp

Energy consumption = (1.799) (26,750) = 48,123 Btu/ton

Market alternative scenarios:

Oahe to NR	19,300	hp
NR to JR	4,500	
JR to NA	400	
Total	24,200	hp

Energy consumption = (1.799) (24,200) = 43,536 Btu/ton.

Pipeline-barge alternative:

Oahe to NR	19,300	hp
NR to JR	2,500	
JR to NA	400	
Total	22,200	hp

Energy consumption = (1.799) (22,200) = 39,938 Btu/ton

Water Recycle Pipeline

Because the hydraulic horsepower requirement was not furnished by ETSI for the segment from the Mississippi River to Niobrara, it was calculated on the following basis:

Elevation = 4200 feet at Niobrara - 200 feet at Miss R. = 4000 feet
Pipeline length = 1120 miles
Pipe sizing velocity = 6 feet per second
Pipe diameter = 28 inches
Pumping efficiency = 0.70
Friction loss per 100 feet = 0.350 (Cameron Hydraulic Data 1977, p. 328)

$$\text{Brake hp} = \frac{(\text{ac-ft/yr})\ (0.62\ \text{gpm/ac-ft/yr})\ (\text{elevation} + \text{friction head})}{(3960\ \text{gallon-ft/hp-min})\ (0.70)}$$

$$= \frac{(20{,}000)\ (0.62)\ 4000 + \frac{0.350}{100}\ (1120)\ (5280)}{(3960)\ (0.70)} = 110{,}480\ \text{hp}$$

Then the horsepower for pumping from Niobrara to Jacobs Ranch is added:

Miss R. to Nio	110,480	hp
Nio to JR	10,200	
Total	120,680	hp

For the different scenarios the horsepowers and energy consumptions become:

Proposed action scenarios:

Miss R. to JR	120,680	hp
JR to NR	200	
JR to NA	450	
Total	121,330	hp

Energy consumption = (1.799) (121,330) = 218,273 Btu/ton

Market alternative scenarios:

Miss R. to JR	120,680	hp
JR to NR	200	
JR to NA	400	
Total	121,280	hp

Energy consumption = (1.799) (121,280) = 218,183 Btu/ton

Pipeline-barge alternative:

Miss R. to JR	120,680	hp
JR to NR	1,200	
JR to NA	400	
Total	122,280	hp

Energy consumption = (1.799) (122,280) = 219,982 Btu/ton

Gillette Water Supply and Pipelines

The city of Gillette could furnish up to 11,200 ac-ft/yr of emergency or surplus water to ETSI. The water supply system would consist of 14 wells and would tie into the Niobrara (and hence recycle), Oahe, or Crook County water distribution pipelines.

Because the demand for Gillette water would be irregular and because water would normally be supplied to ETSI from other sources, the energy contribution of the Gillette water supply system is excluded from the analysis.

E.5 COAL CONSUMPTION AT CYPRESS BEND

The pipeline-barge alternative delivers 18.6 MMTA of coal to Cypress Bend, of which 0.3 MMTA is consumed directly in the dewatering plant. Because this 0.3 MMTA is consumed entirely within the pipeline system, it must be charged as a debit to the pipeline energy budget. All energy intensities were calculated on a basis of 37.4 MMTA of delivered coal for the pipeline-barge alternative, except the boiler feed moisture correction consumption. Therefore, they must be corrected by a factor of (37.4/37.1) = 1.008 to give the proper Btu/ton energy intensity figure for relating to 37.1 MMTA of delivered, as-mined specification coal. The boiler feed moisture correction consumption is on a Btu/ton-of-delivered-coal basis, so this component is not corrected.

E.6 REFERENCES

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TABLE F-1

SITES INCLUDED IN THE NATIONAL REGISTER OF HISTORIC PLACES: PROPOSED ACTION

Name of Site (Site Number)	County, State	Distance/Direction from Proposed Action
Wagenson Stone Circle Site (48CA89)	Campbell Co., Wyoming	2 mi NW of Rawhide Preparation Plant
Site of Ferdinand Branstetter Post No. 1, American Legion (PH0069787)	Niobrara Co., Wyoming	2.5 mi NE of PMB-97
Agate Fossil Beds NM	Sioux Co., Nebraska	3 mi N of PMB-122
Harold J. Cook Homestead Cabin (Bone Cabin)	Sioux Co., Nebraska	3.0 mi NE of PMB-123
Ash Hollow Historic District	Garden Co., Nebraska	1-5 mi NE of PMB-246
Ash Hollow Cave NHL	Garden Co., Nebraska	4 mi NE of PMB-244
California Hill (PH0039314)	Keith Co., Nebraska	4 mi SW of PMB-258
Leonidas A. Brandhoefer Mansion (PH0039306)	Keith Co., Nebraska	5.0 mi E of PMB-265
Diamond Springs Stage Station Site (PH0039322)	Keith Co., Nebraska	4 mi W of PMB-267
Lovitt Site (25CH1)	Chase Co., Nebraska	0.5 mi N of PMB-315
Senator George William Norris House NHL (PH0103691)	Red Willow Co., Nebraska	4.0 mi NE of PMB-363
H.P. Stutton House (Wright House)	Red Willow Co., Nebraska	4.0 mi NE of PMB-363
Walter P. Chrysler House (PH0088013)	Ellis Co., Kansas	2.0 mi E of P-471
Pawnee Rock (PH0066966)	Barton Co., Kansas	3.5 mi SW of P-529
Salter House (PH0055751)	Sumner Co., Kansas	4.0 mi NE of P-630

