

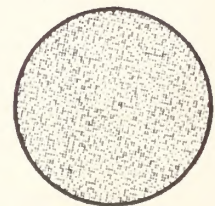


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BAIROIL/DAKOTA CARBON DIOXIDE PROJECTS

DRAFT ENVIRONMENTAL IMPACT STATEMENT

SEPTEMBER 1985



Department of the Interior
Bureau of Land Management
Denver Service Center
Division of EIS Services





United States Department of the Interior

Bureau of Land Management
Wyoming State Office
P.O. Box 1828
Cheyenne, Wyoming 82003

Dear Reviewer:

This draft Environmental Impact Statement (EIS) on the proposed Bairoil/Dakota CO₂ Project is submitted for your review and comment. Please retain this draft EIS for future reference as the final EIS may only be an addendum.

The purpose of this public review is to improve the impact analyses presented in the draft EIS. We welcome your comments on this EIS. The final EIS will be prepared considering comments received.

Comments on the draft EIS may be submitted in writing or presented verbally at a public hearing. As indicated elsewhere in this EIS, a series of public hearings will be held to receive oral comments. In order to be considered in the final EIS, all comments must be received by November 12, 1985.

Please make your comments as specific as possible. Comments will be more helpful if they include suggested changes, sources, or methodologies. Comments providing only opinions or preferences will not have a formal response, but will be included as part of the decisionmaking process.

A copy of the final EIS will be sent to those providing comments on the draft EIS or those requesting a copy. Please address written comments or requests for copies of the draft EIS to:

Janis L. VanWyhe, Project Leader
Bureau of Land Management
Division of EIS Services
555 Zang Street, First Floor East
Denver, Colorado 80228
(303) 236-1080

Sincerely yours,

Hillary A. Oden
State Director, Wyoming

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DRAFT ENVIRONMENTAL
IMPACT STATEMENT ON THE

BAIROIL/DAKOTA CARBON DIOXIDE PROJECTS

SEPTEMBER 1985

Prepared by Bureau of Land Management

Kelley A. Oden

State Director, Wyoming

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COVER SHEET

Bairoil/Dakota Carbon Dioxide Projects Environmental Impact Statement

(X) Draft

() Final

Lead Agency

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

Cooperating Agencies

U.S. Department of Army
Corps of Engineers
U.S. Department of Agriculture
Forest Service

State of Montana
Department of Natural Resources and Conservation,
Facility Siting Bureau

Counties That Could Be Affected

Wyoming
Campbell, Carbon, Converse, Fremont, Johnson,
Natrona, Sheridan, and Sweetwater counties
Montana
Carter, Custer, Dawson, Fallon, Powder River, and
Richland counties
North Dakota
Billings, Dunn, Golden Valley, McKenzie, Montrail,
Stark, and Williams counties
South Dakota
Butte, Lawrence, and Pennington counties

Abstract

The draft and final environmental impact statements (EISs) assess the environmental consequences of federal approval of the Bairoil/Dakota Carbon Dioxide Projects proposed by Exxon Company USA, Amoco Production Company, and Shell Pipe Line Corporation. Major project components are two parallel pipelines (one for Exxon and one for Amoco),

which would carry carbon dioxide from Rock Springs to Bairoil, Wyoming; an Amoco gas plant and enhanced oil recovery project in the Bairoil oil field; an Exxon pipeline beginning at Bairoil and ending at a point near Tioga, North Dakota; and a distribution pipeline along the Cedar Creek Anticline.

Based on the issues and concerns identified during the scoping process, the EIS focuses on impacts to socio-economics, soils and reclamation, water resources, and wildlife. The EIS analyzes direct and indirect impacts to various resources from the project as well as cumulative impacts. Cumulative impacts are impacts that would occur from the Proposed Action or alternatives plus other interrelated projects existing or planned for development in the area of influence, during the analysis period.

(See the Summary for an overview of impacts that would occur from construction and operation of the project.)

EIS Contact

Comments on this EIS should be directed to:

Janis L. VanWyhe, Project Leader
Bureau of Land Management
Division of EIS Services
555 Zang Street, First Floor East
Denver, CO 80228
(303) 236-1080

Date EIS Made Available to EPA and the Public

September 13, 1985

Date By Which Comments on the EIS Must Be Received To Be Considered In the Preparation of the Final EIS.

November 12, 1985

PREFACE

The purpose of this environmental impact statement (EIS) is to analyze the potential environmental and socioeconomic consequences resulting from construction, operation, maintenance, and abandonment of the proposed Bairoil/Dakota Carbon Dioxide Projects and alternatives to this proposal. This EIS is intended to inform the public and aid the decisionmakers in making a knowledgeable decision on whether to grant rights-of-way for the following proposed components:

- two parallel pipelines to carry carbon dioxide from Rock Springs to Bairoil, Wyoming;
- a pipeline to carry carbon dioxide from Bairoil, Wyoming to near Tioga, North Dakota; and
- a distribution pipeline to carry carbon dioxide along the Cedar Creek Anticline, near Baker, Montana.

Other aspects of the project, for which rights-of-way would not be needed, are a gas separation plant, which would be built on private land near Bairoil, Wyoming and an enhanced oil recovery project, in the oil fields at Bairoil. Oil field facilities would require permitting processes other than rights-of-way.

The EIS contains four chapters and eight appendices. Chapter 1 contains descriptions of the Proposed Action; the Single Bairoil Pipeline, U.S. Highway 85, and No-Action alternatives; and the Crooks Gap Option. Chapter 2 describes the affected environment and analyzes potential impacts to a variety of resources from the proposed projects and alternatives. Chapter 3 identifies benefits, tradeoffs, and commitment of resources. Chapter 4 contains a comparative analysis of the Proposed Action; Single Bairoil Pipeline and U.S. Highway 85 alternatives; and Crooks Gap Option. Appendix 1 (located in the back inside pocket) contains project maps. Appendix 2 describes the scoping process and public involvement during the EIS process. Appendix 3 contains material provided by the Montana Department of Natural Resources and Conservation analyzing the uncertainty of the need for the project and the effect of that uncertainty on risk in making decisions about granting permits for the proposed project. The other appendices provide additional resource materials, such as consultation procedures or impact assessment methodologies, which supplement the analysis.

The EIS has been prepared by BLM. Active cooperating agencies have been the Forest Service and the State of Montana, Department of Natural Resources and Conservation, and the Army Corps of Engineers.

The Montana Department of Natural Resources and Conservation is preparing a supplement to this EIS under the requirements of the Montana Environmental Policy Act. The supplement, scheduled to be released October 1, 1985, will cover items on the Exxon and Shell projects in Montana that may need more detailed analysis for state permits. (Copies of the supplement may be obtained by calling Van Jamison, Branch Chief, at [406] 444-6812.)

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Wyoming State Office

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Miles City District and resource areas

Casper District (Lead) and resource areas

Rawlins District and resource areas

Big Sandy Resource Area, Rock Springs District

U.S. Department of Agriculture, Forest Service

Custer National Forest and ranger districts

State of Montana

Department of Natural Resources and Conservation, Facilities Siting Bureau

State of Wyoming

Wyoming State Clearing House and various state agencies

PUBLIC HEARINGS INFORMATION

Public hearings on the Bairoil/Dakota Carbon Dioxide Project draft Environmental Impact Statement will be held at the following locations:

Public Hearing Locations	Date
Crawford Room Natrona County Library 307 East Second Street Casper, Wyoming	October 22, 1985 7:00 PM
Library Basement 6 West Fallon Avenue Baker, Montana	October 23, 1985 7:00 PM
Gate City Building Community Room 204 Sims Street Dickinson, North Dakota	October 24, 1985 7:00 PM

The hearings will be held pursuant to the objectives of the National Environmental Policy Act (PL 91-190;83 Stat. 852,853) to receive comments (testimony) on the scope of the EIS and the adequacy of the impact analysis. Testimony presented at these hearings will be considered in the preparation of the final environmental impact statement.

The public hearings will be conducted by a Bureau of Land Management official who will be accompanied by other personnel* involved with preparing this draft environmental impact statement. The panel members may only ask questions of the witness to clarify points in the testimony. No panel member can respond officially to any comments presented. All hearing proceedings will be recorded.

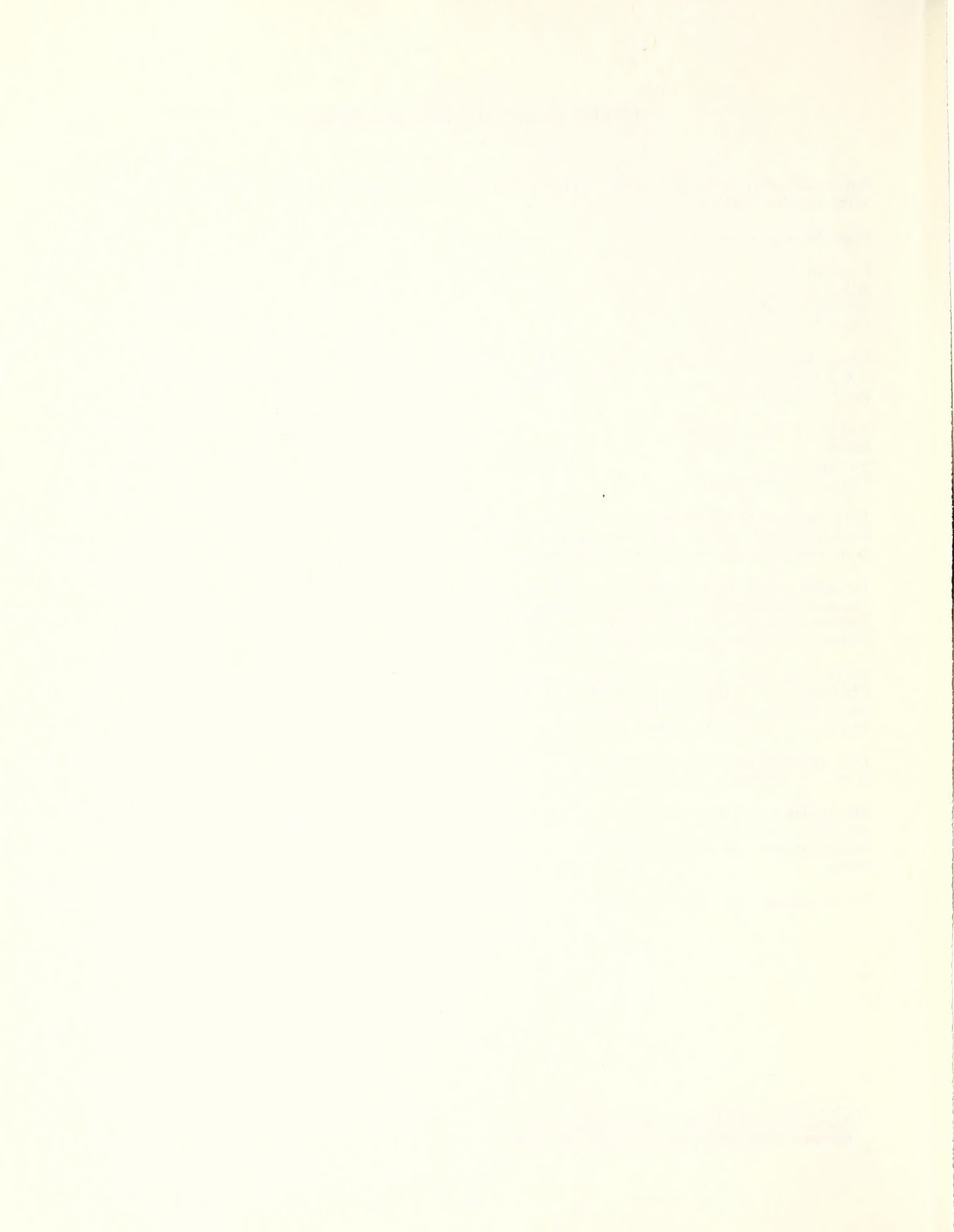
Before giving testimony at the public hearing, participants are requested to complete a hearing registration form. **A REGISTRATION FORM IS INCORPORATED AS THE LAST PAGE OF THIS DOCUMENT.** Additional forms may be obtained from the address shown on the registration form. Registration forms must be returned to that address no later than October 9, 1985. Participants may also register at the registration desk at each hearing.

Time preferences for presenting 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 hearings administrator will consider the requests of other persons present who wish to testify. Only one witness will be allowed to present the viewpoint 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.

Persons wishing to give oral testimony may be limited to 10 minutes.

* *Representatives from BLM will be accompanied by representatives from the Montana Department of Natural Resources at the public hearing in Baker, Montana.*



SUMMARY

Exxon Company USA (Exxon), Amoco Production Company (Amoco), and Shell Pipe Line Corporation (Shell) have applied to the Bureau of Land Management (BLM) for permission to build pipelines to transport carbon dioxide (CO₂) across public land. In addition to building a CO₂ pipeline, Amoco proposes to begin improved oil recovery using CO₂ in its Bairoil, Wyoming oil field. The recovery project would include a gas separation plant, CO₂ distribution and collection pipelines in the oil fields, a pipeline to carry the produced oil from the field to the existing Frontier pipeline in Wyoming, and an oil storage tank at the point the oil pipeline joined the Frontier pipeline. For the purpose of this environmental impact statement (EIS), the projects proposed by each of these separate companies have been combined and analyzed as the companies' Proposed Action.

Exxon plans to build two segments of a CO₂ pipeline that would carry 450 to 500 million cubic feet per day (MMcfd). One segment would transport CO₂ from the Rangely CO₂ pipeline near Rock Springs to Bairoil, Wyoming, and the other from Bairoil to near Tioga, North Dakota.

Amoco's proposed pipeline would carry between 150 and 200 MMcfd of CO₂ to the Bairoil plant. The CO₂ pipeline planned by Amoco is in addition to the proposal by Exxon to transport CO₂ to the Bairoil oil recovery project. Negotiations are still underway between the two companies as to which company will actually transport the CO₂ to the Bairoil oil recovery project.

Shell proposes to build a CO₂ distribution pipeline that would move CO₂ into oil fields along the Cedar Creek Anticline near Baker, Montana for use in oil recovery. Shell has not decided on a CO₂ source yet, but CO₂ could come from either Exxon or Amerada Hess if Amerada Hess built a pipeline from the Great Plains coal gasification plant in Beulah, North Dakota.

Construction of each of the projects would begin in the spring of 1986. If construction of the pipelines was not completed during 1986, it would be finished during the summer of 1987. The Bairoil plant would be completed in December 1987.

In addition to the Proposed Action, this EIS analyzes potential social, economic, and environmental impacts of the U.S. Highway 85, Single Bairoil Pipeline, and No-Action alternatives. In addition to these alternatives

to the Proposed Action, a short optional routing, identified as the Crooks Gap Option, is analyzed. See Appendix 1 for maps detailing the locations and milepost (MP) numbers for the projects. Maps are located in the inside back pocket of this EIS.

ISSUES

During the scoping process, several general concerns were raised relating to impacts on various aspects of the socioeconomic environment, soils and vegetation and how they would be reclaimed, wildlife, water resources, roads, rancher's and farmer's agricultural activities and rights in negotiating easements, and the State of Montana's concern that the costs not exceed the benefits. Appendix 2, Consultation and Coordination, lists the resource concerns and information on the scoping process.

The only known CO₂ market near the Proposed Action route is at Bairoil, Wyoming. Exxon and Amoco are continuing to negotiate a contract for Exxon to deliver CO₂ to Bairoil. If markets for CO₂ do not develop north of Bairoil, permission to cross public lands would not be given to Exxon or Shell, under this proposal. If markets developed in the future, this EIS would be reviewed and updated, as necessary, prior to granting permission to build. Appendix 3 shows an analysis prepared by the Montana Department of Natural Resources and Conservation, which shows project benefits and costs.

MAJOR IMPACT CONCLUSIONS

The EIS concentrates on potential impacts from the projects as proposed by Amoco, Exxon, and Shell. The analysis assumes effective use of the BLM Required General Resource Measures and Required Reclamation and Erosion Control Procedures which would be used on lands administered by BLM. The other state and federal agencies, which administer land that would be crossed by the proposed projects, also have required mitigation. The Montana State Land Board has the ability to require reclamation measures on private lands (as a condition of crossing state lands). These are comparable to those required on state lands and would prevent impacts to the public, public lands, and other private land holdings. Appendix 4 lists measures required by the various agencies.

SUMMARY

The analysis also assumes the commitments made by each of the three companies to use the BLM mitigation on private lands. Exxon made a commitment to apply the BLM measures unless the landowners disagreed. Amoco agreed that if the private landowner wanted to use the BLM measures it would apply them. Shell prefers to leave mitigation measure development to the landowner. Therefore, landowners are encouraged to review these protective measures and decide which measures they wish to be used on their own lands.

The measures were developed to ease or avoid impacts to various physical resources. Soils and vegetation are protected by the required saving of topsoil and reclamation and erosion control procedures. Impacts to agricultural activities are lessened by gaps required to be left in the construction trench to prevent interference with livestock movements and by required weed control activities in the event of weed problems after construction. The companies also proposed to limit the time pipeline trenches would be open.

Among other required measures to protect the roads to be used, the companies must comply with all road regulations or stipulations required by private landowners, municipalities, counties, states, and federal agencies. To protect water resources, existing bridges must be used, culverts on temporary crossings installed, and regulations needed to obtain and dispose of water used in testing the strength of the pipeline must be followed.

In addition to other measures, wildlife would be protected by requiring that no construction occur near habitat needed for species survival (crucial habitat) during its use. Surveys for threatened or endangered species that may occur in the area must also be completed. Cultural and historic resources are protected by procedures to identify, evaluate, and protect resources. Paleontological (fossil) resources are protected in a manner similar to cultural resources.

Impacts to visual resources (scenic views and areas) would be lessened by required use of paint colors on project facilities, which are selected to blend into the background. Wastes would be controlled by measures requiring use of authorized disposal sites.

As identified in Appendix 4, there are many other measures designed to lessen or avoid impacts to these resources and other aspects of the environment.

This EIS analyzes the potential social, economic, and environmental impacts of the Proposed Action and alternatives to the Proposed Action. The analysis will be used to help federal decisionmakers determine whether or not they should grant permission to the companies to cross public lands for this project. The analysis concentrates on impacts caused by (1) the area disturbed during construction of the proposed projects; (2) the increase in

jobs and number of people added to the existing population; and (3) operation impacts, including emissions to the air. To determine impacts, levels of significance were set for each resource (see Chapter 2). Potential impacts from the projects were compared against these levels to determine if they would be significant. The analysis revealed that no significant adverse impacts would occur to the natural resources or to human populations within the area that would last beyond construction. These projects, however, would cause some short-term, construction-related impacts.

Neither the Proposed Action nor the alternatives would affect any federally listed threatened or endangered plant species, national wild or scenic rivers, areas of critical environmental concern, sole sources of drinking water, prime or unique farmlands, floodplains, or wetlands in any of the counties that would be affected in Wyoming, Montana, or North Dakota. Neither the Proposed Action nor the alternatives would have any known effects on the cultural, historical, or religious values of Native Americans. Access to the Fort Berthold Indian Reservation would also not be affected.

Socioeconomics

The Proposed Action, Single Bairoil Pipeline Alternative, and U.S. Highway 85 Alternative would affect social and economic conditions in much the same way during the 1- to 2-year construction period. Many insignificant impacts (those less than the identified significance criteria) and a few significant impacts (those exceeding the significance level) would result. The table on page 3 shows the significant impacts that would occur during construction and operation of the Proposed Action or alternatives.

Cumulative impacts to housing, public services and facilities, and quality of life in Green River and Rock Springs, Wyoming would occur mainly from Exxon's Shute Creek gas separation plant, in southwestern Wyoming. Under the conditions required by the permits issued by the Wyoming Office of Industrial Siting Administration, those cumulative impacts appear to be sufficiently mitigated. Thus, impacts may be insignificant since the towns also have enough housing and other needed facilities, in addition to experience in handling growth-related problems. Impacts to Bairoil, Wyoming would be significant, however.

Soils and Vegetation

Soil loss and reduction of soil productivity from the Proposed Action, the U.S. Highway 85 Alternative, or the Single Bairoil Pipeline Alternative would be insignificant on public lands, with the required use of the erosion control, reclamation, and revegetation program outlined in Appendix 4. Impacts on private land would

SUMMARY

Element	Amount	Percent Increase Over Baseline
PROPOSED ACTION OR ALTERNATIVES		
Construction Population Increase in Bairoil	60 persons	22.2
Tax Revenues During Construction (1986)		
Montana		
Carter County	\$ 210,000	38.3
Carter County Schools	\$ 330,000	37.0
North Dakota		
Golden Valley County Schools	\$ 19,000	12.5
Tax Revenues During Operation (1990-peak year)		
Wyoming		
Sweetwater County	\$ 2,300,000	37.1
Montana		
Carter County	\$ 380,000	69.1
Carter County Schools	\$ 610,000	68.5
North Dakota		
Golden Valley County Schools	\$ 30,000	19.7
Ad valorem, Severance and Federal Royalty Revenues During Operation		
Lincoln County (CO ₂)	\$ 5,200,000	N/A
Sweetwater County (CO ₂ , oil, gas)	\$19,180,000	14.7
Carbon County (CO ₂ , oil, gas)	\$ 1,330,000	2.1
CUMULATIVE IMPACTS (PROPOSED ACTION PLUS INTERRELATED PROJECTS)		
Construction Employment Increase		
Wyoming		
Sweetwater County	3,360 persons	14.0
Construction Population Increase		
Wyoming		
Sweetwater County	5,770 persons	12.9
Green River	1,620 persons	11.4
Rock Springs	3,270 persons	15.8
Bairoil	60 persons	22.2
Gillette	2,480 persons	13.0
Tax Revenues During Construction		
Wyoming		
Sweetwater County	\$ 1,460,000	24.2
Green River	\$ 1,120,000	13.5
Rock Springs	\$ 1,700,000	13.3
Bairoil	\$ 122,000	19.8
Campbell County	\$ 6,210,000	16.2
Gillette	\$ 2,660,000	10.7
Montana		
Carter County	\$ 210,000	38.3
Carter County Schools	\$ 330,000	37.0
North Dakota		
Golden Valley County Schools	\$ 19,000	12.5
Tax Revenues During Operation		
Wyoming		
Sweetwater County	\$ 3,000,000	48.4
Sweetwater County Schools	\$ 4,470,000	10.0
Campbell County	\$ 5,170,000	10.9
Campbell County Schools	\$ 8,970,000	14.0
Montana		
Carter County	\$ 380,000	69.1
Carter County Schools	\$ 610,000	68.5
North Dakota		
Golden Valley County Schools	\$ 30,000	19.7

N/A—no previous taxes on CO₂

Population would increase by 50 persons or 18.5 percent over baseline during construction of the Single Bairoil Pipeline Alternative.