TABLE F-1 Continued

Name of Site (Site Number)	County, State	Distance/Direction from Proposed Action
Electric Park Pavilion	Kay Co., Oklahoma	4.0 mi NE of P-672
Nez Perce Reservation	Kay Co., Oklahoma	0.5 mi NE of P-680.5
101 Ranch NHL	Kay Co., Oklahoma	3.0 mi NE of P-688
Hominy Osage Round House (0790001801)	Osage Co., Oklahoma	2.0 mi S of P-738
Will Rogers Birthplace (PH0079278)	Rogers Co., Oklahoma	4.0 mi NE of PMB-778
Union Mission Site (PH0100072)	Mayes Co., Oklahoma	2.0 mi E of P-814
Fort Gibson NHL (PH0140660)	Muskogee Co., Oklahoma	1.5 mi. E of P-838
Seawell-Ross-Isom House	Muskogee Co., Oklahoma	1.5 mi E of P-838
Fort Davis (PH0079111)	Muskogee Co., Oklahoma	2.0 mi W of P-838
Cherokee National Cemetery	Muskogee Co., Oklahoma	4.0 mi E of P-838.5
Grant Foreman House (PH0079103)	Muskogee Co., Oklahoma	2.0 mi W of P-839
Dwight Mission (PH0079308)	Sequoyah Co., Oklahoma	3.5 mi N of P-881
Sequoyah's Cabin NHL	Sequoyah Co., Oklahoma	1.0 mi N of P-892
Lee Creek NR District: 38 sites; 1 site, Parris Mound, is in NRHP	Sequoyah Co., Oklahoma	4 mi N of P-900
Dr. Charles Fox Brown House	Crawford Co., Arkansas	4.0 mi S of P-910
Bryan House	Crawford Co., Arkansas	4.0 mi S of P-910

TABLE F-1 Continued

Name of Site (Site Number)	County, State	Distance/Direction from Proposed Action
Bob Burns House	Crawford Co., Arkansas	4.0 mi S of P-910
Drennen-Scott House	Crawford Co., Arkansas	4.0 mi S of P-910
Joseph Starr Dunham House	Crawford Co., Arkansas	4.0 mi S of P-910
Henry Clay Mills House	Crawford Co., Arkansas	4.0 mi S of P-910
Mount Olive United Methodist Church	Crawford Co., Arkansas	4.0 mi S of P-910
Van Buren Historic District	Crawford Co., Arkansas	4.0 mi S of P-910
Wilhauf House (PH0075876)	Crawford Co., Arkansas	4.0 mi S of P-910
The Cabins (Deane Summer House)	Franklin Co., Arkansas	4.0 mi S of PMB-940
Capt. Archibald S. McKennon House	Johnson Co., Arkansas	0.5 mi S of PMB-963
Cleburne County Courthouse	Cleburne Co., Arkansas	0-1 mi N of (l) 53-54
Dearing House	Independence Co., Arkansas	3 mi NW of (l) 93
Aycock House	Conway Co., Arkansas	4.0 mi E of PMB-1011
Conway County Library	Conway Co., Arkansas	4.0 mi E of PMB-1011
Cox House (Col. H.W. Burrow House) (PH0075833)	Conway Co., Arkansas	4.0 mi E of PMB-1011
Moose House (PH0075841)	Conway Co., Arkansas	4.0 mi E of PMB-1011
Morrilton Railroad Station	Conway Co., Arkansas	4.0 mi E of PMB-1011
Morrilton Male and Female College (079004007)	Conway Co., Arkansas	4.0 mi E of PMB-1011
Ten Mile House (Stagecoach House)	Pulaski Co., Arkansas	2.0 mi NE of PMB-1057
Harris House	Pulaski Co., Arkansas	2.0 mi NE of PMB-1074
Dollarway Road (PH0069809)	Jefferson Co., Arkansas	1 mi SW of PMB-1077

TABLE F-1 Continued

Name of Site (Site Number)	County, State	Distance/Direction from Proposed Action
Plum Bayou Homesteads (Wright Plantation)	Jefferson Co., Arkansas	4.5 mi ENE of PMB-1077.6
Dilley House	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Dubocage (PH0076031)	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Ferguson House	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Hudson-Grace-Borreson House (PH0076040)	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
R.M. Knox House	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
MacMillan-Dilley House	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Masonic Temple	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Merchants and Planters Bank Building	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Roth-Rosenzweig House	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Trinity Episcopal Church (PH0076058)	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Trulock-Gould-Millis House	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Union Station	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Yauch-Ragar House	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Boone-Murphy House (00790006613)	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Hotel Pines (00790004010)	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Trulock-Cook House (0790000506)	Jefferson Co., Arkansas	4.0-8.0 mi E of PM-1092
Cleveland County Clerk's Building	Cleveland Co., Arkansas	3.0 mi W of PM-1111
Cleveland County Courthouse	Cleveland Co., Arkansas	3.0 mi W of PM-1111
Mount Olivet Methodist Church	Cleveland Co., Arkansas	3.0 mi W of PM-1111
Adams-Leslie House	Bradley Co., Arkansas	E of PM-1138

TABLE F-1 Continued

Name of Site (Site Number)	County/Parish, State	Distance/Direction from Proposed Action
Bailey House	Bradley Co., Arkansas	1.0 mi E of PM-1136
Bradley County Courthouse and Clerk's Office	Bradley Co., Arkansas	1.0 mi E of PM-1136
Warren and Ouachita Valley Railway Station	Bradley Co., Arkansas	1.0 mi E of PM-1136
16OU35 and 16OU36 (part of Filhiol Mound NR Complex)	Ouachita Parish	PM-1228
Boscobel Cottage	Ouachita Parish, Louisiana	1.5 mi W of PM-1230.5
Kent Plantation	Rapides Parish, Louisiana	W of PM-1300-1315
Rosalie Plantation Sugar Mill	Rapides Parish, Louisiana	1 mi E of PM-1313
Bayouside	Rapides Parish, Louisiana	Vicinity of PM(B)-15
Loyd Hall Plantation	Rapides Parish, Louisiana	3 mi SW of PM(NW)-10
Bennett Plantation House and Store	Rapides Parish, Louisiana	1.5 mi SW of PM(NW)-17
Bailey Theatre	Avoyelles Parish, Louisiana	1.5 mi SW of PM(NW)-21.5
Bonnie Glen	Pointe Coupee Parish, Louisiana	5.0 mi S of PM(NW)-69
LeJeune House,	Pointe Coupee Parish, Louisiana	1.5 mi S of PM(NW)-72
St. Francis Chapel (0790002083)	Pointe Coupee Parish, Louisiana	1.0 mi S of PM(NW)-72
St. Francisville Historic District	West Feliciana Parish, Louisiana	3.5 mi N of PM(NW)-75.6
Grace Espicopal Church	West Feliciana Parish, Louisiana	3.5 mi N of PM(NW)-75.6
Propinquity	West Feliciana Parish, Louisiana	3.5 mi N of PM(NW)-75.6
Bayou Plaquemine Lock (PH0047899)	Iberville Parish, Louisiana	2.0 mi E of PM(NW)-106.6

TABLE F-1 Concluded

Name of Site (Site Number)	Parish, State	Distance/Direction from Proposed Action
St. Louis Plantation	Iberville Parish, Louisiana	3.0 mi E of PM(NW)-108
Nottaway Plantation	Iberville Parish, Louisiana	E of PM(NW)-117
Tally-Ho Plantation	Iberville Parish, Louisiana	2 mi NE OF PM(NW)-117
Hermitage	Ascension Parish, Louisiana	3.0 mi N of PM(NW)-133.6
Palo Alto Plantation	Ascension Parish, Louisiana	1.0 mi N of PM(NW)-131.6
Belmont Site (16SJ1)	Saint James Parish	4 mi ESE of Wilton Dewatering Plant

NHL = National Historic Landmark.

TABLE F-2

SITES INCLUDED IN THE NATIONAL REGISTER OF HISTORIC PLACES: MARKET-BARGE ALTERNATIVE

Name of Site (Site Number)	County/Parish, State	Distance/Direction from Market Alternative (MB Segment)
Tobias-Thompson Complex NHL	Rice Co., Kansas	1-3 mi SW of MB-175 to 178
Bernhard Warkentin Homestead (PH0088226)	Harvey Co., Kansas	2.0 mi SW of MB-2274
C.N. James Cabin (PH0066982)	Butler Co., Kansas	3.0 mi NE of MB-261
Nellie Johnstone No. 1 (PH0079359)	Washington Co., Oklahoma	3.5 mi NE of MB-350
Frank Phillips House	Washington Co., Oklahoma	3.0 mi NE of MB-350
Price Tower (PH0079367)	Washington Co., Oklahoma	2.0 mi NE of MB-350
Union Mission Site (PH0100072)	Mayes Co., Oklahoma	3.5 mi SW of MB-410
Cherokee Female Seminary (PH0039624)	Cherokee Co., Oklahoma	2.0 mi W of MB-436
Cherokee National Capitol NHL	Cherokee Co., Oklahoma	2.0 mi W of MB-436
Cherokee National Jail	Cherokee Co., Oklahoma	2.0 mi W of MB-436
Cherokee Supreme Court (PH0039659)	Cherokee Co., Oklahoma	2.0 mi W of MB-436
Indian University of Tahlequah	Cherokee Co., Oklahoma	2.0 mi W of MB-436
Dr. Irwin D. Loeser Log Cabin	Cherokee Co., Oklahoma	2.0 mi W of MB-436
First Cherokee Female Seminary Site (PH0039667)	Cherokee Co., Oklahoma	2.0 mi SW of MB-438
Murrell Home (Hunter's Home) NHL (PH0039675)	Cherokee Co., Oklahoma	4.0 mi SW of MB-439
Lee Creek NR District: 38 sites; 1 site, Parris Mound, is in NRHP	Sequoyah Co., Oklahoma	MB-850
Baton Rouge Water Works Company Standpipe (PH0047732)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Beauregard Town Historic District	East Baton Rouge Parish, Louisiana	Vicinity of M-24

TABLE F-2 (Concluded)

Name of Site (Site Number)	County/Parish, State	Distance/Direction from Market Alternative (MB Segment)
Florence Coffee House	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Louisiana State Capitol Building and Grounds	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Magnolia Mound Plantation (PH0047741)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Old Arsenal Museum (Powder Magazine) (PH0047783)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Old Louisiana Governor's Mansion	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Old Louisiana State Capitol NHL (PH0047759)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Pentagon Barracks (PH0047767)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Potts House (PH0047775)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Reiley-Reeves House (0790002081)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
St. James Episcopal Church	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Spanish Town (0780050357)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Stewart-Dougherty House (PH0047791)	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Tessier Buildings	East Baton Rouge Parish, Louisiana	Vicinity of M-24
Warden's House-Old Louisiana State Penitentiary (PH0047805)	East Baton Rouge Parish, Louisiana	Vicinity of M-24

NHL = Historic Landmark

TABLE F-3

SITES INCLUDED IN THE NATIONAL REGISTER OF HISTORIC PLACES: PIPELINE-BARGE ALTERNATIVE

Name of Site (Site Number)	County, State	Distance/Direction from Barge Alternative (B)
Dollarway Road (PH0069809)	Jefferson Co., Arkansas	2.0 mi W of B-0
Dilley House	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Dubocage (PH0076031)	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Ferguson House	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Hudson-Grace-Borreson House (PH0076040)	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
R.M. Knox House	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
MacMillan-Dilley House	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Masonic Temple	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Merchants and Planters Bank Building	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Roth-Rosenzweig House	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Trinity Episcopal Church (PH0076058)	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Trulock-Gould-Millis House	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Union Station	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Yauch-Ragar House	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Boone-Murphy House (00790006613)	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Hotel Pines (00790004010)	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Trulock-Cook House (0790000506)	Jefferson Co., Arkansas	2.0-6.0 mi NE of B-20
Rohwer Relocation Center (Nisei Camp) (PH0075892)	Desha Co., Arkansas	2.0 mi NE of B-75

TABLE F-4

SITES INCLUDED IN THE NATIONAL REGISTER OF HISTORIC PLACES: COLORADO ALTERNATIVE

Name of Site (Site Number)	County, State	Distance/Direction from Colorado Alternative (C)
Fort Laramie National Historic Site (PH0069329)	Goshen Co., Wyoming	0.5 mi E of C-114.5
Fort Laramie Three-Mile Hog Ranch	Goshen Co., Wyoming	2 mi W of C-115
Tobias-Thompson Complex NHL	Rice Co., Kansas	0.0 mi at C-597 to 599

NHL = National Historic Landmark

TABLE F-5

SITES INCLUDED IN THE NATIONAL REGISTER OF HISTORIC PLACES: CROOK COUNTY WATER SUPPLY SYSTEM

Name of Site (Site Number)	County, State	Distance/Direction
Bush/Bunger Site (48CK69)	Crook Co., Wyoming	4 mi N of Well Field