SUMMARY

depend on how effectively the companies apply these measures. (Private landowners are encouraged to study these measures and use them as a guideline for determining which measures they would require on their own lands, before giving permission to the company to cross.) Accelerated wind and water erosion would cause some unquantified soil loss until erosion control measures could be implemented. Reclamation would be difficult in areas with less than 9 inches average annual rainfall (the southern third of the project area), in areas with slopes of 15 percent or more, on shallow soils over bedrock, and on soils with unfavorable erosion or plant growth properties (sensitive soils). (Reestablishing ground cover to the extent it existed before building the project may take longer than 1 to 2 years.) Of the 9,485 acres disturbed by the Proposed Action, 796.8 acres of sensitive soils and terrain would be disturbed, and 2,718 acres would be located in areas with less than 9 inches average annual precipitation.

The U.S. Highway 85 Alternative would disturb 9,533 acres, including 778.8 acres of sensitive soils and terrain, and 2,718 acres in areas with less than 9 inches average annual precipitation.

The Single Bairoil Pipeline Alternative would disturb 8,799 acres, including 703.7 acres of sensitive soils and terrain; 2,534 acres would be located in areas with less than 9 inches average annual precipitation.

Agriculture

The Proposed Action would cause a 1- to 5-year loss of enough rangeland forage to feed 785 cows for 1 month, and a loss of enough rangeland forage to feed 20 cows for 1 month for the life of the project. This loss of forage would be spread along the entire length of the projects and not significantly affect any single grazing allotment. Although 1,897 acres of cropland would be removed for 1 year, the impacts would be insignificant since they represent less than 1 percent of the cropland in the area. Impacts from the Single Bairoil Pipeline Alternative would be the same as those from the Proposed Action. The U.S. Highway 85 Alternative would remove 1,819 acres of cropland from production for 1 year.

Transportation Networks

During construction of the Proposed Action, the U.S. Highway 85 Alternative, or the Single Bairoil Pipeline Alternative, local traffic volume would significantly increase and traffic flow on some roads serving as access to the pipeline routes and plant site would be impeded.

Water Resources

Impacts to water resources from the Proposed Action, the U.S. Highway 85 Alternative, or the Single Bairoil Pipeline Alternative would be the same, although the number of stream crossings would vary slightly. Building a pipeline across flowing streams would cause sedimentation and probable violation of water quality standards for about a week at the crossing site and for 1 to 2 miles downstream. Construction of the crossing of Lake Sakakawea, North Dakota would take about 2 months. The lake bottom would be in a disturbed condition for about a month of this time. Trenching beneath the lake would be limited to within 100 to 300 yards of the shoreline. This limit on trenching and the low flow rate in the lake would limit suspended sediment increases to the area around the disturbance.

The probability of a CO₂ leak beneath a stream would be very low—one chance in 100,000—since most stream crossings are 0.1 mile or less (Chapter 1). Any leak would potentially increase suspended solids and CO₂ concentrations and lower pH and stream temperatures. State water quality standards for turbidity, pH, and temperature change could be violated, but only the turbidity would be measurable for a short distance downstream. All concentrations and impacts would gradually dissipate as soon as the block valves were shut and CO₂ emptied out of the pipeline segment between them.

Wildlife

Impacts to wildlife would be similar and insignificant under all alternatives including the Proposed Action. Few acres of habitat needed for species survival (crucial habitat) would be crossed, and construction would be prohibited during major habitat use (such as breeding, fawning, or calving periods). Forage losses from vegetation disturbance would be insignificant and last only 1 to 5 years. Although poaching would increase, it would not be significant.

A pipeline break or CO₂ leak, although unlikely, could kill a few fish and other aquatic species by supersaturating an area of water with CO₂. The block valves on either side of some stream crossings, including the Green River crossings at MP 38R and MP 2.6, would limit the amount of CO₂ that would be released. The tendency of fish to avoid bubbles and foreign substances in water would limit the number of fish killed by CO₂. The potential for more fish to be killed would be somewhat higher in Lake Sakakawea because it lacks strong currents. However, the chance of a leak or rupture occurring under the lake is less than under land, since most ruptures or leaks are caused by heavy equipment working on top of or near a pipeline.

SUMMARY

Building and operating the proposed projects could potentially affect some threatened, endangered, or sensitive animal species. Since construction would disturb prairie dog habitat, the black-footed ferret could be harmed. In addition, the piping plover and narrow-footed Hygrotus diving beetle, both proposed for listing by the Fish and Wildlife Service (Category II), could be affected by changes in their habitat. The companies will be required to take steps to protect these species as part of the conditions attached to the Federal Government's permission to build the project on or across public land.

Although whooping cranes, peregrine falcons, and bald eagles occur within the general area, the projects are not expected to affect them. No other threatened or endangered animal species are known to occur in the project area.

Cultural Resources

Because the exact locations of the pipelines and associated facilities are unknown for the Proposed Action and the alternative routes, specific impacts to cultural resources cannot be determined. As a condition to receiving permission to build the projects, the companies will be required to take steps to protect cultural resource values on all lands (see Appendix 4).

Air Quality

Pipeline and plant construction of the Proposed Action, the U.S. Highway 85 Alternative, or the Single Bairoil Pipeline Alternative would temporarily and insignificantly increase air pollution; an estimated 6,473 tons of dust would be produced by the Proposed Action, 6,505 tons by the U.S. Highway 85 Alternative, and 6,020 tons by the Single Bairoil Pipeline Alternative. The impacts would not affect regional air quality because they would be dispersed over the length of the project.

Operation of the new Bairoil gas separation plant would cause emissions of 45 tons per year of sulfur dioxide (SO₂) which is much less than the 509 tons per year of SO₂ currently released by the existing Wertz plant in the same area. The existing plant would be replaced by the new plant and would be shut down when the new one began operating.

Mineral and Paleontological Resources

The Proposed Action pipeline route would cross several coal deposits. The proposed 50-foot-wide, permanent right-of-way would cover about 27 million tons of surface mineable subbituminous coal, northeast of Gillette. If the area was leased and mined, the pipeline would probably be relocated. The Proposed Action would,

however, preclude from recovery 16 million tons of high quality coal. Other areas of lesser quality coal would be crossed, but the coal would probably not be developed within the useful lifetime (30 to 35 years) of the Proposed Action. The alternatives would cross similar coal resources.

All three alternatives would cross 246.5 miles of geologic formations that have a high probability of containing paleontological (fossil) resources. Since paleontological resources are not well inventoried, the companies would be required to take steps to protect these resources, similar to those required for cultural resources. Knowledge of fossils would probably be enhanced by finds made during inventories or construction. Resources not located by surface examination or noticed during construction would probably be destroyed.

Visual Resources

Vegetation clearings needed for the Proposed Action and facilities would create visual contrasts with the existing vegetation and landform that would conflict with Visual Resource Management (VRM) objectives for 550 acres of lands categorized as VRM Class II and III. Of the total, 4 acres would be in conflict for the life of the project. Such conflicts would occur in 11 areas. The scenic views in these areas would be changed from what now exists. People looking at these areas would notice a change in vegetation and see new facilities, such as valves and other pipeline facilities, that did not previously exist in the area. The U.S. Highway 85 Alternative would cause similar impacts. The Single Bairoil Pipeline Alternative would cause impacts to 423 acres, a decrease in acreage at two areas and an elimination of all impacts between MP 37.5R and 38.5R and between MP 48R and 49R.

Recreation Resources

Impacts to recreation sites and users from the Proposed Action would be insignificant. Some camping by construction workers would occur. Populations in communities would not increase significantly except at Bairoil, Wyoming. Increased demand for urban and nonurban (hunting, fishing, sightseeing) recreation resources would be insignificant and temporary, lasting no longer than one or two summers.

Impacts from the U.S. Highway 85 Alternative and the Single Bairoil Pipeline Alternative would be similar.

Wilderness

No significant impacts would occur to wilderness study areas from building the Proposed Action, the U.S. Highway 85 Alternative, or the Single Bairoil Pipeline Alternative.

SUMMARY

Land Use Plans, Controls and Constraints

There are no known conflicts with any federal, state, or local plans.

Health and Safety

CO₂ gas would pose no health hazards to either oil field workers or the public except in the event of a large rupture. Since the pipeline would be under high pressure, 1,800 to 2,200 pounds per square inch (psi), an accidental rupture could pose a physical hazard. Flying rocks and pieces of broken pipe could be fatal if they struck persons nearby. If trapped in the hole around the pipe, such persons could be asphyxiated or frozen by the rapidly expanding CO₂.

Hydrogen sulfide (H₂S) is present in the water, oil, and gas mixture at the Lost Soldier and Wertz oil fields at Bairoil, Wyoming. Risk to the general public is now low and is not expected to change, and risk to the well field workers would not change.

AGENCY PREFERRED ALTERNATIVE

The Agency Preferred Alternative was selected by BLM and the cooperating agencies in the preparation of the EIS: the Forest Service and the Montana Department of Natural Resources and Conservation.

The Agency Preferred Alternative is the Single Bairoil Pipeline Alternative, which involves:

- granting rights-of-way for one CO₂ pipeline from MP 26 of the existing Rangely CO₂ pipeline near Rock Springs, Wyoming to Tioga, North Dakota; the 20-mile segment from the main CO₂ pipeline route over to Bairoil, Wyoming; and associated facilities. The agency has no preference on whether Exxon or Amoco would build the first 111 miles of the main CO₂ pipeline and the 20 miles over to Bairoil;
- granting rights-of-way for all facilities on public land needed to permit construction and operation of the proposed Bairoil gas separation plant;
- granting rights-of-way for the CO₂ distribution pipeline near Baker, Montana and associated facilities.

Chapter 1

Description of Proposed Action and Alternatives



October 1

Position of ...
...



CHAPTER 1

DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

INTRODUCTION

This chapter of the Environmental Impact Statement (EIS) describes three projects proposed by three companies: Exxon Company USA (Exxon), Amoco Production Company (Amoco), and Shell Pipe Line Corporation (Shell). The three companies' proposals are being analyzed together as the Proposed Action because they are related to one another and could be built during the same time. The term *Proposed Action* is used to refer to all three projects. (See Map A-1 in the map pocket for location.)

Exxon submitted right-of-way applications for two segments of a carbon dioxide (CO₂) pipeline and associated facilities. One segment would begin near Rock Springs and end at Bairoil, Wyoming; the other would begin at Bairoil Junction and end near Tioga, North Dakota, in the Williston Basin. The total length of the pipeline segments would be 663.5 miles. Associated facilities would include power distribution lines and microwave facilities.

Amoco submitted a right-of-way application to build a 154-mile-long CO₂ pipeline beginning near Rock Springs and ending at Bairoil. Along with the pipeline, Amoco would conduct an enhanced oil recovery (EOR) project. As part of the EOR process, it would build and operate a gas separation plant and associated facilities. The facilities would include a 20-mile-long crude oil pipeline, an oil storage tank, and a small oil pump station.

Shell submitted a right-of-way application for a 65-mile-long CO₂ distribution pipeline along the Cedar Creek Anticline near Baker, Montana.

In addition to the Proposed Action, this EIS also analyzes the Single Bairoil Pipeline and U.S. Highway 85 alternatives and the Crooks Gap Option. The Single Bairoil Pipeline Alternative involves building one pipeline rather than two between Rock Springs and Bairoil, Wyoming. The U.S. Highway 85 Alternative pipeline would transport CO₂ to the same point at Tioga as the Proposed Action but would leave the Proposed Action route at milepost (MP) 543. From there it would follow U.S. Highway 85 north past the Theodore

Roosevelt National Park in North Dakota. The alternative would rejoin the Proposed Action route at MP 622. Maps A-2 through A-7, Appendix 1, show mileposts and specific locations.

The No-Action Alternative, denial of the right-of-way applications, is also analyzed.

Purpose of and Need for the Proposed Action

The purpose of the Exxon proposal is to transport 450 to 500 million cubic feet per day (MMcfd) of CO₂ in a dense phase or pseudo-liquid state from MP 26 of the Rangely CO₂ pipeline to possible markets in Wyoming, Montana, and North Dakota. Amoco's Bairoil EOR project could be a possible market, requiring 150 to 200 MMcfd. Shell's project along the Cedar Creek Anticline near Baker, Montana and the Amerada Hess EOR project near Tioga, North Dakota could also be possible markets, with other markets possibly developing elsewhere along the route. (See Appendix 3 for the Montana Department of Natural Resources and Conservation evaluation of marketability benefits and uncertainty.)

The need for the proposed pipeline is to provide CO₂ for enhanced oil recovery at various oil fields and to market CO₂ produced at the Shute Creek natural gas processing plant near Opal, Wyoming, thus reducing or eliminating CO₂ venting at the plant. Selling the CO₂ would also make Exxon's Shute Creek plant and gas production at the La Barge Project gas fields near Big Piney, Wyoming more practical and economical.

The purpose of Amoco's proposed pipeline is to transport 150 to 200 MMcfd of CO₂ in a dense phase or pseudo-liquid state from MP 49 of the Rangely CO₂ pipeline to Amoco's proposed CO₂ EOR project at Bairoil. Amoco's proposed gas treatment plant and EOR facilities would be used to increase oil and gas production in the Tensleep and Madison formations of

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

the Wertz and Lost Soldier oil and gas fields. Water-flooding in these formations has left about 50 to 60 percent of the original oil and gas in place. CO₂ enhanced oil recovery should allow an additional 5 to 15 percent of the original oil and gas in place to be recovered.

Currently, both Exxon's and Amoco's CO₂ pipeline projects have the same purpose and could be considered competitive. Each could carry the full amount of CO₂ needed at Bairoil. Both are analyzed in this EIS, although the companies may eventually make arrangements whereby only one pipeline would be needed. Currently, Exxon and Amoco have not reached any agreement for Exxon to deliver CO₂ to Bairoil; they do have an agreement for Exxon to deliver CO₂ to Amoco at MP 49R of the Rangely pipeline, near Rock Springs.

The purpose of Shell's proposal is to distribute about 100 MMcfd of CO₂ to the oil field production units along the Cedar Creek Anticline. Shell could obtain CO₂ from Exxon, the Great Plains coal gasification plant at Beulah, North Dakota, or its own field near Cortez, Colorado. The last two alternate sources, however, have not been proposed and are speculative. The distribution pipeline would use CO₂ to recover more in-place oil, thus prolonging production at the oil fields along the Cedar Creek Anticline.

The EIS impact analysis is based on the projects as presently proposed by Amoco, Exxon, and Shell. At the present time the only known CO₂ market exists at Bairoil, Wyoming. Exxon is actively seeking markets with various oil field operators along the proposed route of the pipeline from Bairoil to Tioga. Shell Oil has determined that EOR would be technically feasible in some of the oil fields in the Cedar Creek Anticline and is continuing economic studies. Tests and analysis of other possible EOR projects are being conducted by various oil field operators. Depending on the results of these tests and studies, additional markets for CO₂ may or may not develop. Therefore, the pipeline may not be built beyond Bairoil, Wyoming, or the Shell Oil distribution line constructed. In this case, the federal right-of-ways would not be granted for these portions of the proposed project. The analysis presented in this EIS will, however, allow the federal decisionmaker to decide whether or not to grant a right-of-way when the applicants have determined that they have the markets and are ready to commit private capital for construction of the proposed projects.

Location of the Proposed Action

The proposed pipelines and EOR project, including the gas plant, would be located in the following counties:

Wyoming—Sweetwater, Fremont, Natrona, Johnson, Campbell, and Carbon (The wellfields and EOR project would be located in Sweetwater and Carbon counties.)

Montana—Powder River, Carter, Fallon, Wibaux, Prairie, and Dawson

North Dakota—Golden Valley, Billings, Stark, Dunn, McKenzie, and Williams

See maps in the map pocket for locations.

Authorizing Actions

The proposals would require federal, state, and local authorizations for rights-of-way for the project. Table 1 shows the types of major permits, approvals, and other authorizing actions that would be required for project construction and operation.

In order to obtain right-of-way grants from federal agencies or easements across private land, several steps must be taken. For federally administered lands, a company submits a right-of-way application to the appropriate federal agency, along with a filing fee to cover the costs of processing the application and of granting and administering rights-of-way. The agency prepares an environmental document (such as this EIS) as required by the National Environmental Policy Act of 1969 to determine potential impacts on all lands (regardless of ownership) occurring from the action. Mitigation is proposed as part of the analysis. In addition to this mitigation, federal agencies require protective measures on federal lands. See Appendix 4 for measures that would become stipulations to the right-of-way grants.

After the EIS or other environmental document is prepared, BLM prepares a Record of Decision (ROD), which is signed by the responsible manager. The ROD documents and provides the legal record on any decision made on the requested rights-of-way on federal lands.

After the ROD is released, the applicant must refile its application to reflect any changes in the route that were specified in the ROD. The company also has the opportunity at this point to notify BLM whether it wants the right-of-way or not. If the company does not want the right-of-way grant because of changed plans BLM would not issue the grant. If the company wanted the right-of-way several years later, the BLM would review the EIS to see whether it needed updating prior to granting a right-of-way. Necessary updates would be made if the socioeconomic or physical environment had changed enough to modify impact assessments in the original EIS.

INTRODUCTION—AUTHORIZING ACTIONS

**TABLE 1
MAJOR FEDERAL, STATE, COUNTY, AND LOCAL AUTHORIZING ACTIONS**

Agency	Nature of Action	Authority	Project Feature (Applicable Project)
Department of the Interior			
Bureau of Land Management			
	Grant rights-of-way and issue temporary use permits	Section 28 of the Mineral Leasing Act of 1920.	Pipeline
	Grant rights-of-way and issue temporary use permits	Title V, Section 501, of the Federal Land Policy and Management Act (1976)	Power lines
	Issue materials sales contract	Materials Act of July 31, 1947, as amended; 30 U.S.C. 601, 602, 43 CFR 3600	All facilities
	Issue antiquities or archaeological resource permit to excavate or remove archaeological resources on lands	Antiquities Act of 1906, 16 U.S.C. Sections 431-433; Archaeological Resources Public Protection Act of 1979, 16 U.S.C. Sections 470aa-47011; 43 CFR Part 3	All facilities
Bureau of Reclamation	Grant special land use license or easement	Reclamation Projects Act of August 4, 1939, 35 Stat. 1189, and Section 10	Pipeline
Department of Transportation			
Federal Highway Administration	Issue permit(s) to cross Federal-aid highways	23 U.S.C. Sections 116, 123, 315; 23 CFR Part 645 Subpart B	Pipeline
Department of Agriculture			
Forest Service	Issue special use permits for constructing rights-of-way and facilities	Title V of the Federal Land Policy and Management Act; Section 28 of the Mineral Leasing Act, 1920	Pipeline Microwave site
U.S. Department of the Army			
Corps of Engineers	Issue Section 404 permit for placement of dredged or fill material in waters of the United States or their adjacent wetlands	Section 404 of the Clean Water Act of 1972 (40 CFR 122-123); 33 U.S.C. Section 1344; 33 CFR Parts 323, 325	Pipeline
	Issue Section 10 permit for crossing navigable waters in the U.S.	Section 10 of the River and Harbor Act of 1899, 33 U.S.C. 401-413	Pipeline
Department of the Treasury			
Bureau of Alcohol, Tobacco, and Firearms	Issue permit(s) to purchase, store, and use explosives	Section 1102(a) of Organized Crime Control Act of 1970, 18 U.S.C. Sections 841-848; 27 CFR Part 181	Pipeline

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

TABLE 1 (Continued)

Agency	Nature of Action	Authority	Project Feature (Applicable Project)
Federal Communications Commission	License to operate industrial radio service	Section 303 of Communications Act of 1934, 47 U.S.C. Section 303; 47 CFR Parts 90, 94	Microwave equipment
WYOMING			
Department of Environmental Quality			
Air Quality Division	Issue air quality construction permit	Wyoming Environmental Quality Act, W.S. 35-502-101 through 35-502-1207	Bairoil plant Pipeline
Water Quality Division	Issue National Pollution Discharge Elimination System Permit for discharge of hydrostatic test water and for plant site runoff.	Wyoming Environmental Quality Act, W.S. 35-11-301	Pipeline Treatment plants
	Approval of water supply for personnel if 20 or more service connections are required.	Wyoming Environmental Quality Act, W.S. 35-11-301	Treatment plants
State Highway Department	Issue permits for oversize and overweight loads	Chapters 17 and 20 of the Wyoming Department of Highways Rules and Regulations	Pipeline and plant
	Issue Encroachment permits	Chapter 12 of the Wyoming Department of Highways Rules and Regulations	Pipeline
State Land Board	Issue easements to cross state lands		Pipeline
Wyoming Oil and Gas Commission	Change in depletion plans	Wyoming Oil and Gas Act, W.S. 30-5-110	Well field
Wyoming State Engineers Office	Grant permit to appropriate water for hydrostatic test water	Wyoming Industrial Development Information and Siting Act, W.S.	Pipeline
Wyoming Industrial Siting Administration	Issue Industrial Facility Siting Permit	Wyoming Industrial Development and Siting Act, W.C. 35-12-101 through 35-12-121; Wyoming 1975 Session Laws, Chapter 169, as amended 1977, and 1981.	Treatment plants and appurtenant components

INTRODUCTION—AUTHORIZING ACTIONS

TABLE 1 (Continued)

Agency	Nature of Action	Authority	Project Feature (Applicable Project)
Wyoming Public Service Commission	Issue Certificate of Public Convenience and Necessity	Wyoming Statutes 1977 and Wyoming Administration Procedure Act, W.S. 37-1-101, 37-1-102, 37-1-116, 37-2-117, 37-2-119, 37-2-120, 37-2-122, 37-2-205 through 207, 37-2-210 through 212, 37-3-114, 37-6-101 through 107 Title 49, CFR Parts 191, 192, and 195 of the Department of Transportation regulations for plants and pipelines.	
MONTANA			
Boards of County Commissioners	Issue Right of Way Easements, Road Crossing Permits, Construction and Building Permits, Stream Crossing Permits.		Pipeline
Department of Natural Resources and Conservation	Prepare Environmental Impact Statement		Pipeline
	Grant Water Appropriation Permit		
	Grant Permit to Construct in a Floodplain		
Department of State Lands	Grant Right of Way Easement		Pipeline
	Issue Notification of Intent to Clear right-of-way on Private Lands		
	Issue Permit to Cross State Water Bottoms		
	Grant Permit to excavate 10,000 cubic feet or more of select fill for pipe bedding material.	Open Cut Mining Act	Pipeline
Department of Health and Environmental Sciences Air Quality Bureau	Grant Open Burning Permit		Pipeline
Department of Health and Environmental Sciences Water Quality Bureau	Grant Point Source Discharge Permit (NPDES) 404 Permit Certification		Pipeline

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

TABLE 1 (Continued)

Agency	Nature of Action	Authority	Project Feature (Applicable Project)
Department of Health and Environmental Sciences Solid Waste Management Bureau	Grant Solid Waste Permit		Pipeline
Department of Highways	Grant State and Federal Highway Crossings Grant Special Overweight and Overlength Permits		Pipeline
Local Conservation Districts	Grant 310 Permit	Montana Streambed and Land Preservation Act	Pipeline
State Fire Marshall	Review building plans		Pipeline
NORTH DAKOTA			
State Land Department	Grant Right of Way Easements Issue Permits to Cross State Water Bottoms		Pipeline
State Engineer	Issue Notice of Intent to Use Water Grant Water Use Permit		Pipeline
State Public Service Commission	Grant Route Permit		Pipeline
State Department of Health	Issue Permit to Construct a Source of Air Pollution Issue Permit to Operate a Source of Air Pollution Grant Open Burning Permit Grant Point Source Discharge Permit (NPDES) Grant 404 Permit Certification		Pipeline
State Highway Department	Grant State and Federal Highway Crossings Issue Permit for Oversized and Overweight Loads		Pipeline
State Game and Fish Department	Review and Manage Wildlife Resources		Pipeline

INTRODUCTION—AUTHORIZING ACTIONS

TABLE 1 (Concluded)

Agency	Nature of Action	Authority	Project Feature (Applicable Project)
State Board of Higher Education	Grant Right-of-way easement		Pipeline
Boards of County Commissioners	Approve Right of Way Way Easements, Road Crossings, Construction and Building Permits		Pipeline

Before a right-of-way can be granted, a company must prepare a construction and use plan covering construction of all project facilities on federal land. This plan must be submitted to the authorizing agencies for approval. The plan would contain site-specific procedures for the following sections, based on the types of terrain, soils, vegetation, land uses, and climatic conditions encountered:

- Engineering Proposals and Construction Drawings
- Fire Protection
- Clearing—Visual Resources
- Erosion Control, Revegetation, and Restoration
- Water Resources
- Transportation
- Communications
- Cultural Resources
- Threatened or Endangered Plant and Animal Species Studies and Mitigation
- Wildlife Mitigation
- Blasting
- Pesticide and Herbicide Use
- Health and Safety

Solid Waste
Emergency Response
Air Quality
Spill Prevention Control and Counter Measures

- Construction Schedule
- Housing and Construction Facilities
- Testing (Pipeline)
- Monitoring of Construction
- Operations and Maintenance
- Abandonment

If the proposed projects were approved, BLM and the Forest Service would authorize rights-of-way as needed.