TABLE F-5

SITES INCLUDED IN THE NATIONAL REGISTER OF HISTORIC PLACES: OAHE ALTERNATIVE

Name of Site (Site Number)	County, State	Distance/Direction from Oahe Alternative Water System (O)
La Verendrye Site (PH0092550)	Stanley Co., South Dakota	5 mi SSE of O-1
Old Fort Pierre School	Stanley Co., South Dakota	5 mi SSE of O-1
Stockgrowers Bank Building	Stanley Co., South Dakota	5 mi SSE of O-1
Gaylord Sumner House	Stanley Co., South Dakota	5 mi SSE of O-1
United Church of Christ, Congregational	Stanley Co., South Dakota	5 mi SSE of O-1
Fort Pierre Chouteau Site	Stanley Co., South Dakota	4 mi SSE of O-1
Bear Butte (39MD33)	Meade Co., South Dakota	Adjacent to and N of O-156
Fort Meade District (PH0092461)	Meade Co., South Dakota	2-5 mi SW of O-162
Sturgis Commercial Block	Meade Co., South Dakota	5 mi SW of O-163
Annie Tallent House	Meade Co., South Dakota	5 mi SW of O-163
Poker Alice Tubbs House	Meade Co., South Dakota	5 mi SW of O-163
John G. Wenke House	Meade Co., South Dakota	5 mi SW of O-163
Bear Butte (PH0092452)	Meade Co., South Dakota	0.0 mi at O-163-166
Frawley Historic Ranch NHL (PH0092436)	Lawrence Co., South Dakota	3-5 mi SSW of O-175
Episcopal Church of All Angels	Lawrence Co., South Dakota	3 mi S of O-186
Halloran-Matthews-Brady House	Lawrence Co., South Dakota	3 mi S of O-186
William Ernest Lown House	Lawrence Co., South Dakota	3 mi S of O-186
Spearfish Historic Commercial District	Lawrence Co., South Dakota	3 mi S of O-186
Vore Buffalo Jump (48CK302)	Crook Co., Wyoming	At O-201

NHL = National Historic Landmark.

Appendix G

AIR QUALITY

Appendix G-1

EMISSION FACTORS

Emission factors used to estimate emissions from construction and operation of the various project components are discussed below. In all cases, conservative assumptions were made so that resulting estimates are an overestimate of what would actually occur.

For construction areas, an emission factor of 1.2 tons per acre per month has been published (EPA 1978a). This factor was developed from data collected in the vicinity of construction sites in a semiarid climate, with soils of moderate silt content, and assuming medium levels of construction activity. The climatic conditions, soil composition, and construction activity levels along the proposed pipeline path are expected to be conservatively approximated by conditions used in establishing this emission factor.

Construction activities related to pipeline digging and burial operations would be a major source of pollutant emissions during construction. At the present time there are no emission factors specifically applicable to pipeline digging and burial operations. An estimate of the amount of fugitive dust that might be generated can be obtained by using emission factors derived for storage pile operations. Both operations—storage pile maintenance and pipeline digging and burial—generate dust from the initial disturbance of material when a pile of earth is formed, from wind erosion of the exposed site, and from the final disturbance during backfilling operations.

Storage pile operation factors have been published by Cowherd et al. (1974). These factors are as follows:

Activity	Correction Parameter	Emission Factor (lb/ton)
Loading onto piles	PE index[a]	0.04
Vehicle traffic	Rainfall frequency	0.13
Loadout from piles	PE index[a]	0.05

[a]Thornwaite's precipitation-evaporation index (from Cowherd et al. 1974).

Cowherd et al. also present a factor for wind erosion; however, a different factor was chosen for use here and is discussed later. The factors for loading and unloading from piles were accordingly modified by Thornwaite's precipitation-evaporation (PE) index, using the following expression:

$$E_{loading + unloading} = \frac{0.05 + 0.04}{(PE/100)^2}$$

The average PE index along the proposed pipeline route is about 85. Thus $E_{loading + unloading}$ = 0.12 pound of dust per ton of soil cycled, and adding in the 0.13 lb/ton cycled for vehicle travel (rainfall frequency was not considered, to be conservative) yields a total factor for pipeline digging and burial of 0.25 lb/ton cycled.

Wind erosion from actively exposed areas such as construction sites and pipeline rights-of-way is a function of many environmental conditions. PEDCO (1976) presents the following expression:

$$Ew = AICKL'V'$$

where

Ew = suspended particulate emissions (tons/acre/year)

A = portion of total wind erosion losses that would be measured as suspended particulate = 0.025 (assumed)

I = soil erodibility (an average value of 86 was used)

C = climatic factor (an average value of 0.5 was used)

K = surface roughness factor = 1.0 (maximum value assumed)

L' = unsheltered field width factor = 0.7 (assumed, based on PEDCO report)

V' = vegetative cover factor = 1.0 (maximum value assumed)

Using the above values, Ew = 0.75 ton/acre/year.

Various emission factors for emissions from construction equipment, locomotive engine operation, and tugboat engine operation were taken from the EPA publication AP-42 (1978a) and from an Office of Technology Assessment (1977) report. These factors will be identified when they are used.

Appendix G-2

FUGITIVE DUST EMISSIONS FROM CONSTRUCTION OF THE COAL PREPARATION PLANTS

The proposed action calls for three coal slurry preparation plants to be located in Wyoming. Each plant would occupy a site which would be a maximum of 45 acres in size. Emissions have been estimated by applying the previously derived emission factor for construction activity of 1.2 tons of dust per acre per month of construction. Although the plants would be constructed in phases over a period of years, a period of one year was assumed for initial construction. Thus fugitive dust emissions from construction would be:

1.2 tons/acre/month x 45 acres x 12 months x 0.5[a]
= 324 tons of dust (uncontrolled)

Emissions would be less for construction of the other plant sites.

Emissions of gaseous pollutants from construction equipment would depend on the size and makeup of the construction fleet. However, these emissions should be similar to those calculated for construction of the slurry pipeline system (see Appendix G-5).

[a]Assumed that one-half of the total area would be actively worked at any one time.

Appendix G-3

DISPERSION MODELING OF THE PROPOSED JACOBS RANCH COAL PREPARATION PLANT

Because the Jacobs Ranch plant would be more than twice as large as any other plant, impacts from its operation were estimated using dispersion models developed by the U.S. Environmental Protection Agency. Impacts from operation of the other two plants would be less than those from the Jacobs Ranch plant. The Jacobs Ranch plant would have 22 emission points; 21 of these points would emit only particulates, and point 22, which represents the boiler stack, would emit both particulates and gaseous pollutants. Particulate emissions would be controlled by wet Venturi scrubbers, and sulfur dioxide would be controlled by adding limestone to the coal to be burned. Controlled pollutant emission data have been provided by ETSI (1980), along with stack parameters for each emission point. A detailed description of methods used to estimate these emissions is presented in ETSI's March 1980 revision to the Prevention of Significant Deterioration permit application for the coal preparation plants (ETSI 1979).

The emission points were modeled with a modified version of the EPA VALLEY model in order to estimate the impact of coal preparation plant operation on ambient air quality. The VALLEY model algorithms are discussed by Burt (1977).

The coal preparation plants would be located in areas of gently rolling terrain at elevations of 4300 to 4700 feet above mean sea level. Thus the model was run in the rural, flat-terrain mode. The required joint frequency distribution of wind speed, wind direction, and stability was taken from data gathered at a meteorological monitoring station located about 9 miles south-southwest of the Jacobs Ranch plant. Terrain features at the monitoring site and the plant site are fairly similar, and the joint frequency distribution should be representative of the plant site. The joint frequency distribution, based on a full year of data, is presented in ETSI's permit application (ETSI 1979).

Emissions from sources 1 through 21 are nonbuoyant plumes. To account for the effluents' initial upward momentum, jet plume rise was estimated with the following formula (Briggs 1969):

$$W = 3D\,(w/u)$$

where

- W = jet plume rise (meters)
- D = internal diameter of the stack (meters)
- w = effluent velocity (meters per second)
- u = average wind speed (meters per second)

Plume rise for emission point 22 was calculated by the model using the Briggs buoyant plume rise method.

The VALLEY model was also run in the short-term (24-hour) mode with maximum short-term emission rates for input. In the short-term mode, VALLEY assumes that a given wind speed, wind direction, and stability scenario persist for 6 hours out of a 24-hour period. Worst-case scenarios were identified with the EPA PTMAX model (Turner and Busse 1973). PTMAX results indicated that the maximum short-term concentrations would be produced by Class A stability and a wind speed of 2.5 meters per second and by Class B stability and a wind speed of 3.0 meters per second. These conditions were then input to the VALLEY model. The results are shown in Table G-1.

TABLE G-1

EXISTING AND PREDICTED AIR QUALITY VALUES ($\mu g/m^3$)

	TSP	SO_2	NO_2
Annual			
Existing	20	6	26
Predicted Maximum Increase			
Within plant boundary	36	6	3
Beyond plant boundary	21	6	3
Predicted Annual Average	41	12	29
Federal Average Standard	60	80	100
Wyoming Average Standard	60	60	100
24-Hour			
Existing	20	28	a
Predicted Maximum	65	39	a
Federal Standard	150	365	a
Wyoming Standard	150	260	a

TSP = total suspended particulates

SO_2 = sulfur dioxide

NO_2 = nitrogen dioxide

[a] No standards established for this category.

EMISSIONS FROM CONSTRUCTION OF PROPOSED WATER SUPPLY SYSTEM

The proposed water supply system would consist of a maximum of 45 wells, gathering lines, and 68 miles of 26-inch-diameter main water pipeline. The system would also require construction of some new access roads. Emissions were estimated by applying the emission factors discussed in Appendix G-1 to construction data.

ACCESS ROADS

Construction

1.2 tons/acre/month x 72 feet[a] x 15,840 feet[b] x (1 acre/43,560 feet^2) x (1 month/30 days) x (0.5 active area/total area)[c]

= 0.52 ton per active construction day

Wind Erosion

(0.75 ton/acre/year) x 15,840 feet x 72 feet x (1 acre/43,560 feet^2) x (0.5 active area/total area) x (1 year/365 days)

= 0.027 ton per active day

Total emissions would depend on the amount of construction time.

---

[a] Assumed width of 72 feet.

[b] Assumed that 3 miles of road would be actively worked at any one time

[c] Assumed that half of the total area would be actively worked at any one time

WATER GATHERING LINES

Construction

(1.2 tons/acre/month) x 50-foot right-of-way x 15840 feet[a] x (1 acre/43,560 feet^2) x (1 month/30 days) x (0.5 active area/total area)[b] x (62 days construction time)[c] = 22.5 tons of dust (uncontrolled)

Pipeline Digging and Burial

(0.25 lb of dust/ton of soil cycled) x (100 lb soil/ft^3)[d] x (3 feet)[e] x (4 feet)[f] x (5280 feet/day)[c] x (1 ton soil/2000 lb soil) x 62 days x (1 ton dust/2000 lb dust) = 24.5 tons of dust (uncontrolled)

Wind Erosion

(0.75 ton/acre/year) x 15,840 feet x 50-foot right-of-way x (1 acre/43,560 feet^2) x (0.5 active area/total area) x (1 year/365 days) x 62 days

= 1.2 tons of dust (uncontrolled) = 0.019 ton/day =

MAIN WATER PIPELINE

Emissions for the main water pipeline were computed using the same techniques as for the gathering lines, except for the following changes: (1) the ditch was assumed to be 4 feet wide and 5 feet deep; and (2) the construction time would be 70 days (a rate of one mile per day).

These methods yield the following uncontrolled emissions:

Construction:	25.2 tons
Pipeline digging and burial:	46.2 tons
Wind erosion:	6.8 tons/year

[a]Assumed 3 miles of pipeline would be actively worked at any one time.

[b]Assumed that one-half of the total area would be actively worked at any one time.

[c]Assumed construction rate of one mile per day.

[d]Assumed soil density.

[e]Assumed ditch width.

[f]Assumed ditch depth.

WELL FACILITIES

Construction

(1.2 tons/acre/month) x (2 acres/well)[a] x 45 wells

= 108.0 tons of dust per construction month (uncontrolled)

Wind Erosion

(0.75 ton/acre/year) x (2 acres/well) x 45 wells = 67.5 tons (uncontrolled)

Gaseous air pollutants would be emitted by construction equipment and vehicles during construction of the water supply system. These emissions would depend on the size and composition of the construction fleet. Although exact quantification of emissions is not possible, emissions would be expected to be similar to those for main slurry pipeline construction, which are presented in Appendix G-5.

[a]Assumed that each well facility would occupy 2 acres during construction.

Appendix G-5

EMISSIONS FROM CONSTRUCTION OF PROPOSED SLURRY PIPELINE SYSTEM

The proposed slurry pipeline system would consist of 55 miles of 24-inch-diameter gathering line, 16 miles of 16-inch-diameter gathering line, and 1664 miles of main slurry pipeline having a diameter as large as 46 inches. Emissions were estimated by applying the emission factors discussed in Appendix G-1 to construction data.