Before construction begins, a company shall pay for required surveys for endangered or threatened species; cultural, historical, and paleontological resources; and nests of federally protected raptors. BLM or the Forest Service then applies mitigation to the construction activities to protect located resources. See Appendix 4 for description of survey requirements and mitigation.

State governments have similar permitting requirements for state lands.

The process used by pipeline companies to obtain easements across private lands is different from that used for federal or state lands. The company's right-of-way agent first contacts the landowner for permission to have a surveyor determine the pipeline center line across the owner's property. At the same time, the right-of-way agent seeks the landowner's permission to conduct the same surveys required to obtain permits to cross federal and state lands.

After the surveyor obtains the necessary data for locating the pipeline within the boundaries of each landowner's property, a plat is prepared. This plat would show the relationship of the pipeline to the property

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

boundaries. The right-of-way agent again meets with the landowners to give them the plat and a proposed document to be used to grant the easement.

The landowners are given time to review the document and discuss it with their advisors. When the parties are in agreement, the landowner will sign the right-of-way grant and deliver it to the right-of-way agent who will have it recorded in the County Clerk's office.

Across private lands, Exxon would seek a 50-foot-wide permanent easement, with an additional temporary 50-foot-wide construction easement. Shell would seek a 40-foot-wide permanent easement with an additional 40-foot-wide construction easement. Construction and rehabilitation procedures would be the same as those used on comparable federal and state lands, or as the landowner requires.

With the landowners' permission, private land would be surveyed for such resources as threatened or endangered species and cultural resources. If the project conflicted with any resources found, a mitigation plan would be developed. The mitigation plan would be reviewed and approved by the landowner before any mitigation began.

Interrelationships

INTERRELATED PROJECTS

Twelve projects could foreseeably coincide with construction of the Bairoil/Dakota project. These projects are described in Table 2 and shown on Map 1. The interrelated projects would collectively employ 5,070 persons and cause impacts in the same locations and within the same time as impacts caused by the Proposed Action or alternatives.

**TABLE 2
INTERRELATED PROJECTS**

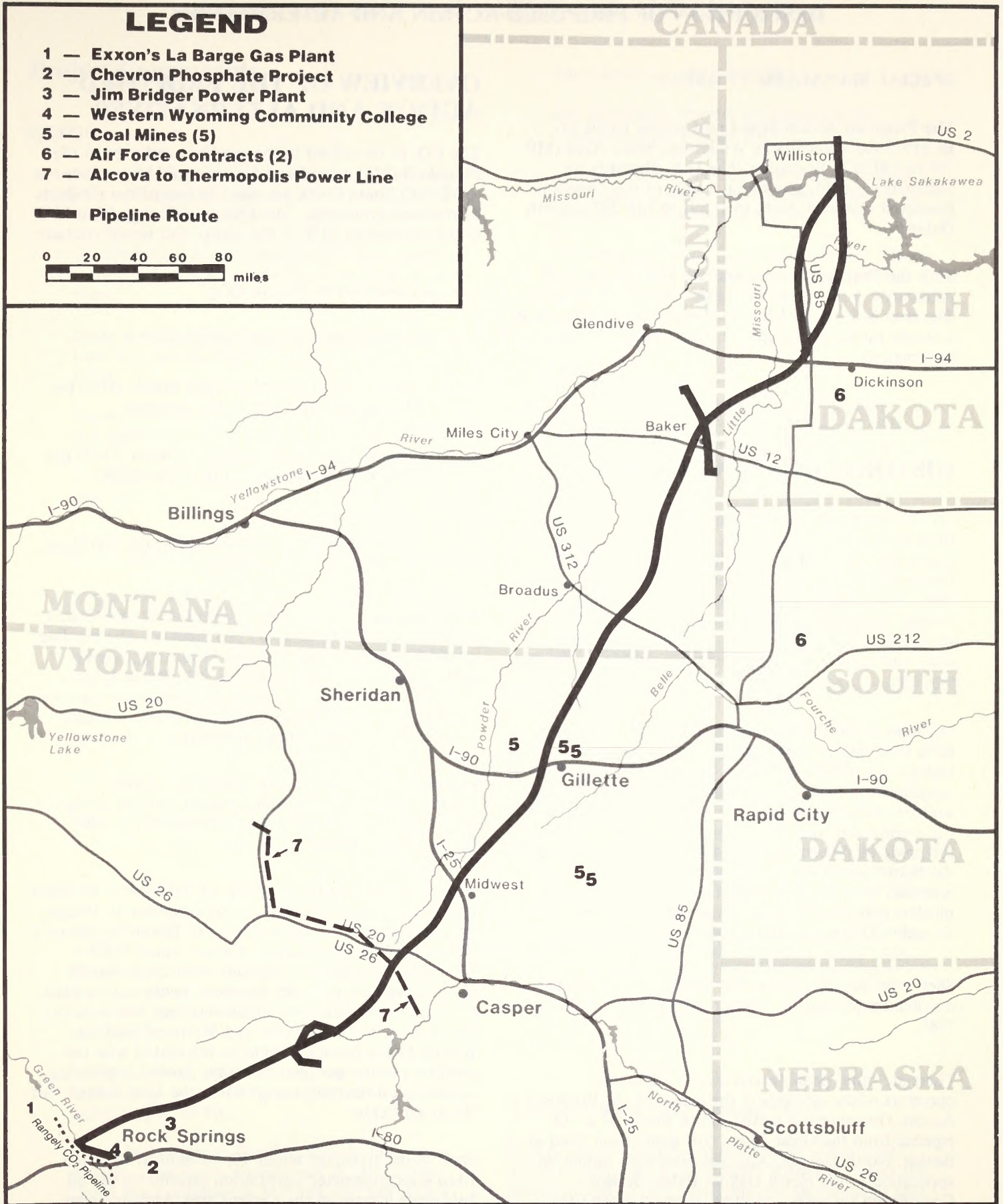
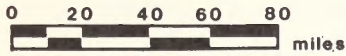
Project	Description	Location
Exxon's La Barge Gas Plant at Shute Creek Site (Phases I and II)	Construction of a 1.3 billion cubic feet per day gas treatment plant, including compressor station & CO ₂ pipeline in Rangely, CO	20 miles northeast of Opal, Wyoming (Lincoln and Sweetwater)
Chevron Phosphate Project	Construction of a fertilizer plant and 98-mile-long slurry pipeline from a mine near Vernal, Utah to the plant	4 miles south of Rock Springs, Wyoming (Sweetwater County)
Jim Bridger Power Plant	Retrofitting of pollution control equipment	26 miles northeast of Rock Springs, Wyoming (Sweetwater County)
Western Wyoming Community College	Expansion	Rock Springs, Wyoming (Sweetwater County)
Coal Mines	Five new mines: Dry Fork (Phillips) East Gillette (Kerr McGee) North Rochelle (Shell) Rochelle (Peabody) Echeta (Nerco)	Converse & Campbell counties, Wyoming
Thermopolis/Alcova Transmission Line	Construction of a transmission line, about 122 miles long, from Alcova to Thermopolis	In Natrona and Fremont counties
Air Force Contracts	Construction of two bombing ranges	Butte County, South Dakota & Stark County, North Dakota

*Refer to Glossary for definition.

LEGEND

- 1 — Exxon's La Barge Gas Plant
- 2 — Chevron Phosphate Project
- 3 — Jim Bridger Power Plant
- 4 — Western Wyoming Community College
- 5 — Coal Mines (5)
- 6 — Air Force Contracts (2)
- 7 — Alcova to Thermopolis Power Line

— Pipeline Route



MAP 1 INTERRELATED PROJECTS

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

SPECIAL MANAGEMENT AREAS

The Proposed Action would pass within 1 mile of BLM's Sweetwater Rocks Wilderness Study Area (MP 134 to 140.5) in Wyoming. The U.S. Highway 85 Alternative would pass within 1 mile of the Theodore Roosevelt National Park, (MP 582 to MP 587), North Dakota.

Both the Proposed Action and the U.S. Highway 85 Alternative would cross the Little Missouri River twice. The river is designated by the State of North Dakota as a Scenic River. See Chapter 2, Recreation, for more information.

HISTORY AND BACKGROUND

On October 1, 1984, Amoco applied to the Rawlins BLM District Office for a CO₂ pipeline right-of-way. Exxon and Amoco then coordinated and agreed to let Exxon build the pipeline instead. On November 26, 1984, Exxon applied for the pipeline right-of-way to Bairoil, Wyoming, and on December 11, 1984, Amoco submitted a project description for the gas processing plant and acknowledged that Exxon would apply for the pipeline.

On January 18, 1985, Exxon submitted an application for a CO₂ pipeline from Bairoil to Tioga, North Dakota. On February 7, 1985, Amoco submitted an amendment to its original application to reinstate, with some modification, its proposal for a CO₂ pipeline from the origin point to Bairoil. In addition, Amoco added the crude oil pipeline and the crude oil storage tank at the Bairoil spur junction. In April 1985, Amoco amended its application again to include a length of CO₂ pipeline that would parallel (within 25 to 35 feet) the Rangely CO₂ pipeline and tie into the original route.

Shell submitted its right-of-way application for a CO₂ distribution pipeline near Baker, Montana on April 18, 1985.

There are other possible sources of CO₂ for the operators of the oil fields in the region of the Proposed Action. One alternate partial source would be a CO₂ pipeline from the Great Plains coal gasification plant at Beulah, North Dakota. Amerada Hess may submit an application to the North Dakota Public Service Commission for such a pipeline. It could move CO₂ from the plant to serve both its own oil fields near Tioga, North Dakota and the Shell-operated oil fields near Baker, Montana.

OVERVIEW OF THE PROPOSED ACTION AND ALTERNATIVES

The CO₂ to be carried in the pipelines and used at the Bairoil oil field and other markets would be produced at the Exxon Shute Creek gas plant as one of the products of methane processing. The CO₂ would range from 75°F in the summer to 34°F in the winter and would contain:

- no less than 96 percent CO₂;
- no more than 2 percent nitrogen;
- no more than 1 grain hydrogen sulfide (H₂S) per 100 standard cubic feet (0.001 percent);
- no more than 4 to 10 pounds of water (H₂O) per million standard cubic feet (0.003 to 0.008 percent); and
- no more than 20 grains total sulfur per 100 standard cubic feet (0.02 percent).

Exxon would transport 450 to 500 MMcfd of CO₂ in a high-pressure (1,800 to 2,400 psi) pipeline. The pipeline would begin near Rock Springs, Wyoming, extend through Wyoming and Montana, into North Dakota where it would terminate at Tioga. From its origin, the pipeline would become progressively smaller, ranging from 20 to 18 to 16 inches in diameter.

Exxon would deliver CO₂ to Amoco at Bairoil, Wyoming and to other undetermined markets along the way, ending with a delivery to Amerada Hess near Tioga, North Dakota.

Amoco would also transport up to 200 MMcfd of CO₂ in a 20-inch-diameter, high-pressure pipeline to Bairoil, Wyoming, should an agreement with Exxon to deliver it not be reached. In addition, Amoco would build a 110 MMcfd gas plant to separate natural gas liquids (NGL-propanes, pentane, butanes), hydrocarbon gases, CO₂, and miscellaneous components that would be produced from its Lost Soldier and Wertz oil fields at Bairoil. Other facilities would be associated with the pipeline and the gas plant. Finally, Amoco is planning enhanced oil recovery using CO₂ in the Lost Soldier and Wertz oil fields.

Shell would transport about 100 MMcfd of CO₂ in a 10-to 4-inch-diameter distribution pipeline to the oil field units located in the Cedar Creek Anticline near Baker, Montana. Shell is planning enhanced oil recovery using CO₂ in this area, but only the CO₂ distribution pipeline is analyzed in this EIS.

OVERVIEW OF PROPOSED ACTION AND ALTERNATIVES

Project Components

EXXON

- 643.5-mile-long, 20-, 18-, and 16-inch-diameter CO₂ main pipeline from the origin point (MP 26 of Rangely CO₂ pipeline);
- 20-mile-long, 12-inch-diameter CO₂ spur pipeline from the Bairoil spur junction to the Bairoil gas plant;
- meter station, block valve, scraper receipt/launch trap, and communications antenna at the origin point;
- booster station at MP 35.5, including scraper traps and block valves;
- 28 block valves along the pipeline at 20-mile intervals;
- block valve and scraper receipt/double launch trap at the Bairoil Spur Junction (MP 111);
- five scraper receipt/launch traps along the pipeline at about 100-mile intervals;
- a building housing a meter station, at the Tioga terminal (MP 643.5) underground valve, scraper receiver, and communications antenna;
- meter station at Bairoil gas plant;
- meter station at Cedar Creek complex; and
- two microwave repeater stations.

AMOCO

- 154-mile-long, 20-inch-diameter CO₂ pipeline;
- 20-mile-long, 10-inch-diameter crude oil pipeline from the gas plant back to the junction of the main CO₂ pipeline route and spur route (Bairoil spur junction);
- booster station, meter station, block valve, scraper launch trap, and microwave tower at origin point facilities (MP 48.9R).
- seven block valves at 20-mile intervals along the pipeline, near roads, and in pairs at each of the Green River crossings at MP 38R and MP 3 (the block valve at MP 3 is one half of a pair, the other half occurring at MP 0). (See Map A-2 for locations of block valve pairs.);

- one booster station at MP 68;
- one microwave repeater station on Green Mountain at an existing site;
- terminal facilities including gas treatment plant, meter station, scraper receipt trap, block valve, and four NGL storage tanks; and
- 150,000-barrel crude oil storage tank and 500 to 600 horsepower electric pump at the Bairoil Junction.

SHELL

- 65-mile-long CO₂ distribution pipeline (The pipeline would be 10 inches in diameter at its intersection with the Exxon pipeline, narrowing to 4 inches at each end);
- six block valves;
- receipt meter station and pump station at this pipeline's intersection with the Exxon main CO₂ pipeline;
- eight CO₂ delivery meter stations at each of the unit injection facilities; and
- fiber optic, cable-based communications system.

As Figure 1 shows, construction of all pipelines would start in April 1986 and be completed by June 1987. The Amoco plant at Bairoil would be completed in December 1987. CO₂ injection at the Amoco Bairoil field is scheduled to begin in the late summer of 1986.

The CO₂ injection program at Bairoil is planned to last about 10 years but could be extended for as long as the program was successful. This EIS analyzes a combined project life of 30 to 35 years before abandonment. Other enhanced oil recovery programs resulting from the projects analyzed in this document would need further compliance under the National Environmental Policy Act.

Land Status and Ownership

The proposed project components would involve federal, state, and private lands. Appendix 5 lists the miles by land status, ownership, or management that would be affected by the Proposed Action or alternatives. Map A-1 (inside back pocket) shows land ownership and management by acres and percentages.

1987

1986

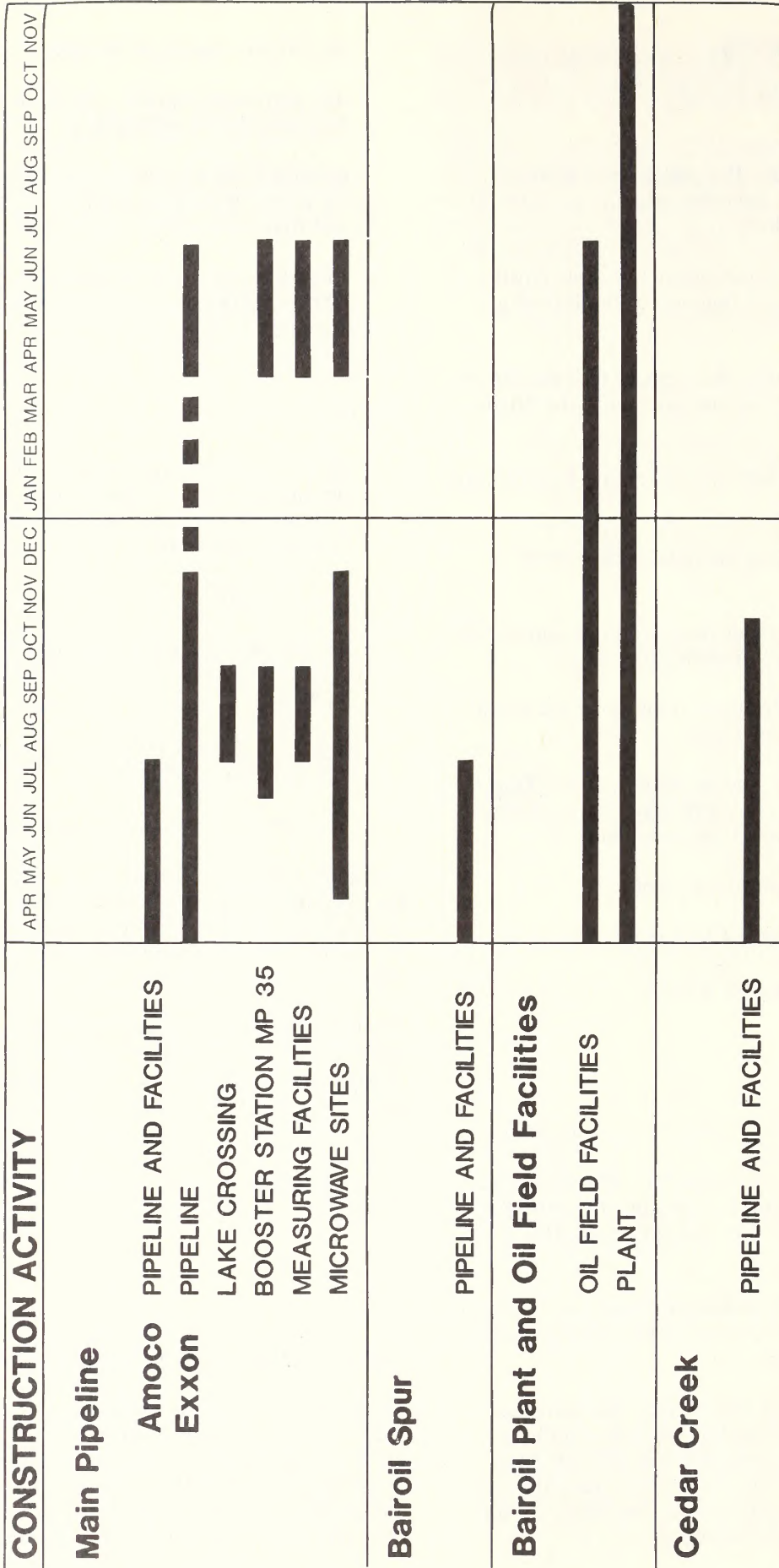


FIGURE 1 PROPOSED ACTION CONSTRUCTION SCHEDULE

PROPOSED ACTION DESCRIPTION

PROPOSED ACTION DESCRIPTION

Exxon Wyoming-Dakota Project

Exxon would build a 643.5-mile-long CO₂ pipeline from the origin point (MP 0.0) at MP 26R of the Rangely CO₂ pipeline to Tioga, North Dakota (MP 643.5). Exxon would also build a 20-mile-long spur to serve Amoco's proposed enhanced oil recovery project at Bairoil, Wyoming. Exxon considers the pipeline to be two projects: the Bairoil pipeline and spur and the Dakota pipeline. For purposes of this EIS, BLM is considering the two pipelines as one proposal totalling 663.5 miles. The first 140 miles would parallel the Frontier pipeline.

The Exxon 20-inch-diameter main CO₂ pipeline would pass about 20 miles from Bairoil, Wyoming. The 12-inch-diameter spur pipeline would begin at MP 111 and go 20 miles to Bairoil along an existing pipeline corridor. (See Figure 2 for Exxon's proposed Bairoil junction facilities; Amoco's facilities are not shown.)