I. 24-INCH GATHERING LINES

Construction

(1.2 tons/acre/month) x 100-foot right-of-way x 15,840 feet[a] x (1 acre/43,560 $feet^2$) x (1 month/30 days) x (0.5 active area/total area)[b] x 55 days[c]

= 40.0 tons of dust (uncontrolled)

Pipeline Digging and Burial

(0.25 lb of dust/ton of soil cycled) x (100 lb $soil/ft^3$)[d] x 4 feet[e] x 5 feet[f] x (5280 feet/day)[c] x 55 days x (1 ton soil/2000 lb soil) x (1 ton dust/2000 lb dust)

= 36.3 tons of dust (uncontrolled)

---

[a] Assumed 3 miles of pipeline would be actively worked at any one time.

[b] Assumed that one-half of the total area would be actively worked at any one time.

[c] Assumed construction rate of 1 mile per day.

[d] Assumed soil density.

[e] Assumed ditch width.

[f] Assumed ditch depth.

Wind Erosion

0.75 ton/acre/year x 15,840 feet[a] x 100-foot right-of-way x (1 acre/43,560 ft^2) x (0.5 active area/total area)[b] x (1 year/365 days) x 55 days

= 2.1 tons of dust (uncontrolled)

II. 16-INCH GATHERING LINE

Construction

(1.2 tons/acre/month) x 100-foot right-of-way x 15,840 feet[a] x (1 acre/43,560 $feet^2$) x (1 month/30 days) x (0.5 active area/total area)[b] x 16 days[c]

= 11.6 tons of dust (uncontrolled)

Pipeline Digging and Burial

(0.25 lb of dust/ton of soil cycled) x (100 lb $soil/ft^3$)[d] x 3 feet[e] x 4 feet[f] x (5280 feet/day)[c] x 16 days x (1 ton soil/2000 lb soil) x (1 ton dust/2000 lb dust)

= 6.3 tons of dust (uncontrolled)

Wind Erosion

0.75 ton/acre/year x 15,840 feet x 100-foot right-of-way x (1 acre/43,560 $feet^2$) x (0.5 active area/total area) x (1 year/365 days) x 16 days

= 0.6 ton of dust (uncontrolled)

---

[a] Assumed that 3 miles of pipeline would be actively worked at any one time.

[b] Assumed that one-half of the total area would be actively worked at any one time.

[c] Assumed construction rate of 1 mile per day.

[d] Assumed soil density.

[e] Assumed ditch width.

[f] Assumed ditch depth.

III. MAIN SLURRY PIPELINE

Construction

(1.2 tons/acre/month) x 100-foot right-of-way x 15,840 feet[a] x (1 acre/ 43,560 $feet^2$) x (1 month/30 days) x (0.5 active area/total area)[b] x 1664 days[c]

= 1210.2 tons of dust (uncontrolled)

Pipeline Digging and Burial

(0.25 lb of dust/ton of soil cycled) x (100 lb soil/ft^3)[d] x 5 feet[e] x 6 feet[f] x (5280 feet/day)[c] x (1 ton soil/2000 lb soil) x (1 ton dust/2000 lb dust) x 1664 days[c]

= 1674.4 tons of dust (uncontrolled)

Wind Erosion

(0.75 ton/acre/year) x 15,840 feet[a] x 100-foot right-of-way x (1 acre/ 43,560 $feet^2$) x (0.5 active area/total area) x (1 year/365 days) x 1664 days

= 62.2 tons of dust (uncontrolled)

IV. PUMP STATIONS

Construction of the 30 pump stations would disturb about 600 acres.

Construction

(1.2 tons/acre/month) x (20 acres/station) x (0.5 active area/total area)[a]

= 12 tons per station per month of construction

Thus emissions would depend on the amount of construction time.

---

[a] Assumed a 3-mile stretch of pipeline route would be worked at any one time by a given construction spread.

[b] Assumed that one-half of the total area would be actively worked at any one time.

[c] Assumed construction rate of 1 mile per day.

[d] Assumed soil density.

[e] Assumed ditch width.

[f] Assumed ditch depth.

Wind Erosion

0.75 ton/acre/year x 20 acres/station x 1 year/365 days x (0.5 active area/total area)[a]

= 0.02 ton per pump station per construction day

Thus emissions would depend on the amount of construction.

V. GASEOUS EMISSIONS FROM CONSTRUCTION

Air pollutant emission factors for heavy-duty construction equipment were obtained from the EPA publication AP-42 (EPA 1978a), Table 3.2.7-1. These emission factors (in pounds of pollutant per hour of equipment operation) are presented for various types of equipment. These factors and a breakdown of ETSI's construction fleet by equipment type for a typical spread are presented below:

Equipment Type	Number of Units	Emission Factors (lb/hr)				
		CO	HC	NO_x	SO_2	TSP
Track laying tractors	37	0.386	0.110	1.47	0.137	0.112
Wheeled loaders	6	0.553	0.187	2.40	0.182	0.172
Motor graders	2	0.215	0.054	1.05	0.086	0.061
Miscellaneous	17	0.414	0.157	2.27	0.143	0.139

Note: CO = carbon monoxide, HC = hydrocarbons, NO_x = nitrogen oxides, SO_2 = sulfur dioxide, TSP = total suspended particulates.

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[a] Assumed that one-half of the total area would be actively worked at any one time.

The following formula was used in the calculation of emissions:

$$E = \frac{NFT}{2000}$$

where

E = pollutant emission, in tons
N = number of equipment units
F = emission factor
T = hours of operation

Emissions were calculated for a construction year, assuming that the fleet would operate 6 days per week, 10 hours per day, but that any given piece of equipment would be active 50 percent of the time. Thus active operating time during a year would be 1560 hours. Results of the calculations are presented below.

Equipment Type	Pollutant Emission (tons/year)				
	CO	HC	NO_x	SO_2	TSP
Track-laying tractors	11.1	3.2	42.4	4.0	3.2
Wheeled loaders	2.6	0.9	11.2	0.9	0.8
Motor graders	0.3	0.1	1.6	0.1	0.1
Miscellaneous	5.5	2.1	30.1	1.9	1.8
Total	19.5	6.3	85.3	6.9	5.9

AIR QUALITY IMPACTS OF OPERATION OF A COAL-FIRED BOILER AT THE CYPRESS BEND DEWATERING FACILITY

The dewatering facility at Cypress Bend would process 18.6 MMTA of coal. According to ETSI, the boiler needed to do this would require 300,000 tons of coal fuel per year. To estimate air quality impacts of this operation it was assumed that only one boiler unit (package) would be operated, that it would be of the general pulverized industrial type, and that it would use coal from the slurry pipeline as fuel. The slurry pipeline coal would have a sulfur content of 0.5 percent and an ash content of 6.4 percent.

Emissions from the burning of 300,000 tons of this coal per year were estimated using the emissions factor presented by the U.S. Environmental Protection Agency (EPA) in Table 1.1-2 of publication AP-42 (EPA 1978a). All emissions presented below are uncontrolled except for total suspended particulates (TSP) and sulfur dioxide (SO_2). For TSP, a control efficiency of 99 percent was assumed for bag filters; and for SO_2 a control efficiency of 70 percent was assumed for adding limestone to the coal being burned. These control measures were taken from ETSI's March 31, 1980, revision to the May 1979 Prevention of Significant Deterioration (PSD) permit application for the coal slurry preparation plants.

Emission estimates are as follows:

- Total suspended particulates (TSP) = 153.6 tons/year
- Sulfur dioxide (SO_2) = 855.0 tons/year
- Carbon monoxide (CO) = 150.0 tons/year
- Hydrocarbons (HC) = 45.0 tons/year
- Nitrogen dioxide (NO_2) = 2700.0 tons/year

Stack characteristics for the boiler were assumed to be the same for the largest boilers to be used at the coal slurry preparation plants. These are as follows.

- Stack height = 27.0 meters
- Gas exit temperature = 450.0 degrees K
- Gas exit velocity = 15.2 m/sec
- Stack diameter = 0.78 meters

Because emissions of TSP, SO_2, NO_x, and CO are estimated to be over the emissions significance level presented in Chapter 4, these pollutants were modeled, as a screening approach, with EPA's PTMAX model (Turner and Busse 1973). Using an emission rate of 1.0 gram per second, the maximum predicted χ/Q (seconds per cubic meter) value of 1.31×10^{-5} was predicted to occur under Class A stability and wind speed of 2.5 meters per second. This value is representative of a 3-minute average and was multiplied by the various emission rates (in grams per second) to get the following predicted 3-minute concentrations:

- o TSP 57.7 $\mu g/m^3$
- o SO_2 321.9 $\mu g/m^3$
- o CO 56.5 $\mu g/m^3$

The above concentrations were converted to 1- and 3-hour values according to the following formula suggest by Gifford (1976) and recommended by the American Meteorology Society's Workshop on Stability Classification Schemes and Sigma Curves (1977):

$$\sigma y / \sigma y_{P-G} = (\tau/\tau_0)^R \qquad R = 0.20,\ 3\text{ min.} < \tau < 1\text{ hour}$$
$$R = 0.25,\ 1\text{ hour} \le \tau$$

where σy_{P-G} is the Pasquill-Gifford horizontal dispersion

coefficient appropriate to time τ_0 and σy is the coefficient appropriate to time τ. Thus to convert to 1-hour values:

$$\sigma y / \sigma y_{P-G} = (60/3)^{0.25} = 2.11 \text{ and}$$

$$\chi_{1\text{-hour}} = (\chi_{3\text{-min}})(1/2.11)$$

Therefore:

TSP = 27.3 $\mu g/m^3$
SO_2 = 152.6 $\mu g/m^3$
CO = 26.8 $\mu g/m^3$

Using the same approach yields the following estimates of 3-hour concentrations (R=0.25):

- TSP = 20.7 $\mu g/m^3$
- SO_2 = 115.9 $\mu g/m^3$
- CO = 20.4 $\mu g/m^3$

These results indicate that predicted 1-hour concentrations of CO are below the EPA 1-hour significance level of 2000 $\mu g/m^3$. Predicted 3-hour SO_2 concentrations are well below the federal standard of 1300 $\mu g/m^3$ and the class II PSD increment of 512 $\mu g/m^3$. The 3-hour predicted TSP concentration is well below even the 24-hour standard of 260 $\mu g/m^3$. Because the "worst case" meteorology assumed above would not be likely to persist for periods longer than 3 hours, and because the resulting 3-hour concentrations are predicted to be low, 24-hour concentrations should also be well below standards.

Annual averages were not modeled because no representative meteorological data were available for the boiler site. Short-term SO_2, TSP, and CO concentrations of these pollutants would be below standards. However, the impact of NO_2 emissions is uncertain.

Appendix G-7

EMISSIONS FROM OPERATION OF THE BARGE LOADING FACILITY

Sources of emissions related to barge transport of coal would include wind erosion from stockpiles, barge loading operations, and pollutant emissions from tugboat engines.

Wind Erosion from Stockpiles

Stockpiles with a total capacity of about 90,000 tons would be located at the barge loading facility. Cowherd et al. (1974) present the following expression applicable to coal stockpiles:

$$E = 1.2\ U \times 0.75$$

where

E = wind erosion emission (lb/acre/hr)

U = mean windspeed

This factor can be adjusted to take into account the number of days each year having precipitation in excess of 0.01 inch. In the area of the barge loading sites, the mean annual windspeed is about 10 miles per hour (4.5 meters per second) and the number of "wet days" is about 110. This yields:

$$E = 1.2\ (4.5)\ (0.75)\ \ [(365 - 110)/365] = 2.8 \text{ lb/acre/hr}$$

Thus actual emissions would depend on the size of the stockpile area. Also, any control measures to be used would reduce emissions.

Loading Emissions

Particulate matter would be emitted during loading of the barges. Gaseous pollutants would be emitted from tugboats used to tow the barges. The EPA (1978b) has estimated pollutant emissions for barge loading and transport of 20,000 tons of coal. These emissions should be similar to those that would occur during operation of the pipeline-barge alternative and are presented below.

SUMMARY OF ATMOSPHERIC EMISSIONS IN BARGE TRANSPORT OF COAL

Pollutant	Air Emissions (lb/day)
Particulates	135
SO_2 [a]	280
NO_2	3850
HC	447
CO	2340
Particulate, during loading	8000 lb/trip

[a] Based on diesel fuel sulfur content of 0.2 percent.

These emissions would occur over the entire barge route, except for loading emissions, which would occur at the loading site.

Appendix G-8

EMISSIONS FROM CONSTRUCTION OF THE CROOK COUNTY ALTERNATIVE WATER SUPPLY SYSTEM

This alternative water supply system would consist of approximately 24 wells, one pump station and surge tank on a 20-acre site, 47 miles of 26-inch-diameter pipeline, and 55 miles of 24-inch-diameter pipeline. The pipeline would be constructed adjacent to existing roads where possible; thus access road construction would be minimal.