At the Bairoil junction (MP 111), the main CO₂ pipeline would narrow to 18 inches in diameter. The route would then continue northeast to pass west of Casper and Gillette, Wyoming, where the pipeline would again narrow from 18 inches to 16 inches in diameter (MP 280). A total of 375.5 miles of pipeline would be built in Wyoming. The pipeline would enter eastern Montana at MP 355.5 southeast of Broadus and pass just northwest of Ekalaka and Baker, Montana. It would then leave Montana and enter North Dakota at MP 487. A total of 131.5 miles of the pipeline would be in Montana.

Once in North Dakota, the proposed route would cross the Little Missouri National Grasslands administered by the Forest Service. It would follow a designated Forest Service corridor east through the Grasslands and then head northeast toward Belfield, North Dakota, near MP 533. From there, it would swing north and then northeast to pass near Killdeer, North Dakota. The route would then turn north again and cross Lake Sakakawea, ending at a point near Tioga, North Dakota. A total of 156.5 miles of pipeline would be built in North Dakota. (See Map 2 for location of Exxon's proposed project.)

BLOCK VALVES

Block valves are used to block the flow of CO₂ when necessary. Although most of Exxon's block valves would be motorized, some would be hydraulic if a nearby source of power was not available.

Twenty-eight block valves would be placed at 20-mile intervals along the pipeline, including MP 3.2 (the east bank of the Green River) and the crossing of Lake

Sakakawea. Block valves would also be placed at the origin point (MP 0.0) and at all other facility locations including the booster station, the Bairoil junction, the Cedar Creek meter, and the Tioga terminal. Each block valve would occupy about 1/10 acre for the life of the project.

See Table 3 for a listing by milepost of all ancillary facilities associated with Exxon's proposed pipelines and Figures 3 and 4 for a typical block valve and meter station.

SCRAPER TRAPS

Scraper traps are used to clean and remove moisture from the inside of the pipeline after construction. After the internal scraper or *pig* is placed in the scraper launcher, it is forced by gas pressure through the pipe. The pig is caught at the scraper receiver or trap and removed along with the collected rust and debris. Generally, the scraper traps are not needed again (as they are with crude oil pipelines) unless maintenance work is done.

Scraper launchers and receivers would be located on the proposed Exxon pipeline at the same locations as other ancillary facilities. In addition, there would be five other scraper launchers and traps, not associated with other ancillary facilities. See Table 3 for a listing of locations by milepost and Figure 5 for a typical scraper trap.

BOOSTER STATIONS

A booster station would be built at MP 35.5, adjacent to the proposed midpoint booster station site on the existing Frontier pipeline. The booster station would be used to increase the pressure of the CO₂ to 2,400 pounds per square inch (psi) so sufficient volumes could be sent to Tioga, North Dakota. Power for the booster station would be purchased from Pacific Power and Light; a 20-mile-long, wooden pole power line, which will be analyzed in another environmental document, would be built from the south to serve Exxon's and eventually Frontier's proposed stations. Exxon's booster station would have three centrifugal pumps, each driven by a 1,500 horsepower motor. One of the units would be used as a spare to allow periodic maintenance during continuous operation.

See Figure 6 for a typical booster station. The pumps, controls, and maintenance facilities would be enclosed in a pump house with a surface area, 40 feet by 80 feet. A communications antenna, an electrical substation, and a scraper launcher would also be located at this facility. All components would be designed so that forms, material types, textures, and colors blended into the surrounding scenery. The whole facility would cover about 1 acre.

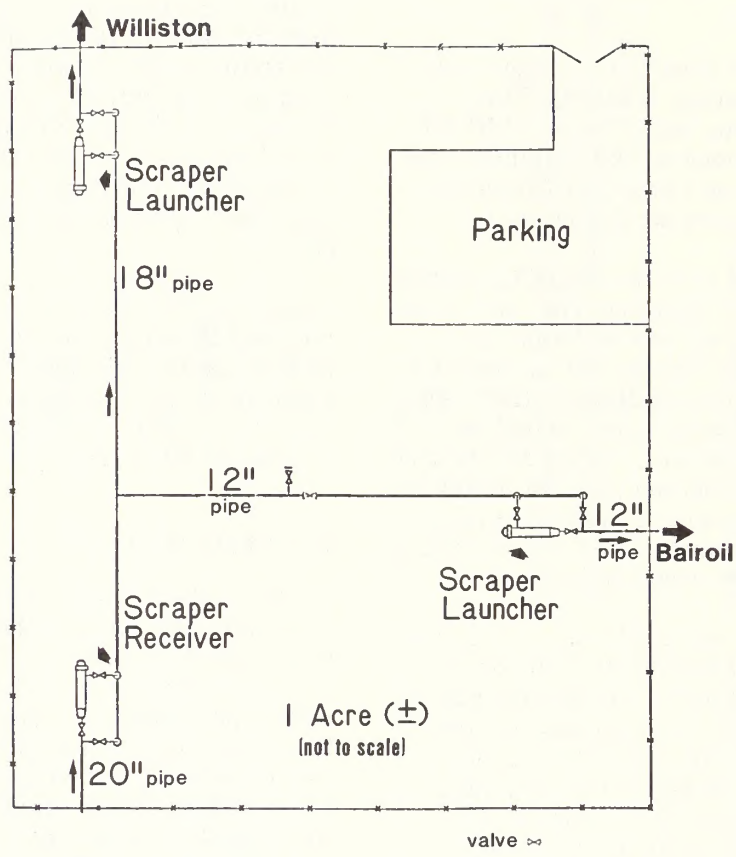


FIGURE 2 PROPOSED JUNCTION FACILITIES



MAP 2 EXXON WYOMING-DAKOTA PROJECT

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

**TABLE 3
PROPOSED ACTION MILEPOST LISTING OF ANCILLARY FACILITIES**

MILE-POST ¹	BLOCK VALVE		SCRAPER TRAP		METER STATION		BOOSTER STATION		FEATURE
	Exxon	Amoco	Exxon	Amoco	Exxon	Amoco	Exxon	Amoco	
49.0 R					X ²				
38.3 R		X							
38.2 R									E. Bank-Green River
38.1 R									W. Bank-Green River
38.0 R		X							
26.0 R									End of R Milepost
0.0	X	X	X	X	X	X		X	Origin
2.6									SW Bank-Green River
2.7									NE Bank-Green River
3.2	X	X							
23.0	X	X							
35.5	X	X	X	X				X	Booster Station
57.7	X	X							
68.1		X		X				X	
80.1	X	X							
98.1	X	X							
111.4/0.0 S	X	X	X	X					Bairoil Junction
20.0 S					X				Meter Station at Plant
131.3	X								
133.6									Sweet Water River
138.3									Beef Gap
149.1	X								
168.4	X								
172.4	X								
178.3									Middle Fork Casper Creek
187.5	X		X						
205.2	X								
226.4	X								
226.5									Interstate 25
234.3									Salt Creek
244.7	X								
265.0	X								
282.4	X		X						
301.4	X								
312.2	X								
334.7	X								
336.1									Little Powder River
355.0									WY-MT State Line
358.8	X								
375.4	X		X						
395.4	X								

PROPOSED ACTION DESCRIPTION

TABLE 3 (Concluded)
PROPOSED ACTION MILEPOST LISTING OF ANCILLARY FACILITIES

MILE-POST ¹	BLOCK VALVE		SCRAPER TRAP		METER STATION		BOOSTER STATION		FEATURE
	Exxon	Amoco	Exxon	Amoco	Exxon	Amoco	Exxon	Amoco	
417.1	X								
433.3									Little Beaver Creek
435.8	X								
455.2	X								
467.0	X				X				Cedar Creek Meter Station
473.8	X								
487-									MT-ND State Line
497.0	X		X						
510.4									W. Bank-Little Missouri River
510.5									E. Bank-Little Missouri River
526.9	X								
532.3									Interstate 94
543.0									Proposed Action and Alternative Divide
546.5	X								
568.5	X								
583.0	X								
587.8									S. Bank-Little Missouri River
588.0									N. Bank-Little Missouri River
609.5	X		X						
622.0									Proposed Action and Alternative (MP A626) Join
625.5	X								
625.8									S. Side-Lake Sakakawea
628.0									N. Side-Lake Sakakawea
629.0	X								
643.5	X		X		X				Tioga Terminal

¹Letters following milepost numbers represent the following pipelines: R = Rangely; S = Bairoil spur, D = Cedar Creek distribution pipeline.

²Analyzed in Rangely EIS (BLM 1984a).

COMMUNICATIONS SYSTEM

The communications system would consist of microwave radio equipment installed at and between major project facilities. The system would provide the following services:

- Fixed-station voice communication: Telephone service for operations personnel;
- Mobile communication: Radio communication for maintenance bases and associated field units; and

- Data communication: Digital data transmission for the supervisory control system.

Exxon's proposed communications system would consist of four terminal stations located at the origin point; Bairoil, Wyoming; the Cedar Creek meter station; and Tioga, North Dakota. Twenty repeater stations would also be located on or near the pipeline route. All but six of these repeater stations would be built at existing microwave sites. (See Table 4 for locations of microwave sites.)

At the terminals, the communications equipment would be housed in buildings needed for the other facilities.

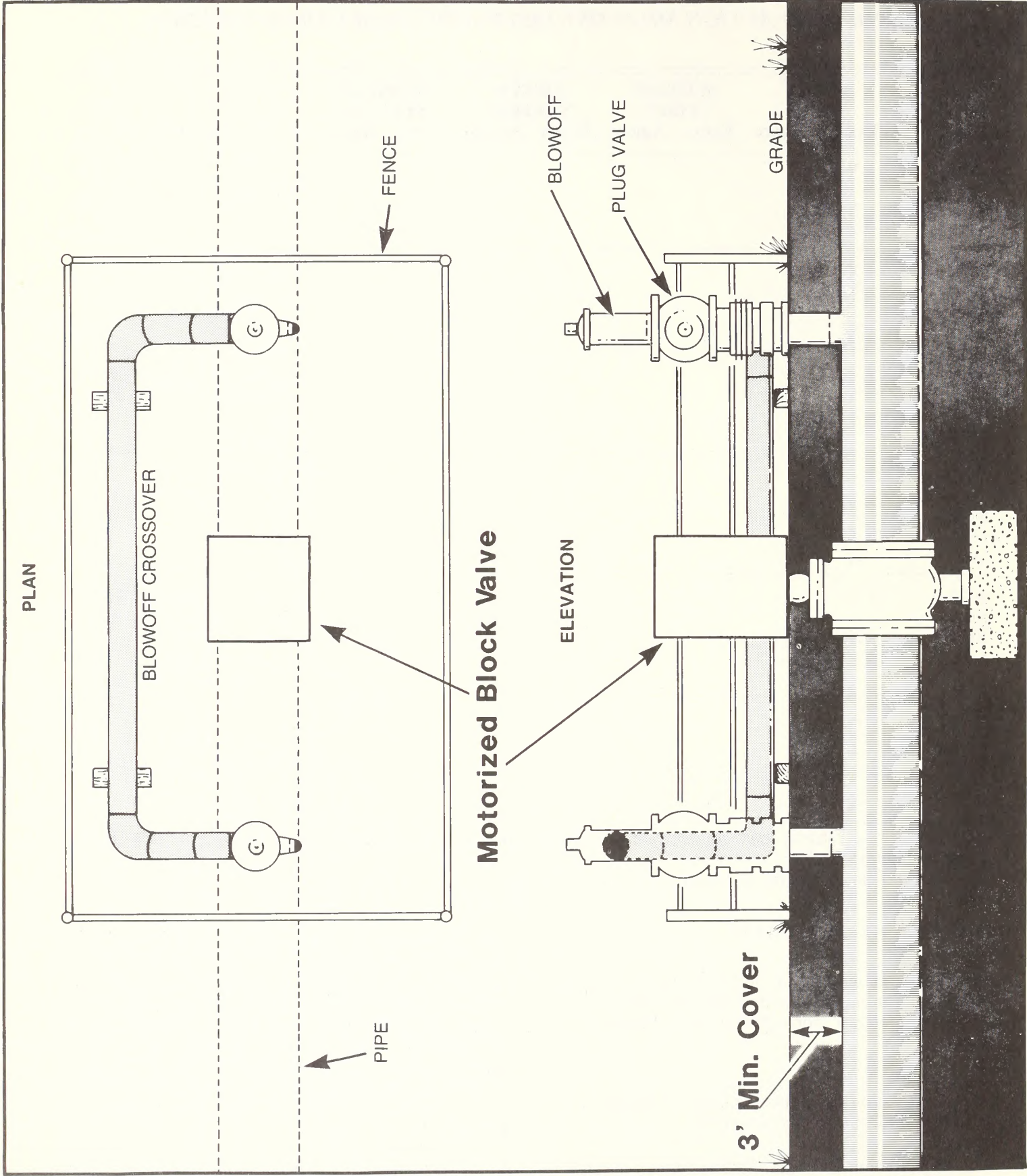


FIGURE 3 TYPICAL BLOCK VALVE

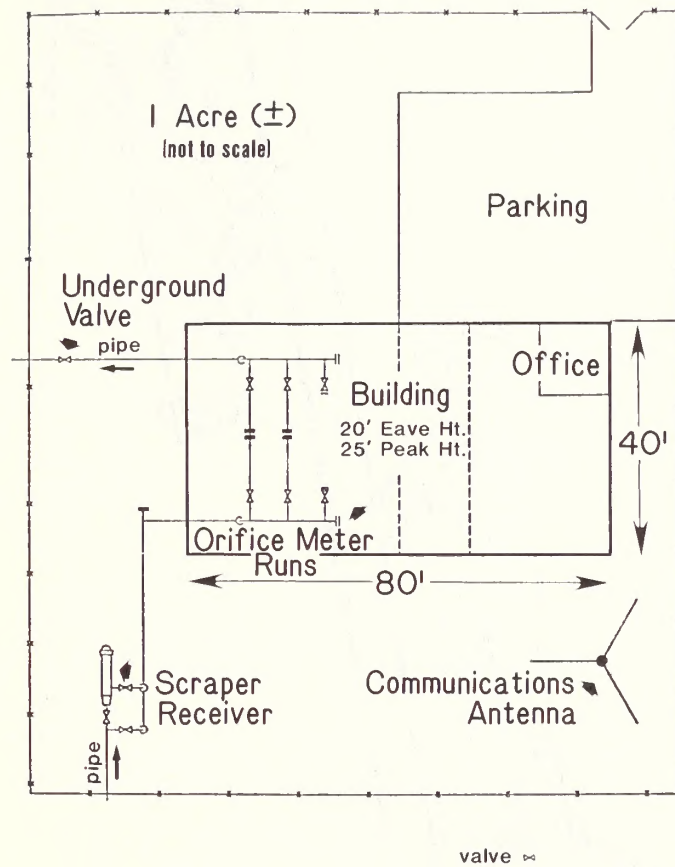


FIGURE 4 TYPICAL METER STATION

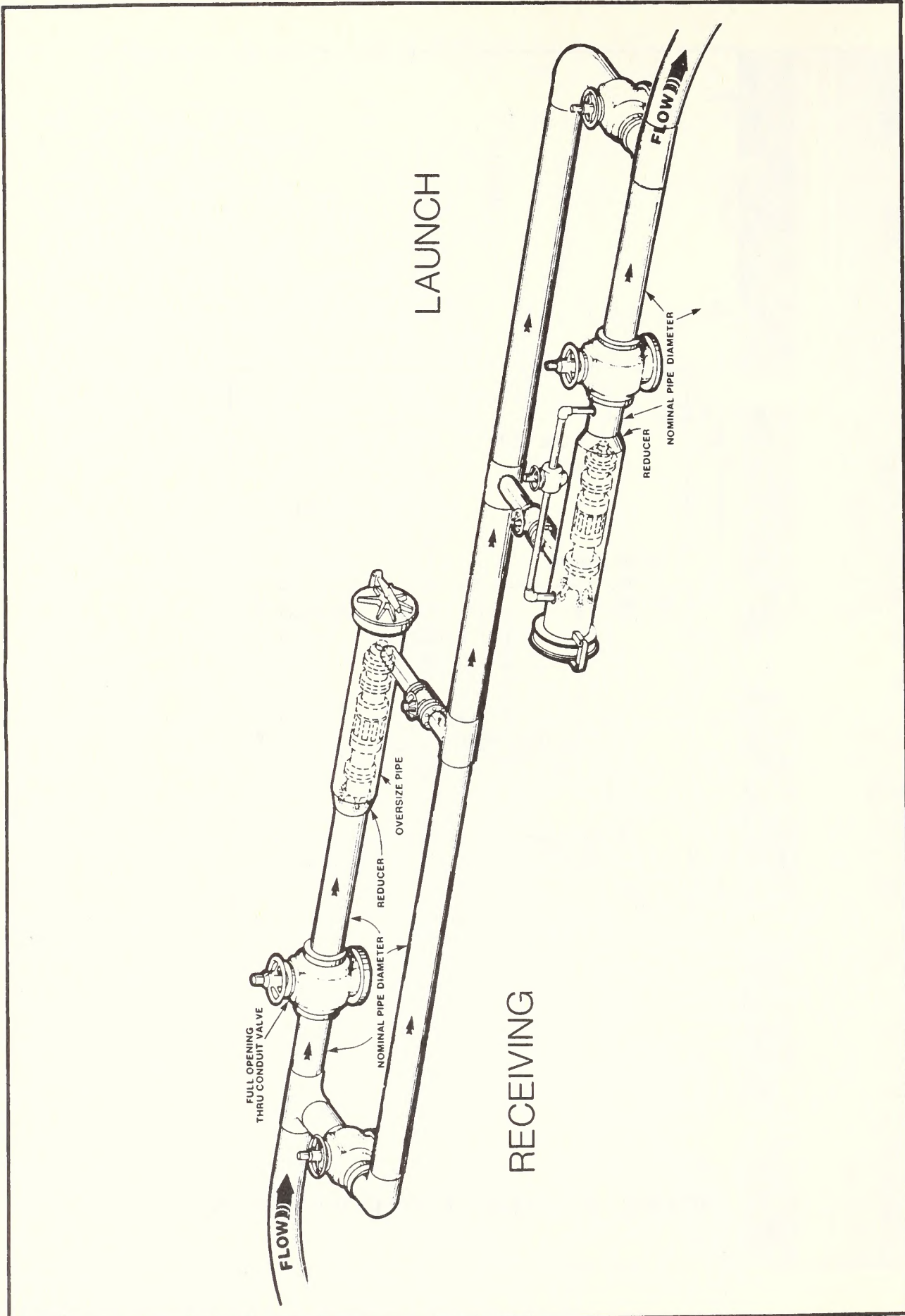


FIGURE 5 TYPICAL SCRAPER TRAP

PROPOSED ACTION DESCRIPTION

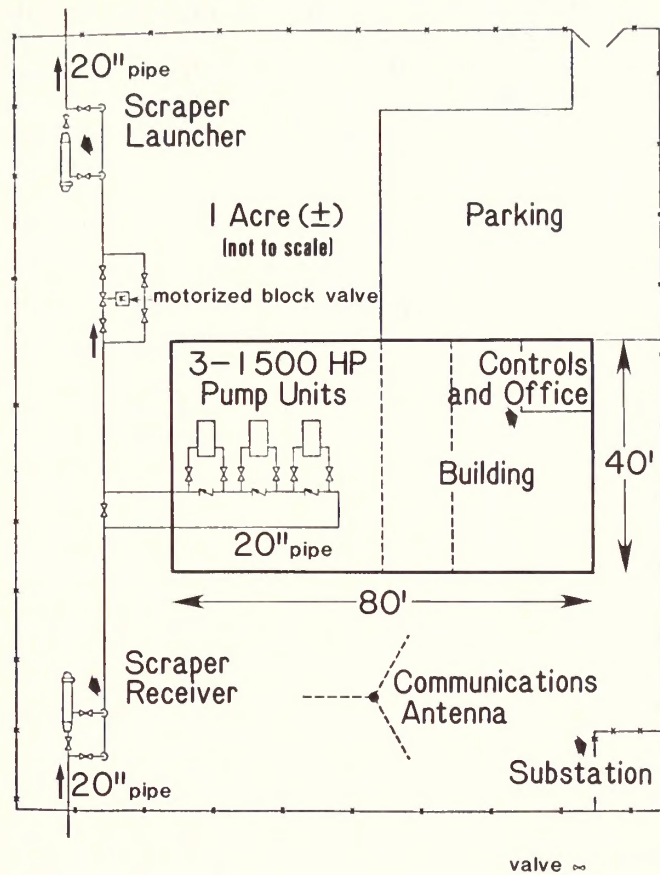


FIGURE 6 TYPICAL BOOSTER STATION

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

TABLE 4
MICROWAVE SITES
PROPOSED ACTION, SINGLE BAIROIL PIPELINE ALTERNATIVE,
U.S. HIGHWAY 85 ALTERNATIVE & CROOKS GAP OPTION

Site	Name	State	Location*	Remarks
1.	Pacific Creek	WY	SE, NW, Sec 10, T25N, R105W	Adjacent to Existing Site—7 miles NE of Larson
2.	Atlantic City	WY	NW, NW, Sec 17, T29N, R98W	Adjacent to Existing Site—7.5 miles E of Atlantic City
3.	Crooks Mt.	WY	SE, SW, Sec 16, T28N, R93W	Adjacent to Existing Site—9 miles SW of Jeffrey City
4.	Separation Peak	WY	SE, NW, Sec 11, T19N, R88W	Adjacent to Existing Site—13 miles SW of Rawlins
5.	Cyclone	WY	NW, SW, Sec 9, T33N, R88W	Adjacent to Existing Site—32 miles N of Jeffrey City
6.	Casper Mt.	WY	SW, NW, Sec 18, T32N, R79W	Adjacent to Existing Site—6 miles S of Casper
7.	Edgerton	WY	NW, SE, Sec 16, T40N, R77W	Adjacent to Existing Site—7.5 miles E of Edgerton
8.	North Butte	WY	SW, NE, Sec 14, T44N, R76W	Adjacent to Existing Site—14 miles NW of Pine Tree
9.	Gillette	WY	NW, SW, Sec 27, T49N, R74W	Adjacent to Existing Site—13 miles SW of Gillette
10.	Wildcat	WY	NW, NE, Sec 30, T54N, R72W	New Site—23.5 miles N of Gillette
11.	Rockpoint	WY	NE, NE, Sec 27, T57N, R69W	New Site—2 miles W of Rockpoint
12.	Alzada	MT	NW, SE, Sec 6, T9S, R59E	New Site—6.5 miles NW of Alzada
13.	East Fork Lo Ck	MT	NW, SE, Sec 3, T6S, R59E	New Site—14.5 miles NW of Albion
14.	Coal Creek	MT	SW, NW, Sec 6, T1N, R60E	New Site—11 miles E of Ekalalsa
15.	Willard	MT	NW, SW, Sec 33, T6N, R59E	New Site—9 miles S of Baker
16.	Big Hill	MT	SE, NE, Sec 30, T9N, R60E	Adjacent to Existing Site—10 miles N of Baker
17.	Sentinel	ND	SW, SW, Sec 5, T139N, R104W	Adjacent to Existing Site—7.5 miles SE of Beach
18.	Fryburg	ND	SE, SE, Sec 8, T139N, R100W	Adjacent to Existing Site—6 miles W of Belfield
19.	Killdeer	ND	NE, SW, Sec 21, T146N, R96W	Adjacent to Existing Site—9.5 miles NW of Killdeer
20.	Keene	NS	NE, SW, Sec 18, T152N, R96W	Adjacent to Existing Site—5 miles NW of Keene

*Locations given to nearest 1/16 of a section.

The antenna would be mounted on a tower 20 to 300 feet high. Towers less than 100 feet high would be self-supported, whereas towers higher than 100 feet would be guyed.

Each of the 20 proposed repeater stations would require an area about 50 by 50 feet, enclosed by a chain link fence. Equipment would be housed in a 8- by 12-foot building. A 20- to 300-foot-high tower would support four microwave dishes and a small VHF antenna. Dual antennas on each path would be used on long expanses to alleviate multipath fading. Towers less than 100 feet high would be self-supported. See Figure 7 for a typical microwave repeater station.

The communications system would use radio frequencies in the portion of the spectrum designated as *Private Operation, Fixed Microwave Services*. A frequency engineering analysis would be performed to ensure that the proposed facilities would not cause interference with existing or previously applied-for stations in this service. The frequency would be analyzed by competent commercial organizations, recognized by the Federal Communications Commission (FCC), that would prepare the exhibits needed as part of the licensing process.

Voice channels would be used for fixed-station voice communication. Telephone sets would be provided at the booster station, terminals, and main communications control room in the office.

A mobile radio system would provide voice communication for vehicles serving the pipeline. This system would be licensed by the FCC in accordance with standard procedures. Antennas would be mounted on the microwave towers and are expected to consist of one fiberglass-covered element, about 18 inches long and 1.5 inches in diameter.

PIPELINE SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

Exxon plans to use a SCADA system to transmit data on pressure, temperature, flow rate, and total flow, from the booster and meter stations to the control center at the Shute Creek plant. The SCADA system would provide a pipeline pressure and status alarm system.

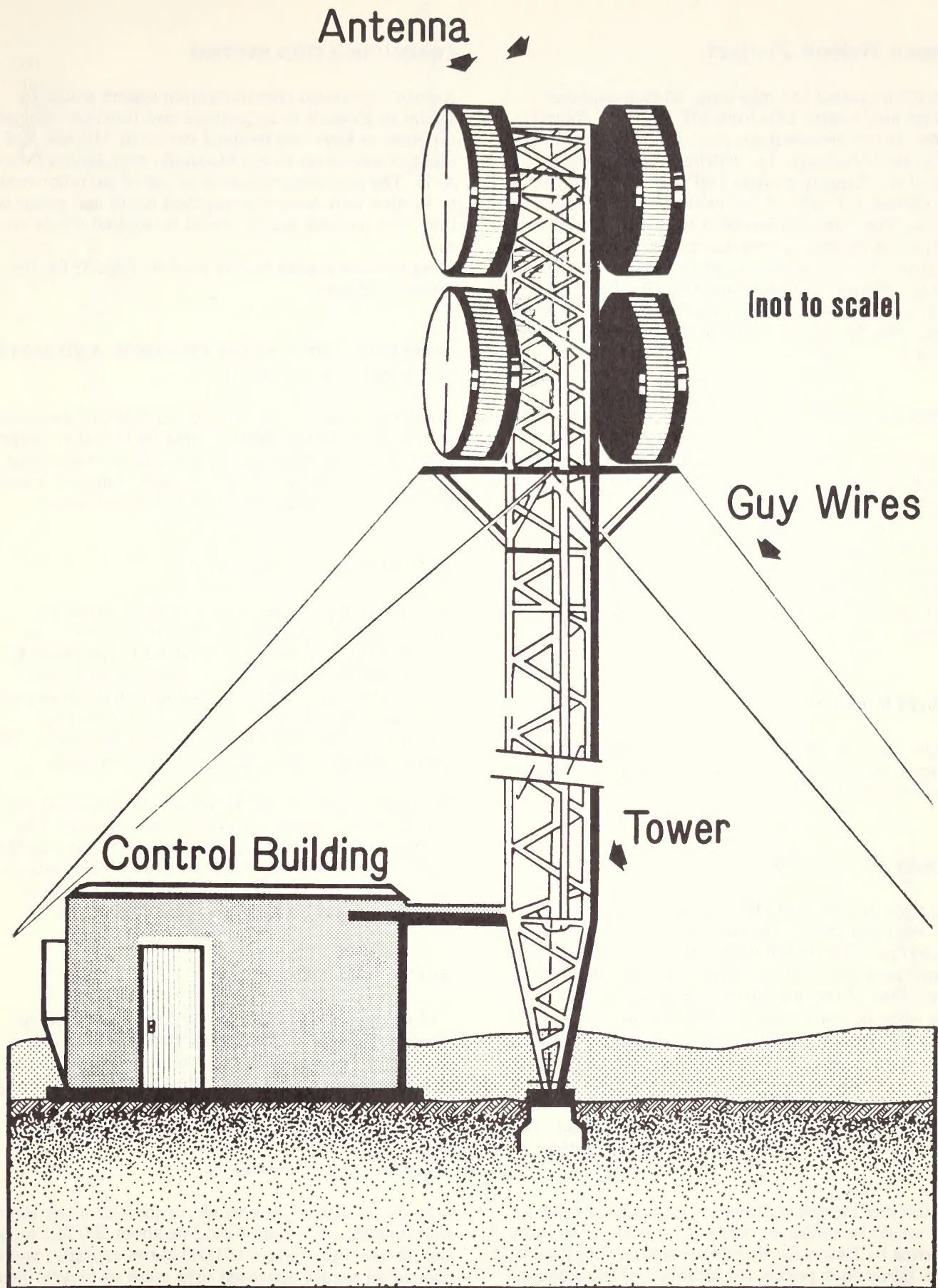


FIGURE 7 TYPICAL MICROWAVE REPEATER STATION

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

Amoco Bairoil Project

Amoco's proposed 154-mile-long, 20-inch-diameter pipeline would carry CO₂ from MP 49 of the Rangely pipeline to the proposed gas plant in Bairoil, northwest of Rawlins, Wyoming. The pipeline would parallel 23 miles of the Rangely pipeline (MP 49 to MP 26) and then parallel 111 miles of the existing Frontier crude oil pipeline. The Rangely pipeline is owned by Exxon and the Frontier pipeline is operated by the Amoco Pipeline Company. The pipeline segment to the Bairoil field from the Frontier corridor would be 20 miles long and would parallel several existing pipelines at a distance of 25 feet. (See Map 3 for location of the Amoco Bairoil project.)

BLOCK VALVES

Five mechanical block valves would be placed at 20-mile intervals along the pipeline, including a block valve installed at the origin point and at MP 3 on the east side of the Green River. Block valve pairs would also be placed at the booster station at MP 68 and at the gas treatment plant. A typical block valve is shown in Figure 3. See Table 3 for a listing by milepost of all ancillary facilities associated with Amoco's proposed pipeline.

SCRAPER TRAPS

Scraper launchers and traps would be located on the proposed Amoco pipeline, in conjunction with various other ancillary facilities.

BOOSTER STATIONS

A booster station would be built at the origin point (MP 49R) and used to increase the pressure of the CO₂ to 2,400 psi. The station would have three centrifugal pumps, each driven by a 1,500 horsepower electric motor. One of the units would be used as a spare to allow periodic maintenance during continuous operation. Power would be purchased from Pacific Power and Light.

A second booster station, similar to the first, would be located at MP 68. Power to the site would be provided by a 10-mile-long power distribution line from the south.

The facilities located in Amoco's proposed booster stations would be similar in type and appearance to those proposed by Exxon for its booster station. See Map A-2 in the inside back pocket for locations of these booster stations.

COMMUNICATION SYSTEM

Amoco's proposed communication system would be similar to Exxon's in appearance and function. Amoco proposes to have one terminal station at MP 49R and a repeater station on Green Mountain near Bairoil (Map A-2). The microwave terminal at the origin point would be located with Amoco's proposed meter and pump station. The repeater station would be located within an existing repeater station facility used by Amoco for the Frontier pipeline.

PIPELINE SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA)

Amoco proposes to use the Amoco-patented system to provide SCADA capabilities. Data on pressure, temperature, flow rate, and total flow would be transmitted to the control center at the Bairoil plant. Amoco's system would provide pipeline pressure and status alarms.

GAS PROCESSING PLANT

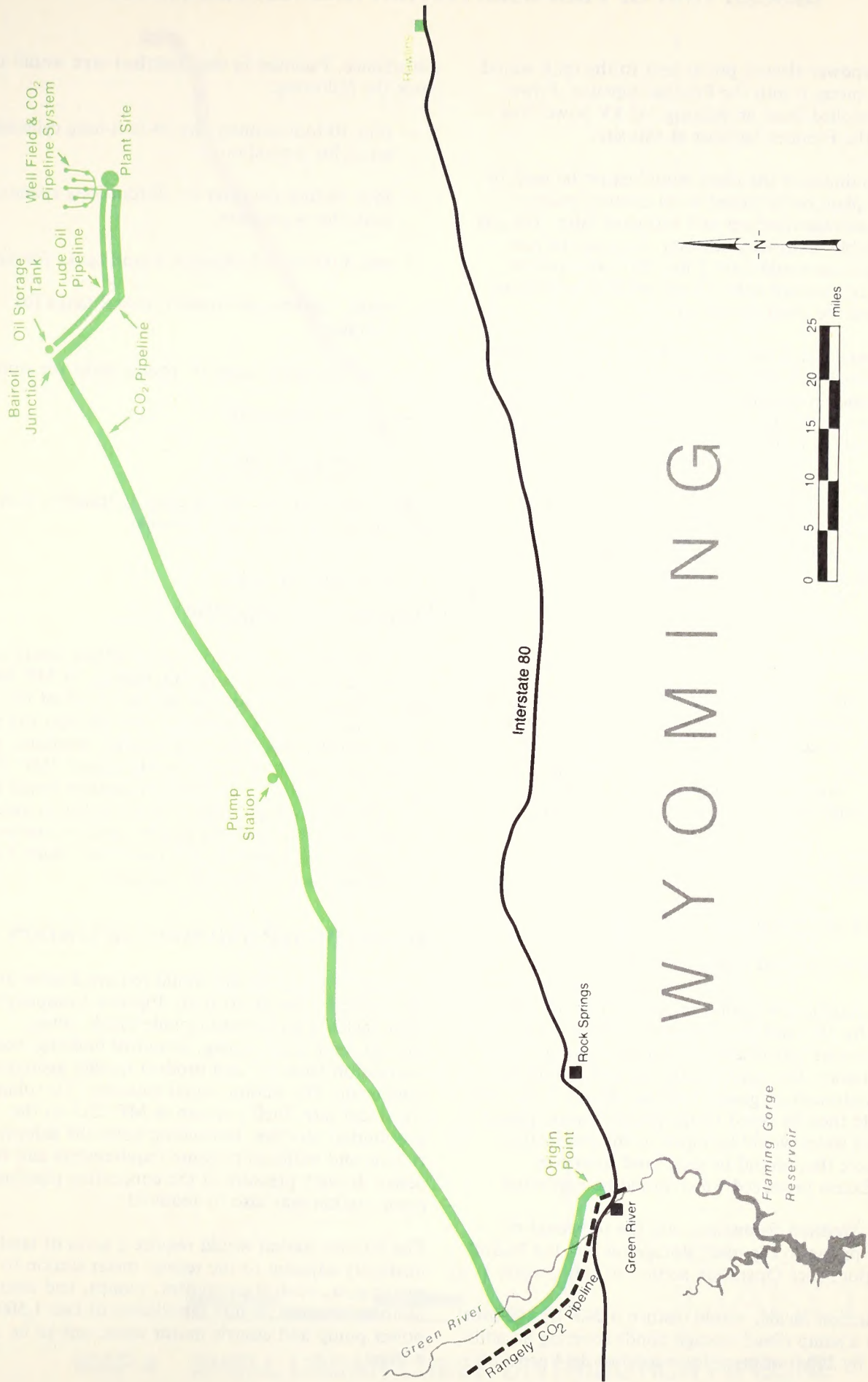
Amoco's proposed gas processing plant would be located along State Highway 73 in the oil field near Bairoil (Map A-3, inside back pocket). The plant site would disturb 100 acres and be enclosed by a fence. Some of this area would be occupied by the plant, some by the related facilities, and some by the clearings needed for safety and for moving large equipment. The plant would look like a large industrial building.

The plant would be used to process hydrocarbon gas, CO₂, and NGL produced in the EOR program. The produced oil would be separated from the gases in field satellite tank batteries. (See the Field Facilities section later in this chapter.) The plant would also produce methane gas and 14 to 70 tons of sulfur per week.

ANCILLARY FACILITIES

Part of the oil would be carried through an existing pipeline and sold to the Sinclair Refinery in Sinclair, Wyoming. The rest of the oil would be carried in the proposed 10-inch-diameter crude oil pipeline following Amoco's main pipeline corridor back to the Frontier pipeline corridor. The CO₂ and crude oil pipelines would be placed about 25 feet apart.

A crude oil storage tank would be located at the Bairoil spur junction. The tank would be about 200 feet long and 32 feet high, have a 150,000-barrel capacity, and be painted an agency-approved light color to prevent heat absorption. The tank would be used to store oil; a 500



W Y O M I N G

MAP 3 AMOCO BAIROIL PROJECT

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

to 600 horsepower electric pump next to the tank would periodically pump it into the Frontier pipeline. Power would be supplied from an existing 345 kV power line that serves the Frontier facilities at this site.

Methane produced at the plant would either be used to operate the plant or be stored in an existing underground gas storage reservoir and extracted later. The gas would probably be stored, however, because the produced gas stream would have a low Btu value (about 300 Btu's per standard cubic foot), which may prevent its being used for plant operation.

The NGL would be stored in four 80-foot-long, 10-foot-diameter, cylindrical tanks near the plant. A peak of 1,099 thousand barrels per year would be produced in 1989. About one 20-ton truck per day would be used to transport NGL to market.

Sulfur would be recovered, dried, and stacked in a 15-foot-high pile at the plant site. The pile would be surrounded by an earthen berm to prevent run off. A 20-ton truck would take the sulfur to market once or twice a week.

FIELD FACILITIES

The Lost Soldier and Wertz oil fields are old operating fields, criss-crossed by roads, power lines, and pipelines. Waterflood oil recovery wells and pipelines are currently in place or are being added under approved operating plans. The following additional facilities would be needed for enhanced oil recovery in the well field:

- 100 miles of CO₂ injection and production pipelines;
- 11 new satellite production facilities; and
- 1 new production facility.

A satellite production facility site would disturb 1.43 acres (250 by 250 feet) and contain a 40-foot-long, 10-foot-diameter cylindrical vessel (tank) and two slightly smaller tanks. The tanks would be used to separate CO₂ and hydrocarbon gases from the oil and water. The gases would then be piped to the gas separation plant. The oil and water would be piped to the production facility where they would be separated from one another. Excess produced water would be reinjected into the Wertz Madison formation, and the oil would be stored for piping to the main storage tank at the Bairoil spur junction. (See Operation section of this chapter.)

The production facility would disturb a 240- by 480-foot area, with a sump (lined storage pond) covering an additional 90- by 240-foot area, for a total of 3.14 acres of

disturbance. Facilities in the disturbed area would include the following:

- four 10-foot-diameter by 50-foot-long cylindrical tanks for separation;
- four 10-foot-diameter by 30-foot-long cylindrical tanks for separation;
- two 3,000-barrel-capacity, round tanks for storage;
- eight 1,500-barrel-capacity, round tanks for storage;
- two 500-barrel-capacity, round tanks for storage;
- a small compressor;
- a small pump; and
- several lease automatic custody transfers (LACTs) for monitoring flow amounts.

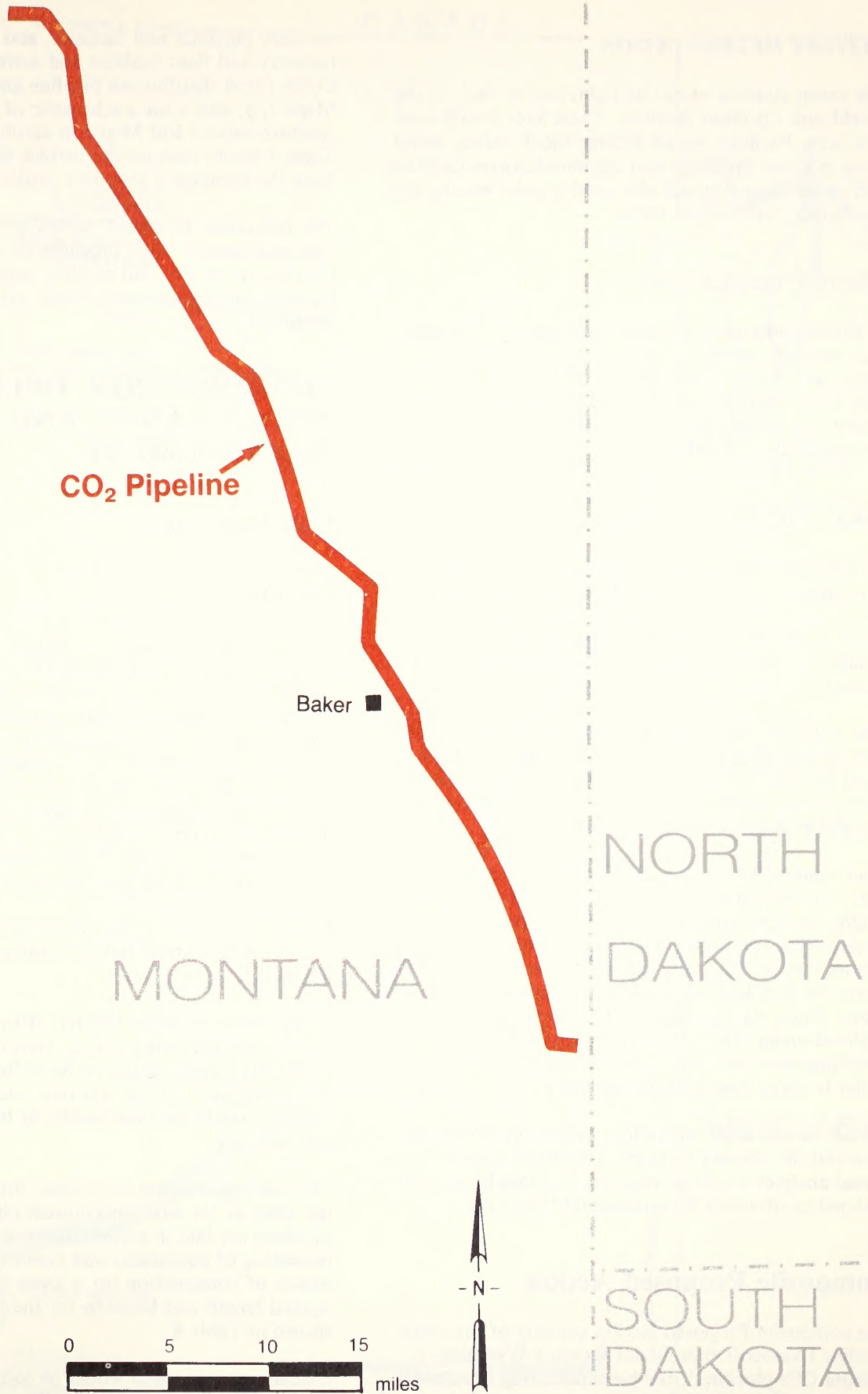
Shell Cedar Creek Distribution Pipeline

Shell's proposed CO₂ distribution pipeline would intersect the proposed Exxon CO₂ pipeline at MP 467 and run northwest and southeast for the length of the Cedar Creek Anticline. The pipeline would intersect the main Exxon pipeline near Shell's existing gas treatment plant, several miles north of Baker on Highway 7 (MP 25D of the Shell line). Shell's distribution pipeline would be 65 miles long and would range from 10 inches in diameter at the intersection with the Exxon pipeline intersection to 4 inches in diameter at either end. See Maps 4 and A-1 (inside back pocket) for location.

RECEIPT METER AND BOOSTER STATION

The receipt meter station would require 2 acres of land immediately adjacent to Butte Pipeline Company's existing facilities and would include block valves, aboveground meter piping, a control building, communication facilities, and product quality assurance equipment. The station would measure CO₂ volume for placement into Shell's system at MP 25D on the distribution pipeline. Depending upon the shipper's volume and wellhead pressure requirements and the design delivery pressure of the connecting pipeline, a pump station may also be required.

The booster station would require 2 acres of land immediately adjacent to the receipt meter station to house switch gear, control equipment, pumps, and electrical motors. It would require installation of two 1,500 horsepower pump and electric motor units, one to be used as a spare.



MAP 4 SHELL CEDAR CREEK DISTRIBUTION PIPELINE

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

DELIVERY METER STATION

Eight meter stations would be built, one at each of the oil field unit injection facilities. These sites would need 2 acres each. Facilities would include block valves, meter piping, a meter building, and communications facilities. Each meter station would also need a short electric line, transformer, and electric meter.

ELECTRIC POWER LINE

An electric wooden pole power line, about 1 1/2 miles long, would be needed to provide power to the pump station and receipt meter station. The power line would begin at an existing main regional switch station and parallel two existing lines (57 kV and 115 kV) owned by Montana-Dakota Utility.

COMMUNICATIONS SYSTEM

The communication system would consist of either a microwave or fiber optic-based network, or a combination of the two, to provide voice, data, pipeline control circuits, and mobile radio communications along the pipeline. The circuits would tie to existing Shell communications facilities in the area.