WATER WELLS

Construction

1.2 tons/acre/month x 2 acres/well[a] x 24 wells = 57.6 tons of dust per construction month

Wind Erosion

0.75 ton/acre/year x 2 acres/well[a] x 24 wells x 1 year/365 days = 0.10 ton per day

Thus total emissions would depend on the amount of construction time required.

PUMP STATION AND SURGE TANK

Construction

1.2 tons/acre/month x 20 acres = 24.0 tons of dust per construction month

Wind Erosion

0.75 ton/acre/year x 20 acres x 1 year/365 days = 0.04 ton of dust per day

[a]Assumed each well facility would occupy 2 acres during construction.

Thus total emissions would depend on the amount of construction time required.

26-INCH PIPELINE

Construction

1.2 tons/acre/month x 50-foot right-of-way x 15,840 feet[a] x (1 acre/43,560 feet^2 x (1 month/30 days) x (0.5 active area/total area)[b] x 47 days construction time[c] = 17.1 tons of dust (uncontrolled)

Pipeline Digging and Burial

0.25 lb dust/ton soil cycled x (100 lb soil/ft^3)[d] x (3 feet)[e] x (4 feet)[f] x (5280 feet/day)[c] x (1 ton soil/2000 lb soil) x (1 ton dust/2000 lb dust) x 47 days[c] = 18.6 ton of dust (uncontrolled)

Wind Erosion

0.75 ton/acre/year x 15,840 feet[a] x 50-foot right-of-way x (1 acre/43,560 feet^2) x (0.5 active area/total area)[b] x (1 year/365 days) x 47 days[c] = 0.90 ton of dust (uncontrolled)

[a]Assumed 3 miles of pipeline would be actively worked at any one time.
[b]Assumed that one-half of the total area would be actively worked at any one time.
[c]Assumed construction rate of one mile per day.
[d]Assumed soil density.
[e]Assumed ditch width.
[f]Assumed ditch depth.

24 INCH PIPELINE

Emissions for construction of the 24-inch pipeline were computed using the same method as above except the construction time would be 55 days (a rate of one mile per day. This yields the following uncontrolled fugitive dust emissions:

Construction: 20.0 tons per year

Pipeline digging and burial: 21.8 tons per year

Wind erosion: 1.0 ton per year

Gaseous air pollutants would be emitted by construction equipment and vehicles. These emissions would depend on the size and composition of the construction fleet, and would be similar to those presented for the main slurry pipeline construction in Appendix G-5.

EMISSIONS FROM CONSTRUCTION OF THE OAHE RESERVOIR ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would involve construction of 276 miles of 28-inch-diameter pipeline to supply water for the proposed slurry pipeline.

Construction

1.2 tons/acre/month x 100-foot right-of-way x 15,840 feet[a] x (1 acre/43560 $feet^2$) x (1 month/30 days) x (0.5 active area/total area)[b] x 276 days[c]

= 200.7 tons of dust (uncontrolled)

Pipeline Digging and Burial

0.25 lb of dust/ton of soil cycled x (100 lb soil/ft^3)[d] x 4 feet[e] x 5 feet[f] x (5280 feet/day)[c] x 276 days x (1 ton soil/2000 lb soil) x (1 ton dust/2000 lb dust)

= 182.2 tons of dust (uncontrolled)

Wind Erosion

0.75 ton/acre/year x 15,840 feet[a] x 100-foot right-of-way x (1 acre/43,560 $feet^2$) x (0.5 active area/total area)[b] x (1 year/365 days) x 276 days

= 10.3 tons of dust (uncontrolled)

[a] Assumed that 3 miles of pipeline would be actively worked at any one time.

[b] Assumed that one-half of the total area would be actively worked at any one time.

[c] Assumed construction rate of 1 mile per day.

[d] Assumed soil density.

[e] Assumed ditch width.

[f] Assumed ditch depth.

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APPENDIX H

METHODOLOGY FOR DETERMINING SOCIOECONOMIC PROJECTED BASELINE

This appendix discusses the basic procedure used to determine future employment and population in Campbell County, Wyoming, and the Gillette Planning Area. The analysis and projections were performed by Woodward-Clyde Consultants (WCC) to estimate the existing and potential socioeconomic impacts of a proposed energy development project in Campbell County. Since the study has not yet been published, it will be referenced as an internal WCC document with only the following information provided:

- Discussion of the methodology used in the study
- Summary of the employment and population projections for two time periods, 1984 and 1990, which are described in Section 3.A.2 of the text.

The methodology used to determine the future employment and population is as follows:

- All major energy-related projects were reviewed with respect to the levels of employment for both construction and operating work force. To modify the study for this particular effort, all ETSI-related components were excluded from these projections.
- Total employment was projected by applying sectoral multipliers to the projected change in mining and associated construction employment. Based on an examination of the existing relationships between basic and induced employment in Campbell County, by sectors, the following multipliers were used to determine basic/nonbasic employment: 1.2 for permanent workers; 0.6 for construction workers.
- Conversion of employment to place of residence was based on the assumption that all basic and nonbasic workers would be new to the area. There would be enormous demands for construction workers during this period, and there would not be sufficient supply from the local labor market. Even if these firms would hire away many of those employed locally, these individuals would have to be replaced, and consequently there would still be a net increase in in-migrants.

- Labor force estimates were based on an assumed 3.0 percent unemployment rate. Statistics provided by the Wyoming Employment and Security Commission indicate that the unemployment rate has remained close to an average of 3 percent over the past five years.
- Household estimates were derived by dividing total labor force by a ratio of 1.45 workers per household, based on observations of workers and households in Campbell County over the past several years.
- Population estimates were based on a factor of 3.18 persons per new household, again based on observations of population and household statistics and discussions with staff members of the Campbell County and Gillette planning departments.

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From: Name ______________________________

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Representing ______________________________

I wish to appear at the ________________ public hearing on ________________,
(town)

1980, afternoon ( ) evening session ( ) to express my views on the adequacy of the EIS.

I intend to submit written documentation: Yes __________ No __________

____
Signature

Verbal testimony will be limited to 10 minutes; written testimony will be accepted at the above address until close of business on January 6, 1981. Registration forms are to be submitted by November 26, 1980. Registration will also be accepted at the door for each hearing.

[illegible]

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Representing ______________________________

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