Fiber optic circuits would be trenched into the pipeline ditch. If new microwave facilities are required, they would be located on as many existing towers as possible. New sites on federal or state lands would require permits and environmental evaluation.

Other small well field CO₂ distribution pipelines, wells, tanks, and miscellaneous facilities would be needed to develop an EOR project in the Cedar Creek Anticline. These facilities and activities are not analyzed in this EIS because they are on-going oil field activities and do not require the EIS level of National or Montana Environmental Policy Act compliance. However, they will be regulated under other BLM and State of Montana permitting processes. The facilities would probably be similar to those described for the Bairoil EOR project.

If Shell needed a gas separation plant to implement an enhanced oil recovery program, additional environmental analyses would be required for compliance with National or Montana Environmental Policy Act.

Composite Proposed Action

The composite Proposed Action consists of the main pipeline (Amoco's Bairoil and Exxon's Wyoming-Dakota CO₂ pipelines); the pipelines along the Bairoil spur route (Exxon's 12-inch spur pipeline and the last 20 miles of Amoco's 20-inch pipeline); the Bairoil plant,

ancillary pipelines and facilities, and enhanced oil recovery well field facilities and activities; and the Shell Cedar Creek distribution pipeline and facilities. See Maps 2, 3, and 4 for a schematic of the projects as separate entities and Map 5 as combined for analysis. Table 5 shows data on the surface disturbance, resulting from the composite proposed project.

The composite Proposed Action would be 751.5 miles long and parallel other pipelines or roads for 436.7 miles (58 percent of the total pipeline length). See Table 6 for locations of pipelines and roads that would be paralleled.

CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

Construction

PIPELINE

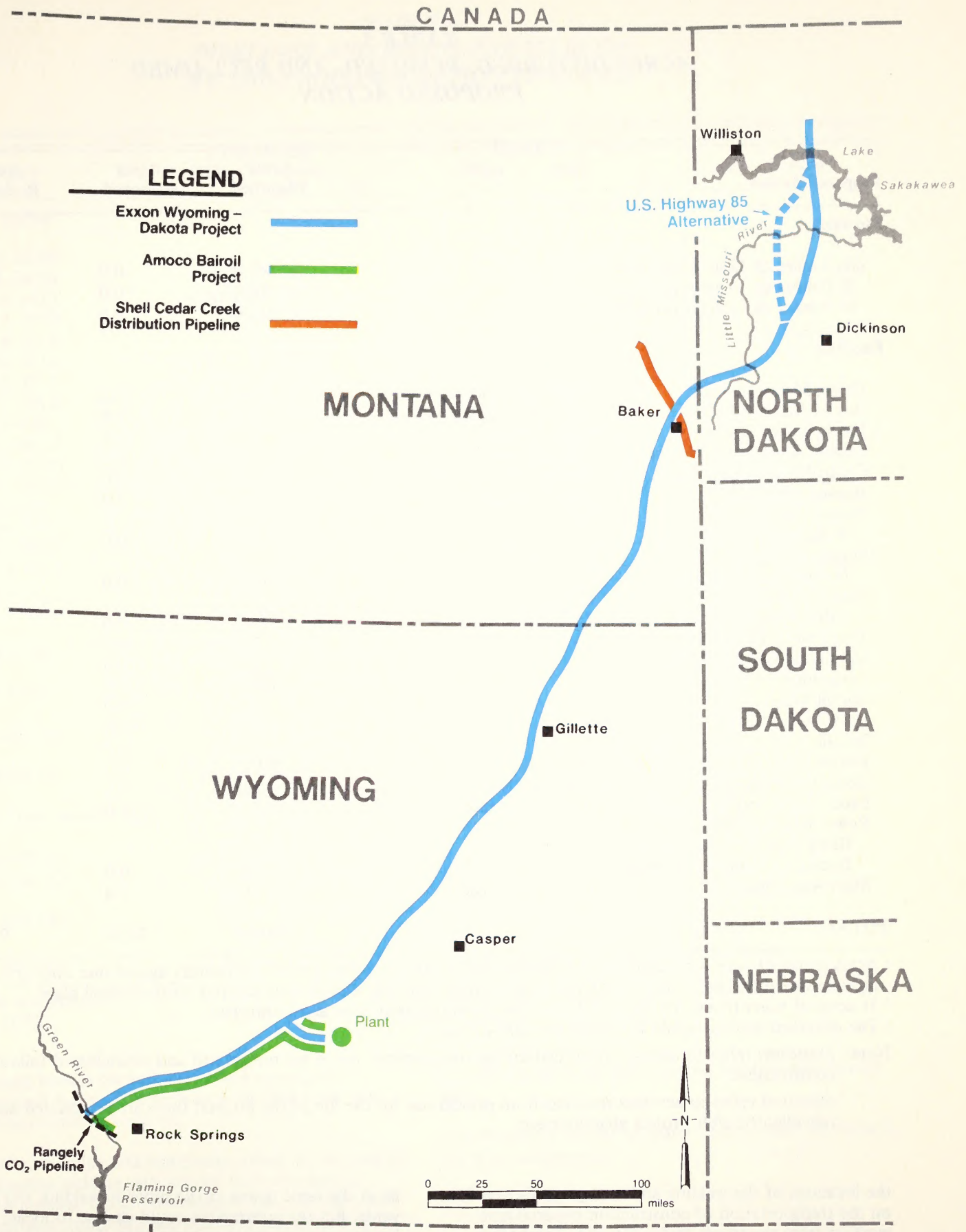
Construction procedures on Exxon's and Amoco's proposed CO₂ pipelines would be the same. Shell's CO₂ distribution pipeline and Amoco's crude oil pipeline would be smaller in diameter and involve a scaled-down construction process. Construction of the proposed CO₂ pipelines is scheduled to occur during the summers of 1986 and 1987 (Figure 1). Crews for the Exxon pipeline would work six days a week and average 1 1/2 miles a day. Amoco's crews would work seven days a week and also average 1 1/2 miles a day. Shell's crews would work six days a week and average 2 miles a day.

Construction would peak in the summer of 1986. See Table 7 for quarterly direct construction employment numbers.

Many of the unskilled laborers (Exxon estimates 50 percent of the total work force; Amoco, 30 percent; and Shell, 50 percent) would be hired locally (within a 50-mile radius). Skilled laborers, such as pipeline welders, would be hired locally or brought in from outside the area.

Pipeline construction techniques for a CO₂ pipeline are the same as for any conventional pipeline. Typically, pipelines are laid in a continuous operation by a *spread* consisting of equipment and crews handling various phases of construction for a given pipeline segment. Spread length and location for the CO₂ pipelines are shown in Table 8.

Pipeline storage yards would be located at Rock Springs, Casper, and Gillette, Wyoming; Baker, Montana; and Williston, North Dakota. Table 9 shows



MAP 5 COMPOSITE PROPOSED ACTION AND ALTERNATIVE

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

TABLE 5
ACRES DISTURBED, REMOVED, AND RECLAIMED
PROPOSED ACTION

Proposed Action	Acres ^a Disturbed	Acres Removed	Acres Reclaimed
Pipelines			
666.5 miles @ 12 acres per mile	7,967.0 ^b	0.0	7,961.0
20.0 miles @ 15 acres per mile	300.0	0.0	300.0
65.0 miles @ 6 acres per mile	390.0	0.0	390.0
Facilities			
Origin Meter/Junction	2 @ 1 acre each	2.0	0.0
Bairoil Junction	1 @ 1 acre each	1.0	0.0
Block Valves	35 @ 1/10 acre each	0.0 ^c	3.5
Scraper Traps w/Block Valves	5 @ 1/2 acre each	0.0 ^c	2.5
Green River Staging Areas	6 @ 2 1/2 acres each	15.0	0.0
Booster Stations	3 @ 3 acres each	9.0	9.0
Staging Area			
S. Side-Lake Sakakawea	3.5	0.0	3.5
Staging Area			
N. Side-Lake Sakakawea	17.5	0.0	17.5
Staging Areas			
Other Creeks & Rivers	7 @ 5 acres each	35.0	0.0
Tioga Meter (Terminal)	1.0	1.0	0.0
Upgrading Existing Roads	74.0	74.0	0.0
Temporary Access Roads	108.0	0.0	108.0
Bairoil Meter	1.0	1.0	0.0
Bairoil Gas Plant	100.0	100.0	0.0
Bairoil Product Storage Tank Site	3.0	3.0	0.0
Bairoil Field CO ₂ Distribution System	300.0	0.0	300.0
Cedar Creek Receipt Meters (2)/Booster Station	5.0	5.0	0.0
Cedar Creek Delivery Meters	8 @ 2 acres each	16.0	16.0
Power Lines to Junctions, Block Valves, Scraper Traps, Booster Stations & Microwave Sites	132.0	0.0	132.0
Microwave Sites	20 @ 1/4 acre each	5.0	0.0
TOTAL	9,485.0	223.0	9,262.0

^a Acres represent worst-case analysis even though both Exxon and Amoco have informally agreed that only one pipeline would be needed for the 20-mile-long segment from the Bairoil Spur junction to the Bairoil plant.

^b 31 acres of water (rivers, creeks, and lakes) have been removed from acres disturbed.

^c The disturbed acreage would be within the right-of-way.

Note: *Disturbed* refers to acreages disturbed during construction, which are revegetated and rehabilitated following construction.

Removed refers to acreages removed from present use for the life of the project; these are revegetated and rehabilitated after project abandonment.

the locations of the welding and storage yards and data on the transportation of construction material and workers from the towns to the job site. Temporary headquarters for construction spreads would probably

be in the same towns as the pipeline welding and storage yards, but the contractors could choose to locate the headquarters in other communities. Temporary headquarters would consist of an office trailer; one or more

CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

**TABLE 6
PIPELINES AND ROADS PARALLELED
BY THE PROPOSED ACTION PIPELINES**

MILEPOST	PIPELINES		ROADS		NAME
	Miles	State	Miles	State	
Main Pipeline¹					
35.0R-26.0R			9.0		
49.0R-26.0R	23.0	WY			
0-140.1	140.1	WY			
184.2-185.3	1.1	WY			
278.6-287.6			9.0	WY	State Highway 50
297.6-307.9	10.3	WY			
313.0-355.1	42.1	WY			
355.1-361.8	6.7	MT			
398.0-428.7	30.7	MT			
417.1-420.1			3.0	MT	Chalk Buttes Road
435.8-451.0			15.2	MT	State Highway 7
455.3-459.9			4.6	MT	State Highway 7
468.0-474.0			6.0	MT	State Highway 7
502.6-526.4	23.8	ND			
540.0-543.0			3.0	ND	U.S. Highway 85
577.6-583.5			5.9	ND	State Highway 22
599.0-625.0	26.0	ND			
628.5-643.0	14.5	ND			
SUBTOTAL:	318.3		46.7		
Bairoil Spur¹					
0.0S-20S	20.0	WY			
SUBTOTAL:	20.0				
Cedar Creek Distribution²					
1.8D-25.0D	23.2	MT			
32.0D-63.5D	31.5	MT			
SUBTOTAL:	54.7				
TOTAL:	393.0		46.7		(3 miles of road & pipeline overlap)

¹Exxon and Amoco (1985)

²Shell (1985)

warehouse trailers (or suitable rented space); and a storage yard for pipe, other major pipeline materials, and construction equipment.

Generally, the pipe and equipment would be shipped to each pipeline welding and storage yard via railroad. Various numbered and unnumbered state, county, and private roads would provide access to the project right-of-way. Table 10 shows some of the main roads that

would be used from each pipeline welding and storage yard.

The following is a list of major construction activities in order of occurrence:

- surveying and staking
- right-of-way clearing and grading

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

**TABLE 7
DIRECT CONSTRUCTION EMPLOYMENT BY QUARTER
PROPOSED ACTION**

Component	1986									1987				
	2nd Qtr.		3rd Qtr.			4th Qtr.			1st Qtr.		2nd Qtr.		3rd Qtr.	4th Qtr.
	Exxon	Amoco	Shell	Exxon	Amoco	Shell	Exxon	Amoco	Shell	Exxon	Amoco	Shell	Amoco	Amoco
Main Pipeline														
Spread 1 (includes Bairoil Spur)	174	174	199	199	97	97								
Spread 2	122			162			62			46			62	
Spread 3	122			162			62			46			62	
Spread 4	122			162			62			46			62	
Spread 5	122			162			62			46			62	
Spread 6	122			162			62			46			62	
Booster Station														
Origin (MP 0)					16								19	
MP 35				16						19				
MP 68					16								19	
Lake Crossing				30										
Meter Stations														
Origin	7	7		16	16		3	3						
Bairoil Plant	7			16			3							
Tioga Terminal				16							8			
Cedar Creek				16										
Distribution Pipeline			45			45								
Meter Stations/ Booster Station						25		10				10		
Bairoil Plant & Facilities		245			318			256		411			620	
													461	267
Microwave System														
Spread 1 & Spur	35	30		35	30		35	30						
All Other Spreads	36			58			28				58			
TOTAL BY COMPANY:	869	456	45	1,212	595	70	476	386	10	230	411	395	658	10
QUARTER TOTAL:		1,325			1,877			872		641		1,063	461	267

- trenching
- stringing, lineup, welding, and radiographic examination
- coating and wrapping
- pipe lowering
- trench backfilling
- hydrostatic testing and tie-ins

- cleanup and restoration

In relatively level areas, including croplands, widths as little as 60 feet could be disturbed; another 20 feet to be used for equipment would not need to be bladed and thus may need only discing and seeding after construction was completed. In some areas, the full 80-foot-width may need blading. In steeper areas, wider widths would be needed, thus disturbing more land. The amount of rock, topographic detail, and soil type would cause disturbance widths to vary. See Figures 8, 9, and 10 for illustrations of widths on varying terrain.

CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

TABLE 8
PIPELINE SPREAD LOCATION
AND LENGTH
PROPOSED ACTION

Spreads ¹	Location by Milepost	Length in Miles
Exxon		
Spread 1	MP 0.0-111 0.0S-20S	131
Spread 2	MP 111-203	92
Spread 3	MP 203-280	77
Spread 4	MP 280-437	157
Spread 5	MP 437-567	130
Spread 6	MP 567-643.5	76.5
TOTAL (Spreads 1-6):		663.5
Amoco		
Spread 1	MP 49R-26R MP 0.0-111 MP 0.0S-20S	23 111 20
TOTAL (Spread 1):		159
Shell		
Spread 7	MP 0.0-65	65

¹There are a total of eight construction spreads: see Maps A-2 through A-7 in the inside back map pocket for spread and milepost locations.

The average width needed for construction of a single pipeline on flat land would be 60 to 80 feet; new pipelines would be placed next to existing pipelines at distances of 25 to 35 feet. A 10-foot-wide safety zone would be established next to the existing pipeline to protect it from construction activities. Topsoil would be saved subject to agreements with landowners and the appropriate federal land managing agency. The topsoil would be placed beside the safety zone and the ditch spoil or subsoil would be placed next to the topsoil but in a separate windrow. The space needed for the two soil windrows would be 15 to 25 feet wide depending on topsoil depth. The trench would be placed next to the ditch spoil. After completion of construction, the ditch

would be backfilled first with ditch spoil and then with the topsoil, thereby returning the soils to their original position.

An 80- to 115-foot construction width would be needed for two pipelines built next to each other on level land. (This type of situation would occur between MP 0 and 111.) For three pipelines built consecutively, such as along the Bairoil spur route, a 110- to 150-foot-wide construction width would be needed.

On steep slopes, in mountainous or hilly terrain, a level work pad would have to be cut out of a hillside; this is referred to as a sidehill cut. Grading for sidehill cuts would begin at the uphill end of the cut and continue downward until the required working width was obtained. Spoil from the cut (uphill) would be graded to fill the opposite (downhill) side of the bench, where it would form part of the work pad. This technique would disturb less area.

The slope of the cut (as well as the fill on the opposite side) would depend on the natural slope of the material being graded. The looser the material, the larger the cut would be for a given work pad width.

Once the working area was prepared, the ditching operation would begin. Since the ditching machine would usually be about 7 miles ahead of the rest of the spread, the pipeline ditch could be open for 14 days. But to reduce the likelihood of accidents, ditching operations would be timed so that the ditch would not remain open for longer than this. Where an open ditch interfered with livestock trails, driveways, or rural roads, temporary crossings such as plank bridges would be provided to allow safe and unobstructed passage across the right-of-way. Alternately, a portion of the ditch could be left unexcavated to allow vehicles and equipment to pass.

The depth of the ditch would vary with the conditions encountered. The cover from the top of the pipe to ground level would generally be at least 3 feet, and at least 4 feet required in the Little Missouri National Grasslands. In areas of consolidated rock, burial depth from the top of the pipe would vary from 18 to 24 inches (minimum) in accordance with the American National Standards Institute (ANSI) Code B31.8. At highway crossings, the depth of the ditch would conform to the regulations and requirements of the agencies responsible for the highways.

In rocky terrain, ditching could require drilling and blasting. Blasting would be used for materials that could not be ripped. In preparation for blasting, loose material would be removed from the surface and a series of holes drilled into the rock by air-powered drills. The drills would generally be suspended from a sideboom tractor, which would also tow the compressor supplying the air. Self-propelled drills could also be used if necessary.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

**TABLE 9
LOCATION OF PIPELINE
STORAGE YARDS, AND TRANSPORTATION¹**

Pipeline Welding & Storage Yard Location¹	Items Being Hauled	Size of Vehicle or Load	Loads (one way)	Total Tonnage of Material Handled/Destination
Rock Springs, WY ²	Pipe and Materials	20-Ton	70/day	85,000 tons for Spread 1
	Workers	Buses, Cars, & Pickups	52/day	
Casper, WY	Pipe and Materials	20-Ton	20/day	26,000 tons for Spread 2
	Workers	Buses, Cars, & Pickups	26/day	
Gillette, WY	Pipe and Materials	20-Ton	45/day	58,000 tons (22,000 to south, Spread 3: 36,000 to north, Spread 4)
	Workers	Buses, Cars, & Pickups	26/day	
Baker, MT ³	Pipe and Materials	20-Ton	Exxon 23/day	30,000 tons for Spread 5
			Shell 2/day	5,000 tons for Spread 1 ⁴
	Workers	Buses, Cars, & Pickups	26/day	
Williston, ND	Pipe and Materials Materials	20-Ton	15/day	16,000 tons for Spread 6
	Workers	Buses, Cars, & Pickups	20/day	

Note: Pipe and materials loads based on a 5-day work week and 60 to 65 actual hauling days. Number of worker vehicle trips based on 80% use of buses and a 1.8-person load per private vehicle.

¹ This table would apply to the Proposed Action, the U.S. Highway 85 Alternative, and the Crooks Gap Option. The Proposed Action would require about 60 days of hauling, the U.S. Highway 85 Alternative would require about 63 days and the Crooks Gap Option about 65 days.

² Amoco and Exxon each would have a storage yard.

³ Exxon would have a storage yard; Shell would use an existing facility.

⁴ Shell would haul for about 120 days.

Where blasting was needed, the following safety precautions would be used:

- In areas of human use, shots will be blanketed (matted) to prevent flying rocks and debris.
- Landowners or tenants within 1 mile of the

blasting area will be notified in advance so that livestock and other property can be adequately protected.

- Before blasting, construction workers and local residents will be cleared from the blasting area.

CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

TABLE 10
 MAIN ROADS USED TO HAUL
 MATERIALS, PERSONNEL, AND EQUIPMENT

Main Roads Used for Hauling	I ^a	Plant	II	Spreads/Facility		V	VI	VII ^b
				III	IV			
Interstate 80	X	X	X					
U.S. 191	X	X	X					
Wyoming 372	X		X					
Wyoming 73	X		X					
U.S. 287/Wyoming 789	X		X					
Wyoming 220	X		X					
U.S. 20/26	X		X					
U.S. 20/26-Spur	X		X					
Interstate 25				X				
Wyoming 259				X				
Wyoming 387				X				
Wyoming 192				X				
Wyoming 50				X	X			
Interstate 90					X			
Wyoming 59					X			
U.S. Highway 14/16					X			
Montana 544					X			
Montana 59					X			
Montana 277					X			
Montana 327					X			
U.S. Highway 12								X
U.S. Highway 212					X			
Montana 7						X		X
Montana 336						X		
Federal Aid Secondary (FAS) 1711						X		
North Dakota 16						X		
FAS 1746						X		
Interstate 94						X		
FAS 0419						X		
FAS 0408						X		
North Dakota 23							X	
North Dakota 23A Bypass							X	
FAS 200							X	
FAS 73							X	
FAS 1804							X	
North Dakota 40							X	
U.S. 85							X	

^a Amoco and Exxon would each haul along roads for their own Spread I.

^b Shell's spread. The rest are Exxon's spreads.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES



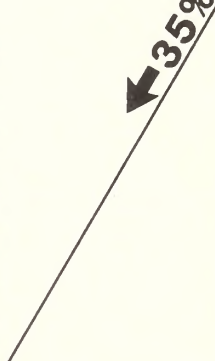
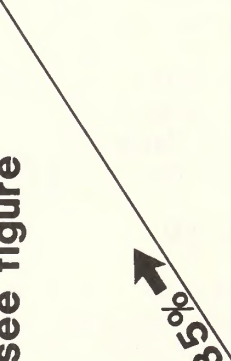
TERRAIN	CRUSHED VEGETATION WIDTH, VERY LITTLE OR NO RECLAMATION REQUIRED (USED AS PASSING LANE)	DISTURBED WIDTH, VEGETATION AND TOPSOIL REMOVED, THEN RECLAIMED
Flat with no top soil	20'	50'
Flat with top soil see figure	20'	60'
15% Right to Left 	n/a	120'
15% Left to Right 	20'	60'
35% Right to Left 	n/a	135'
35% Left to Right see figure 	n/a	200'

FIGURE 8 TYPICAL VARYING CONSTRUCTION WIDTHS

FIGURE 8 TYPICAL VARYING CONSTRUCTION WIDTHS

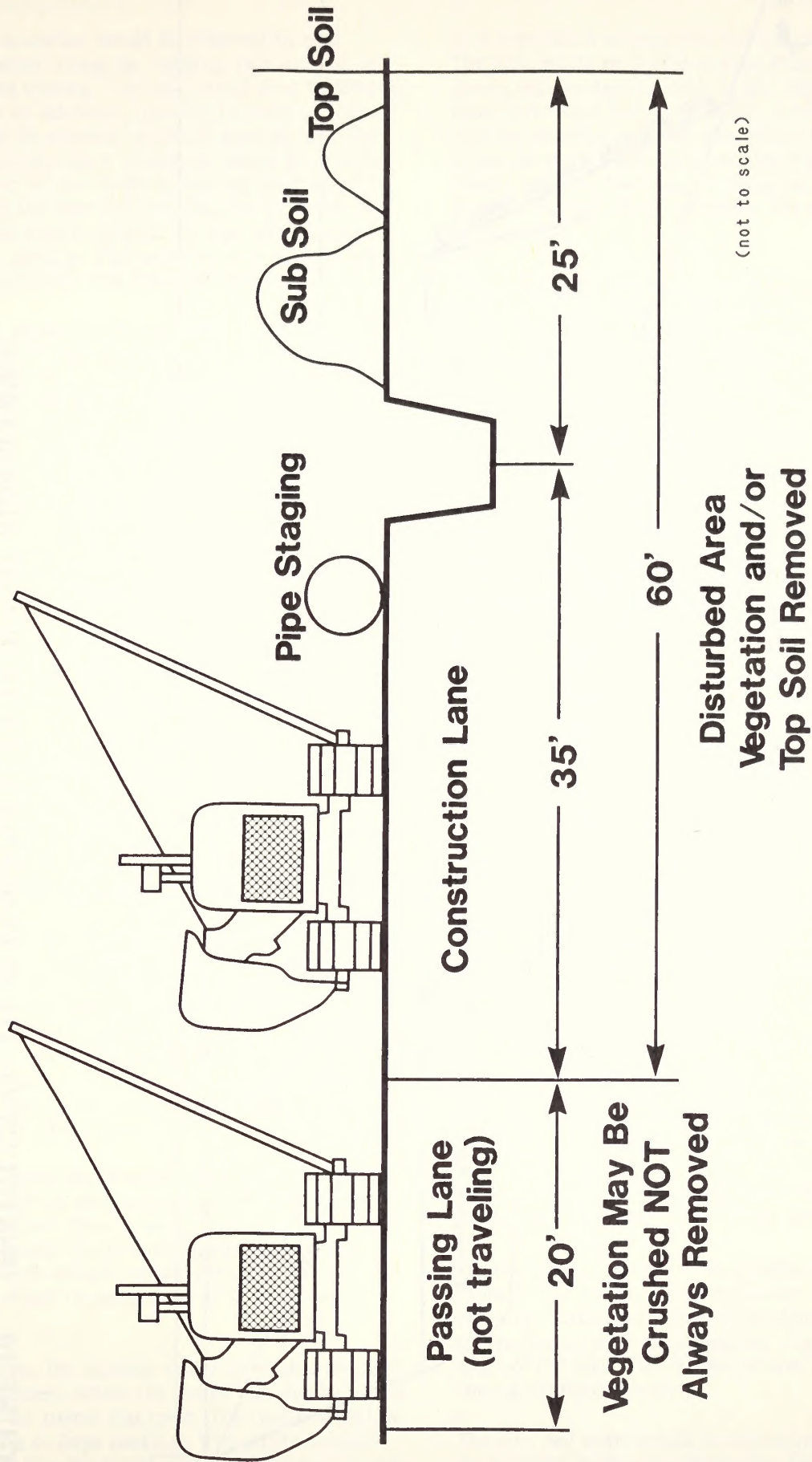


FIGURE 9 CONSTRUCTION ON LEVEL TERRAIN

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

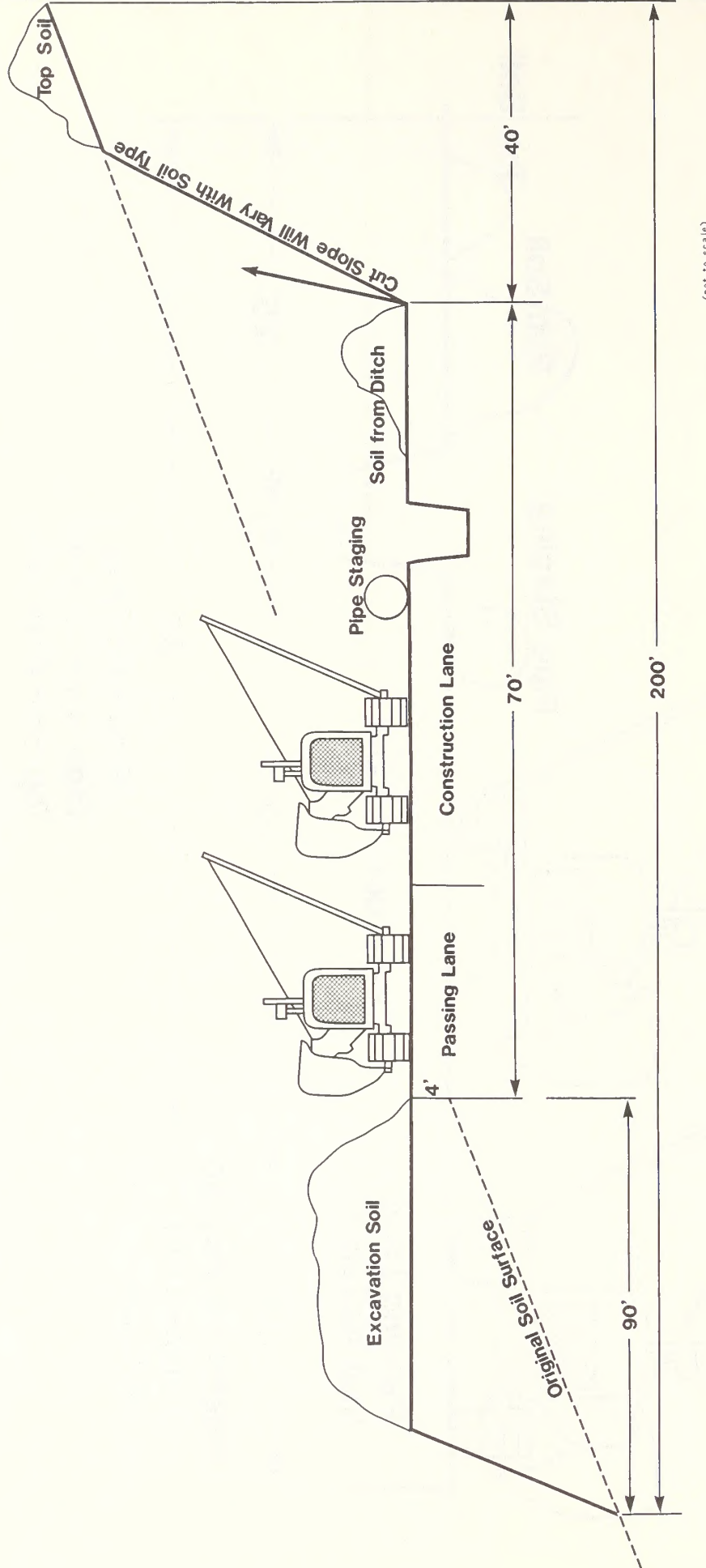


FIGURE 10 CONSTRUCTION ON 35 PERCENT LEFT TO RIGHT SIDESLOPES

CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

The ditching operation would be followed by pipe stringing, bending, lining up, welding, radiographic examination, and coating. The pipe would then be lowered into the ditch by sideboom tractors. In stony or rock areas, selected fill material (generally sand or rock-free soil, brought to the site if necessary) would be used to pad the bottom of the trench before the pipe was lowered. After the pipe was lowered, the fill would be placed over the pipe to protect the pipe and coating material from damage. The backfill could then be completed with spoil excavated from the trench.

In hilly areas, depending on the angle of the pipe gradient, sacks filled with sand or smooth soil could then be placed across the trench as barriers, perpendicular to the pipe at regularly spaced intervals. This would prevent water from running down the trench and washing out the backfill during storms. When these preparations were completed, the areas between and over the sack barriers could be backfilled with spoil excavated from the trench.

For relatively short distances in restricted areas or sensitive sidehill areas, the working width on the large pipelines could be reduced to no more than 50 feet. If this was done, topsoil could not be saved since there would be no room to place it. Fill from the cut would be placed on the working side and packed down to allow equipment movement. The fill would be used later to partially restore the cut. The ditch would be dug about 10 feet from the toe of the cut, leaving a working side of 40 feet. This method would reduce the amount cut but would hamper normal construction because there would not be enough room for equipment to pass other equipment. The method could, therefore, be used only for short sections and on a case-by-case basis.

The pipeline would be buried in a trench at perennial stream crossings. Vegetation would be cleared on each bank of the stream only as needed to provide enough work space and equipment storage; an area about 450 feet by 260 feet (2 1/2 acres on each bank) would be cleared. A plan and profile of a typical stream crossing is shown in Figure 11. Pipeline construction would meet standards of Section 404 of the Federal Water Pollution Control Act (33 CFR 323.4).

Construction across the streams would occur during periods of low flow, generally late summer to early winter, to eliminate impacts on aquatic species. The pipeline trench would cross the stream at about right angles. Each crossing would take 2 to 4 weeks. Stream flow would be maintained at all times during construction.

At each crossing, the pipeline would be welded on one bank of the streams before the trench was dug to reduce the time that the trench was open. The trench would be dug by dragline or large backhoe. The pipeline would then be placed into the trench and weighted as required

to ensure that it remained in the trench until covered. The pipe would be buried at least 4 feet below the stream bed, or deep enough so that high water flow would not affect the pipe through scour action. Where rock was encountered, the pipe would be buried 2 feet below the stream bed. Sacks containing a sand and cement mixture, breakers, or riprap would be placed over the pipeline where necessary. No cofferdam would be required.

The gradient of the stream would be maintained by removing all spoil from the bed after construction was completed. Banks would be restored to their original profiles and stabilized to minimize erosion.

In addition to the previously described stream crossings, the proposed pipeline would cross Lake Sakakawea on the Missouri River in McKenzie and Williams counties, North Dakota, between MP 625.5 and 628. Where mean water depth was 20 feet or less, the pipeline would be buried in a trench, at least 4 feet below the lake bottom. Where the water depth exceeded 20 feet, the pipeline would not be placed in a trench, but for the entire crossing (regardless of water depth) the pipe would be coated with concrete to ensure that it stayed on the bottom of the lake.

The pipeline would be built across the lake at a right angle during the late summer or early fall when the water level should be low. A preliminary plan and profile of the lake crossing is shown in Figure 12.

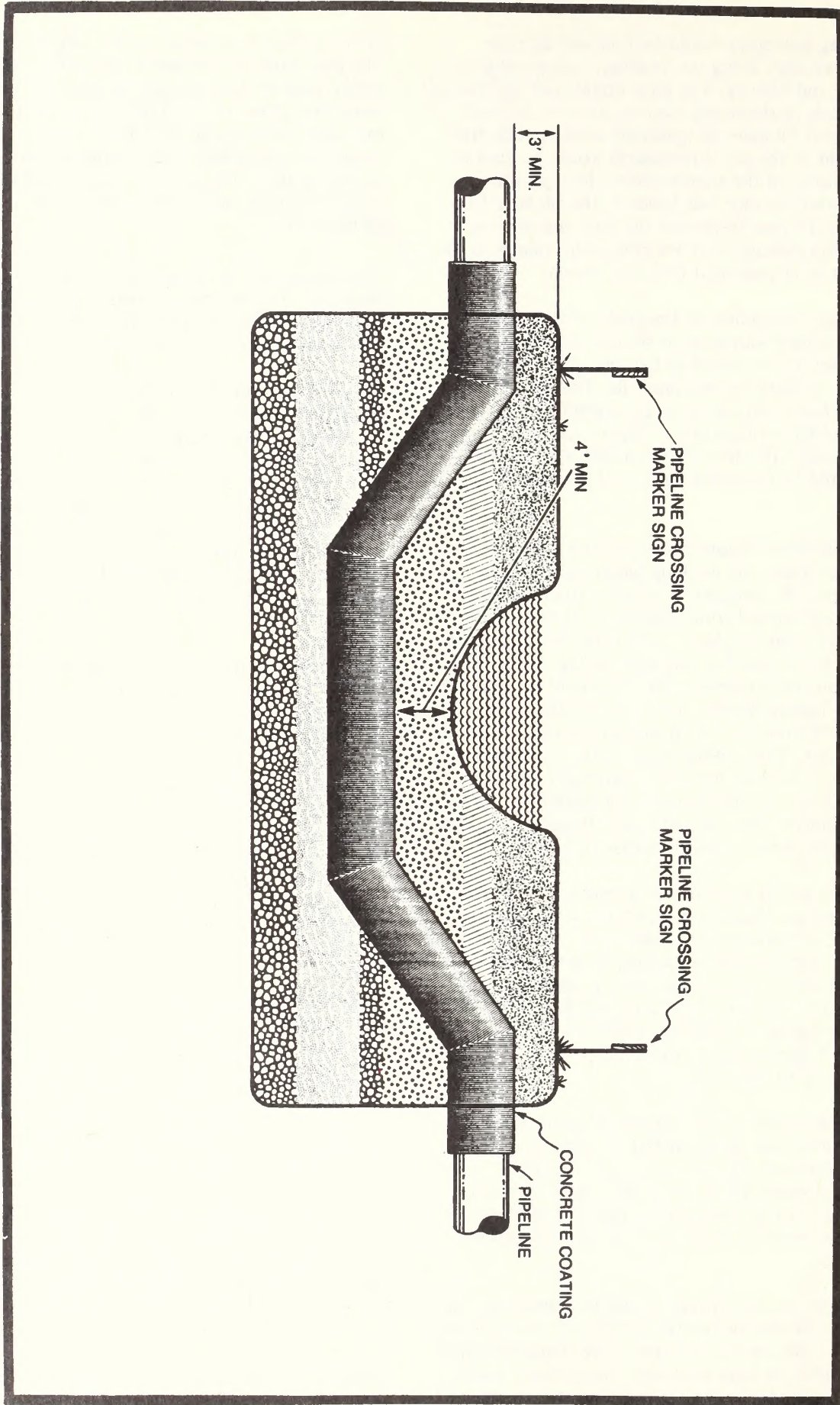
Vegetation would be cleared on each bank of Lake Sakakawea only as needed to provide enough work and equipment storage space. A 17-acre staging area would be cleared on the north side of the lake and a 3.5-acre staging area would be cleared on the south side. These areas would provide room to work with the pipe while it is being prepared for placement into the trench or laying on the lake bed.

Pipeline segments to cross the reservoir would be welded into 2,000 to 3,000 foot lengths at the main 17-acre staging area. When there are enough of these segments to at least reach across the lake, the segment ends would be welded together at the staging area on the north shoreline. After each connection was welded, the connected segments would be towed, welded to a previously welded pipeline section, and towed further across the lake.

For the towing operation, the pipeline would be suspended from buoys, towed across the lake deep enough below the surface so as not to interfere with boaters, and positioned over the previously dug trench along the edges of the lake. The pipeline would then be sunk by cutting the buoys loose.

The lake bed slope would be maintained by backfilling the trenches to the original profile. The lake banks

FIGURE 11 TYPICAL PROFILE OF RIVER CROSSING



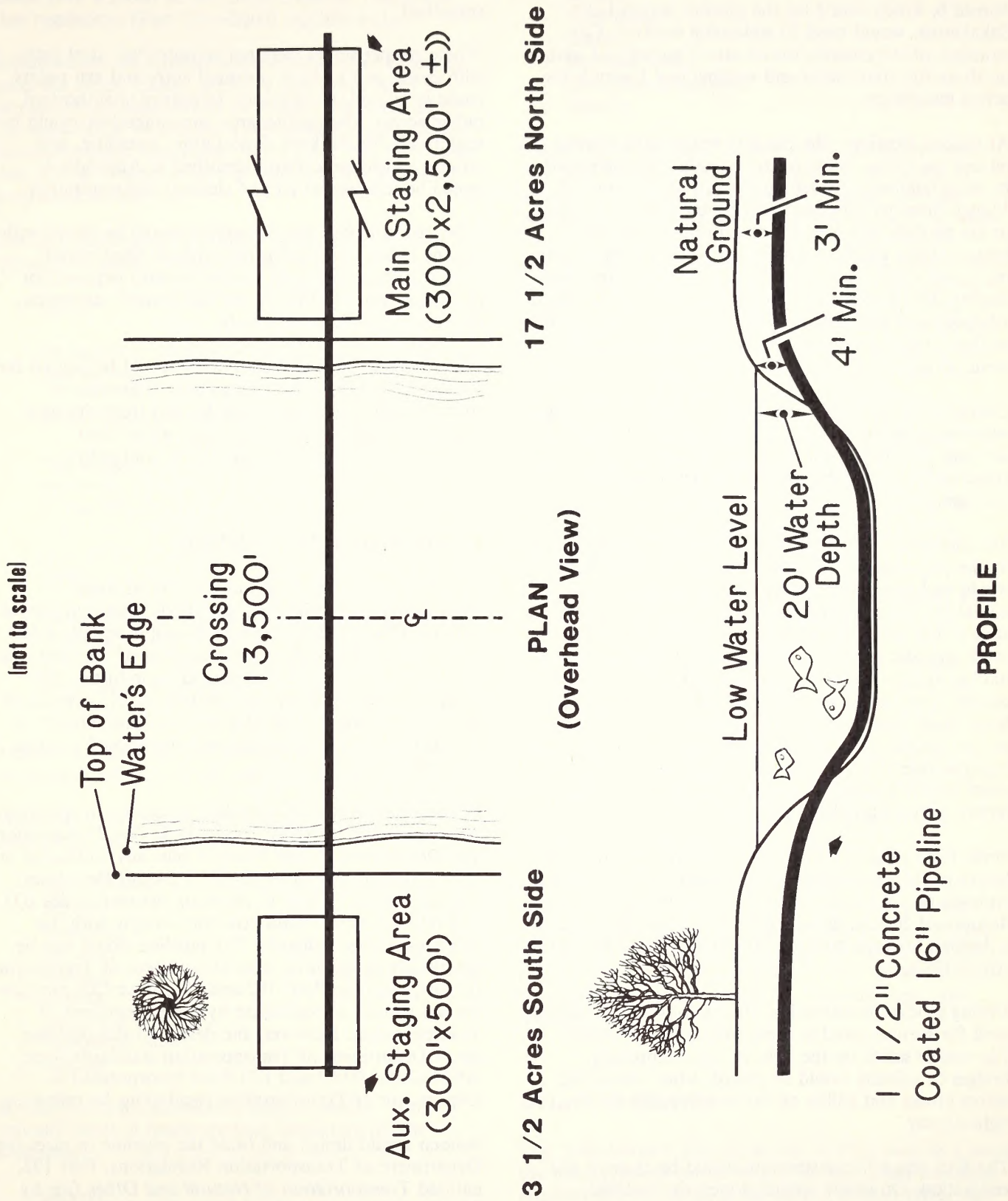


FIGURE 12 TYPICAL PROFILE OF RESERVOIR CROSSING

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would also be restored to their original profiles and stabilized to minimize erosion.

Spread 6, which would lay the pipeline across Lake Sakakawea, would need 30 additional workers. Construction of the crossing would take 2 months—1 month on shore for preparation and welding and 1 month for actual installation.

At various locations, the pipeline would cross existing oil and gas fields. These fields typically are crisscrossed by large numbers of small buried and aboveground 4- to 12-inch diameter pipelines, which are often not mapped or are partially mapped. Construction crews would locate existing pipelines with metal detectors when working in well fields to avoid damaging them during trench digging. Pipeline crossings would often be dug by hand. Aboveground well field pipelines would be covered with earthen ramps to prevent damage during heavy equipment crossings.

Casing would be installed at road and railroad crossings where required by federal, state, or local authorities. A separate crew would install casings ahead of the main construction crew, who would later insert the pipe into the casing.

The pipeline would be protected from rust and corrosion by the pipe coating, rectifiers, and anodes. Rectifiers would be located near power distribution lines and mounted on a pole adjacent to the right-of-way; associated anodes would be buried. The exact locations of these cathodic protection devices cannot be determined until a pipeline was installed and the proper tests conducted. Test leads would be attached to the line at fence lines, roads, and highways to monitor the cathodic protection system. Each set of test leads would be brought to a junction box. The box would be mounted on a short post that would be installed where it would not interfere with existing land uses.

Noise from construction would be distributed over the length of the spread. Heavy equipment and construction typically produce noise levels of about 90 decibels at a distance of 50 feet, assuming a noise attenuation rate of 6 decibels for each doubling of distance from the source (BLM 1980).

During pipeline construction, the right-of-way would be used for surface travel in areas with no access roads. For vehicle safety on the right-of-way, temporary bridges or culverts would be placed, when warranted, across creeks and gullies on the working side of the right-of-way.

The final phase of construction would be cleanup and restoration. On gentle sidehill slopes, the material graded from the work area would be replaced, contoured, and restored as nearly as possible to preconstruction conditions. However, in some areas with

steeper sidehill cuts, especially in rock, recontouring might not be totally possible. Instead, the debris from construction would be removed and the work area smoothed.

Where steeper slopes were not recontoured, steel gates with chains and locks at potential entry and exit points could be placed, as necessary, to restrict unauthorized public access. The maintenance superintendent would be responsible for the keys. Restoration, reseeding, and erosion control procedures identified in Appendix 4 would be followed as part of cleanup and restoration.

After construction, fence openings would be closed with fencing as least as good as the original. Shell would build the temporary gates to the standard required for permanent gates so that, at the landowner's discretion, they could remain permanently.

Water bars (at least 12 inches deep) would be dug on the contour across the work area to divert rainwater or spring runoff. The small berms formed from the spoil from the trench would help prevent water from cascading downslope and creating rills and gullies.

PIPELINE QUALITY CONTROL

CO₂ pipelines are not regulated by Department of Transportation regulations. Required engineering standards for CO₂ pipeline strengths do not exist. BLM has not performed an independent analysis of the safety factors in pipeline strength, presented by industry. The companies will perform pressure tests at 125 percent of operating pressures. The State of Montana intends to conduct an independent analysis of proposed pipeline and valve strengths.

Exxon would design the pipeline according to specifications contained in ANSI Code B31.8, *Gas Transmission and Distribution Piping Systems*, plus any additional or more stringent provisions in B31.4 *Liquid Petroleum Transportation Piping*. In choosing between codes B31.8 and B31.4, Exxon would generally comply with the more restrictive standards. The pipeline would not be specifically designed to meet Department of Transportation Regulations, Parts 192 and 195, since CO₂ pipelines are not subject to regulation by the Department of Transportation. However, the design of this pipeline meets Department of Transportation standards since ANSI Codes B31.4 and B31.8 are incorporated in Department of Transportation regulations by reference.

Amoco would design and build the pipeline to meet the Department of Transportation Regulations, Part 192, entitled *Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards*. Amoco would also use ANSI Code B31.8-1982 *Gas Transmission and Distribution Piping Systems* as a guideline.

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Shell would design and construct the CO₂ distribution system to meet or exceed the requirements of the ANSI Code 31.4, a subset of the Department of Transportation regulations (Part 195—liquid pipeline code).

Exxon would use separate contractor(s) to x-ray and inspect the welds. Exxon estimates that about 90 to 95 percent of the welds would be x-rayed, although all of the welds could be x-rayed if the process did not delay the construction contractor. ANSI Code B31.8 requires that at least 10 percent of the welds of each welder be x-rayed each day.

During construction, the following inspectors would typically be needed to inspect each spread:

- chief;
- an inspector for right-of-way clearing, stringing, and ditching;
- a third-party radiographic contractor;
- two inspectors for welding (one at the front to ensure compliance with welding procedures and one at the end to monitor radiographic work);
- an inspector for joint coating, installing crack arrestors, lowering of the pipe, and backfilling;
- an inspector for tie-ins and for pipeline and utility crossings; and
- an inspector for cleanup and right-of-way restoration.

Amoco and Shell plan to use third-party contractors to radiographically inspect all welds on the pipeline.

In addition to the third-party inspectors, Amoco would need inspectors for the following:

- rights-of-way,
- ditching,
- benching,
- crossing,
- welding,
- coating,
- pipeline lowering,
- backfilling, and
- cleanup

In addition to a construction superintendent, Shell typically needs in-house contract inspectors for the following:

- surveys,
- rights-of-way,
- coating yard,
- ditching,

- welding,
- coating,
- tie-ins,
- backfilling,
- station,
- electrical work,
- communication, and
- cleanup

Exxon's entire pipeline would be hydrostatically tested to at least 125 percent of the maximum operating pressure. The test water would be obtained through negotiations with local authorities who control the water resources. The spread building the 20-inch-diameter pipeline segment proposed by Exxon would take 10 acre-feet of water for testing. The two spreads building the 18-inch diameter pipeline proposed by Exxon would each require about 12 acre-feet of water for testing, and the three spreads building the 16-inch-diameter pipeline would each require about 11 acre-feet for testing. The exact amount required would depend on the testing procedures used. Exxon has applied for permits to obtain water from four sources in Montana: a tributary of Beaver Creek in Fallon County, a tributary of Branch Creek in Powder River County, and tributaries of Cabin Creek and Little Beaver Creek in Carter County. The test water would be disposed of in accordance with federal, state, and local requirements.

Amoco's entire pipeline would be tested to at least 125 percent of the maximum operating pressure. Either water or nitrogen could be used as the test medium. If water was used, about 15 acre-feet would be needed from Battle Springs and the Green River. The testing procedure would not greatly contaminate the water, although small amounts of dirt, oil and grease, and metal fragments could be picked up. The water would be discharged into evaporation ponds and disposed of in accordance with state and federal regulations. If nitrogen was used, it would be released into the atmosphere in a gaseous state after the test.

Shell's system would be hydrostatically tested for 24 hours at a minimum of 125 percent of the maximum operating pressure. About 1.2 acre-feet of water needed for the test would come from local authorities or from existing production-related water sources. Water would be disposed of in accordance with federal, state, and local requirements.

OTHER FACILITIES

The three booster stations at MP 0, 35.5, and 68.1 along the main pipeline routes would be built using standard construction methods, as would the various meter stations. A peak of 48 workers would be needed for construction of the booster stations—two crews of 16 each for Amoco's two stations and one crew of 16 for

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Exxon's station. A peak of 64 workers would be needed during the summer of 1986 for construction of the meter stations—three crews of 16 each for Exxon's three meter stations and one crew of 16 for Amoco's meter station. Construction of the receipt meter station/pump station and eight delivery meters on Shell's distribution pipeline would require a peak of 25 workers during the summer of 1986.

Standard construction procedures would also be used in building the microwave facilities. A crew of about 30 people would build Amoco's communication system. A crew of about 35 people would build Exxon's proposed microwave repeater stations and the three microwave stations—origin, MP 35.5 (booster station), and Bairoil terminal—on the Bairoil part of Exxon's proposed pipeline. A crew of about 58 would move from site to site to build the proposed microwave repeater stations and two microwave stations (Cedar Creek take-off and Tioga terminal) along the rest of Exxon's pipeline. See Table 7 for direct employment by quarter.

The electric distribution lines to the microwave stations and the motorized block valves would also be built during the summer. Pacific Power and Light and other utilities, depending location, would be responsible for providing power. Usually a crew of six or seven, working 1/2 to 1 mile per week, would build this type of line. The utility companies generally keep these crews employed full time. See Table 5 for acres to be disturbed and reclaimed.

GAS PLANT AND WELL FIELD

Amoco's proposed gas plant would be built using standard construction procedures for industrial facilities. Materials, equipment, and some personnel would be transported from the railhead at Rawlins, Wyoming. About 20 trucks a day would be needed to carry an average of 20 tons each of materials and equipment. The total weight of materials would be 50,000 tons, including material for field pipelines. Workers would commute daily, working 10-hour shifts, 5 days a week, on a 7 day a week basis. (Different workers would have different days off.) A total of 110 one-way trips per day would be needed during peak construction. Amoco would also provide housing for about 90 supervisors and security personnel in the town of Bairoil. Construction would begin in the spring of 1986 and end December 1987.

Well field pipe laying activities for the enhanced oil recovery program would be similar to those described for large pipelines. However, fewer workers would be required and smaller equipment would be used. See Table 7 for quarterly construction employment numbers for the proposed gas plant and oil field activities.

HOUSING

All pipeline and some plant construction workers would live in local motels, rented houses or other lodging, or in personal trailers or pickup campers parked in authorized commercial camping facilities. Camping could also occur in nondesignated campgrounds anywhere along the pipeline route. Car pools, privately owned vehicles, and other means would be used to transport workers to the construction site.

Operation and Maintenance

PIPELINE MONITORING AND SERVICING

A communications and control center at the Shute Creek gas plant control center would monitor and control Exxon's pipeline operation. The control center would be attended 24 hours a day, 7 days a week, during pipeline operation. Computers would continuously monitor pipeline pressure and flow conditions at the Tioga, North Dakota terminal and future delivery points. The computers would be programmed to sound an alarm whenever pressure or flow deviated; the alarm would indicate an outage or other unusual conditions in the pipeline system. Specialists and technicians would be on call to service the pipeline at their assigned locations.

A district manager with a staff of 11 would be headquartered at Gillette, Wyoming, to operate the Exxon pipeline. Six measurement technicians and two communications technicians would be located at various locations between the Shute Creek plant and Tioga.

Amoco plans to use existing pipeline maintenance personnel to service its proposed pipeline.

Shell would add two to four permanent jobs for the operation and maintenance of its distribution pipeline.

Once every other week, Exxon, Amoco, and Shell would each inspect their rights-of-way by aerial patrol. Valves and scraper traps would be inspected and tested at 6-month intervals. River crossings would be inspected annually. Cathodic protection surveys would be conducted annually at test lead locations. Site traffic would be limited to workers performing valve maintenance or emergency repairs on the pipeline or corrosion-control devices. The pipeline would be maintained as required, using local contractors specializing in this type of work.

GAS PLANT OPERATION AND MAINTENANCE

The Bairoil gas plant would remove H₂S; recover, compress, and dehydrate sulfur; recover NGL; and separate CO₂ for reinjection. Initially, the plant would have a

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70 MMcfd capacity for H₂S removal and sulfur recovery, compression, and dehydration. For 3 years, no attempt would be made to remove NGL from CO₂ and the gases would be reinjected. After 10 years, the plant would be expanded to a full operating capacity of 110 MMcfd.

The produced gas could be delivered through the pipeline to the plant at approximately 170 pounds per square inch gauge (psig). It would then enter a LO-CAT unit (Amoco 1984-85) for H₂S removal and sulfur recovery. H₂S would be converted to elemental sulfur and SO₂. The wet sulfur product would be recovered, dried, and stacked for sale as a solid material. The SO₂ and small amounts of other pollutants would be discharged into the air at the rate of 45 tons per year.

The sweetened gas (methane) leaving the LO-CAT would be compressed to approximately 500 psig. It would then be dehydrated to remove water and lessen cold weather and corrosion problems.

The sweet, dry gas would enter the separation portion of the plant, where NGL and CO₂ would be separated from the produced gas. The NGL stream would be treated to meet pipeline specifications and would then be sold. The relatively pure CO₂ in a condensed phase, would be compressed to 2,500 psig for injection. The residual hydrocarbon gas would either be used for fuel or stored in an existing gas storage reservoir for future use. Since residual gas would typically make up less than 5 percent of the produced gas, it could not be marketed economically, given current prices.

If the plant needed to be shut down, the hydrocarbon gas, CO₂, and H₂S normally being separated would have

to be burned to avoid hazards associated with H₂S. A flare requiring 1,000 million Btu's per hour of additional methane would be activated. More methane would be needed because the product from the field would not be pure enough to burn.

Operation of the plant would require the disposal of solid wastes, including charcoal, waste from filters used in gas separation catalysts, hydrocarbon waste sludges, hay, and diatomaceous earth. All of these wastes would be nontoxic and would be disposed of in accordance with regulations at an approved disposal site.

Water to operate the proposed plant would come from the existing Battle Springs wells located northwest of Bairoil. Projected water use would be about 47 acre-feet per year. The Bairoil gas plant would be designed so that no water would be discharged during normal operations.

Electricity and fuel gas would be consumed by various plant components. Under full operation, the plant would require about 41 kilowatts of electricity per hour. Normal heat requirements for equipment fired with fuel gas are projected to be 174.94 million Btu's per hour.

ENHANCED OIL RECOVERY OPERATION AT BAIROIL

Oil is currently being recovered at Amoco's Lost Soldier and Wertz fields using secondary waterflood techniques. Of the 10 producing formations in these fields, the Tensleep and Madison are targeted for CO₂ flooding. Table 11 shows the depths and thicknesses of these two formations.

TABLE 11
ENHANCED OIL RECOVERY,
MAJOR PRODUCTIVE FORMATIONS AND PRESSURES

Formation and Location	Age	Depth (feet)	Thickness (feet)	Original Pressure (psig ¹)	Existing Pressure (psig)	CO ₂ Pressure Required (psig)
Tensleep Sandstone						
	Pennsylvanian					
Lost Soldier Field		5,000	210	2,328	1,103	2,620
Wertz Field		6,200	150	2,940	2,000	2,623
Madison Horizon						
Madison Limestone	Mississippian					
Darwin Sandstone	Pennsylvanian					
Lost Soldier Field		5,400	235	2,350	1,150	2,620
Wertz Field		6,621	250	2,750	1,835	2,631

¹psig = pounds per square inch gauge

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Waterflood is used for oil production in the two formations at Bairoil. The Wertz field, Madison formation, is still using primary recovery oil wells with no materials being injected to force additional oil out of the ground. A program to begin waterflooding in the Wertz field is currently being implemented. During the first year of CO₂ injection, an excess of water would be produced with the oil and gas and disposed of at the Wertz field, Madison formation.

After the first year, water production would decrease and CO₂ production would begin. CO₂ injection at the Wertz field would occur later in the Madison formation than in the others, since the field would be used for excess water disposal during the first year. The waterflood process in the Lost Soldier and Wertz fields, Tensleep formation, and the Lost Soldier Field Madison formation would recover an additional 20 to 30 percent of the original oil in place. When waterflooding is no longer economical, 50 to 60 percent of the original oil in place would still be trapped in the pore spaces of the producing formations. This residual oil is the target for enhanced oil recovery using CO₂ flooding. CO₂ is strongly attracted to and very soluble in oil. Enhanced oil recovery displaces oil by using CO₂ in a way similar to using solvents to dry-clean clothes. Most CO₂ floods alternate CO₂ and water injection until the desired amount of CO₂ has been injected. Then the injection wells continue to inject water, forcing the CO₂ and liberated oil toward the producing wells, thus producing more oil and CO₂. The CO₂ and hydrocarbon gases are then separated from the hydrocarbons, impurities, and water at the satellite tank batteries and piped to the gas separation plant. At the plant, the CO₂ is purified and returned to the field for reinjection, and the hydrocarbon gases are readied for market. The oils and water are sent from the satellite tank facilities to the production facilities for separation.

The existing pressure in each of the Bairoil reservoirs is much lower than either the original pressure or the pressure required to achieve an effective CO₂ flood. Table 11 shows the pressures of the four reservoirs. In order to achieve miscibility (smooth mixing) between the CO₂ and hydrocarbon products in the Lost Soldier field, Tensleep and Madison formations, the reservoir pressure would have to be raised to a higher level than the original pressure. This should not cause any expansion or fracturing of either formation.

An additional 5 to 15 percent of the original in place oil could be recovered in the Lost Soldier and Wertz fields with CO₂ EOR. A total of 22,326,000 more barrels of oil, 221,526 million more standard cubic feet of gases (3½ to 4 percent of which would be hydrocarbon gases, the rest mostly CO₂), and 5,826,000 more barrels of NGL could be produced.

Table 12 shows the predicted annual production volumes of oil, gas, and NGL under the proposed CO₂ flooding

process and the annual production volumes under continued waterflooding processes. (Simultaneous flooding of all four reservoirs has been assumed.) About 90 percent of the production would occur in Sweetwater County and the remaining 10 percent in Carbon County.

The proposed EOR process at the Bairoil field could be used at most other suitable oil and gas fields near Exxon's proposed CO₂ pipeline, including fields along the Cedar Creek Anticline. Details relating to water and CO₂ schedules, pressures, formations, and amounts of recovered in-place oil would vary, but basically the concept and surface and subsurface impacts would be similar.

Operation of the Bairoil plant would require 13 workers in addition to those presently employed at the Wertz plant. Operation of the enhanced oil recovery program at the well field would require 12 additional workers.

Operation would require an additional 20-ton truck to haul sulfur once or twice a week and another 20-ton truck to haul NGL daily. The workforce would cause one-way commuting trips to increase by seven per day.

RUPTURE SCENARIO

The frequency or size of leaks that could occur along the pipeline cannot be predicted, since few CO₂ pipelines exist. However, based on other types of natural gas pipelines, an average rupture frequency of 1 in 10,000 ruptures per mile per year could be expected (DNRC 1980 and BLM 1984a). Most ruptures are caused by heavy equipment operations and other outside forces 61 percent of 1983 ruptures according to the U.S. Department of Transportation [1985]). With advances in pipeline technology and the rural location of the pipeline, ruptures could occur even less frequently than cited above. In rural or isolated areas, heavy equipment would not often be used; therefore the chance of rupture would be less.

Since CO₂ is nonflammable, no explosion or fire would occur in the event of a rupture. However, flying soil, rocks, and other debris could be extremely dangerous. Studies of natural gas pipeline ruptures, where gas did not explode, show flying debris to be limited to within 150 to 200 feet of the rupture (Pleshko 1985).

Gas concentration near the rupture would be high. The exact concentration would depend on how fast the CO₂ could go from a highly compressed state, rapidly expanding and absorbing heat from the atmosphere, to a gaseous state at ambient temperature. The gas would be slightly heavier than air.

If a rupture occurred at a stream crossing, the escaping CO₂ plume would spread and be diluted by dispersion as

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TABLE 12
ESTIMATED ANNUAL PRODUCTION VOLUMES
INCREASES IN CO₂ ENHANCED OIL RECOVERY
AT BAIROIL

Year	Oil (thousand barrels)			Produced Gas (thousand SCF)			Liquid Natural Gas (thousand barrels)		
	Waterflood	CO ₂ Flood	Increase or Decrease	Waterflood ^a	Flood ^b	Increase or Decrease	Waterflood	CO ₂ Flood	Increase or Decrease
1985	4,737	4,737	0	947,400	948,000	+600	152	152	0
86	4,028	4,027	-1	805,600	805,000	-600	129	129	0
87	3,486	3,755	+269	697,200	751,000	+53,800	112	120	+8
88	3,078	4,792	+1,714	615,600	18,676,000	+18,060,400	98	598	+500
89	2,757	5,741	+2,984	551,400	40,307,000	+39,755,600	88	1,099	+1,011
90	2,496	4,147	+1,651	499,200	43,668,000	+43,168,800	80	952	+872
91	2,278	5,490	+3,212	455,600	36,720,000	+36,264,400	73	1,021	+948
92	2,095	5,579	+3,484	419,000	35,124,000	+34,705,000	67	949	+882
93	1,938	3,703	+1,765	387,600	22,193,000	+21,805,400	62	608	+546
94	1,801	2,990	+1,189	360,200	15,102,000	+14,741,800	58	469	+411
95	1,681	2,745	+1,064	336,200	7,411,000	+7,074,800	54	328	+274
96	1,575	3,331	+1,756	315,000	3,745,000	+3,430,000	50	251	+201
97	1,481	3,481	+2,000	296,200	1,910,000	+1,613,800	47	165	+118
98	1,398	2,949	+1,560	279,600	914,000	+634,400	45	104	+59
99	1,322	1,177	-145	264,400	372,000	+107,600	42	42	0
2000	1,253	1,248	-5	250,600	238,000	-12,600	40	37	-3
01	1,191	1,953	+762	238,200	366,000	+127,800	38	58	+20
02	1,134	973	-161	226,800	236,000	+9,200	36	29	-7
03	1,082	973	-109	216,400	236,000	+19,600	35	29	-6
04	1,035	779	-256	207,000	156,000	-51,000	33	25	-8
05	991	748	-243	198,200	149,000	-49,200	32	24	-8
06	643	718	+75	128,600	144,000	+15,400	21	23	+2
07	622	691	+69	124,400	138,000	+13,600	20	22	+2
08	601	665	+64	120,200	133,000	+13,000	19	21	+2
09	582	642	+60	116,400	128,000	+11,600	19	20	+1
10	564	620	+56	112,800	124,000	+11,200	18	20	+2
11	547	600	+53	109,400	120,000	+10,600	18	20	+2
12	531	581	+50	106,200	117,000	+10,800	17	18	+1
13	516	563	+47	103,200	112,000	+8,800	17	18	+1
14	502	361	-141	100,400	72,000	-28,400	16	11	-5
TOTALS	48,433	70,759	+22,326	9,589,000^a	231,115,000^b	221,526,000	1,536	7,362	+5,826

^a Approximately 75 percent would be hydrocarbon gas; the remaining 25 percent would be a mixture of H₂S, helium, nitrogen, and other gases.

^b Approximately 3 to 4 percent of produced gas would be hydrocarbon gas, 71 percent would be CO₂, and the remaining 25 percent would be a mixture of H₂S, helium, nitrogen, and other gases.

it is swept downstream. A small amount of gas would go into solution with most of the gas bubbling to the surface. Under standard conditions, at 25°C, equilibrium concentration would be 0.55 mg/l. Adjacent to the leak, supersaturation could occur with concentrations as high as 1,500 mg/l. The volume of water saturated would depend on the flow of the stream, the size of the rupture, and length of time before block valves were closed.

Any physical damage from the rupture of the pipe would be cleaned up after the line was repaired. Clean-up and restoration procedures would be determined by consulting with landowners or agencies having jurisdiction.

Pinhole leaks during operation of the pipeline could occur but would not cause any adverse effect on the environment. The leak would probably cause a high-

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

pitched sound made by the escaping gas and form a white frost spot on the ground that would be quickly noticed.

If a rupture occurred under Lake Sakakawea the plume of CO₂ and saturated water would rise and spread out in a radial pattern, as affected by the current. Concentration of CO₂ in the plume would range from pure CO₂ in the center to saturated equilibrium conditions at the top outer edges of the plume. At a 50-foot lake, depth supersaturation would occur adjacent to the escaping gas; these concentrations could be from 1,500 to 3,000 mg/l. The supersaturation zone would be small and quickly dissipate as it rises. As the gas leaves the water and saturated equilibrium conditions occur, eventually only 0.55 mg/l of CO₂ would remain.

The size of the plume, its volume, and the time it would take to reach equilibrium would depend on the size of the rupture and the time the leak went undetected.

Abandonment

When the pipeline and plant project ended in 30 to 35 years, all surface facilities would be removed, the pipe-

line plugged or removed, and the disturbed acreage reclaimed according to the measures identified in Appendix 4.

SINGLE BAIROIL PIPELINE ALTERNATIVE

The Single Bairoil Pipeline Alternative involves building and operating only one of the two main pipelines proposed to take CO₂ from the origin point to Bairoil, Wyoming. See Tables 13 through 18 for facts about this alternative.

The alternative could be implemented if (1) Amoco and Exxon agreed that only one pipeline needed to be built and the two companies were able to develop a cost-sharing or ownership arrangement, or (2) the Wyoming BLM State Director decided to authorize only one pipeline.

The difference between this alternative and the Proposed Action is that 154 miles of 20-inch pipeline and ancillary facilities would not be built from MP 48.9R to the Bairoil plant. Facilities not built would include the origin meter station at MP 48.9R, seven block valves,

TABLE 13
SINGLE BAIROIL PIPELINE ALTERNATIVE MILEPOST LISTING OF
ANCILLARY FACILITIES

Milepost	Block Valve	Scraper Trap	Meter Station	Booster Station	Feature
0.0 2.6	X	X	X		Origin Southwest Bank Green River
2.7 3.2 23.0 35.5	X X X	X		X	Northeast Bank Green River Booster Station
57.7 68.1 80.1 98.1	X X X				
111.4/0.0 S 20.0 S 131.3 133.6 138.3	X X	X	X		Bairoil Junction Meter Station at Plant Sweet Water River Beef Gap
149.1 168.4 172.4 178.3	X X X				Middle Fork Casper Creek

SINGLE BAIROIL PIPELINE ALTERNATIVE

TABLE 13
SINGLE BAIROIL PIPELINE ALTERNATIVE MILEPOST LISTING OF
ANCILLARY FACILITIES (Concluded)

Milepost	Block Valve	Scraper Trap	Meter Station	Booster Station	Feature
187.5	X	X			
205.2	X				
226.4	X				
226.5					Interstate 25
234.3					Salt Creek
244.7	X				
265.0	X				
282.4	X	X			
301.4	X				
312.2	X				
334.7	X				
336.1					Little Powder River
335.0					WY-MT State Line
358.8	X				
375.4	X	X			
395.4	X				
417.1	X				
433.3					Little Beaver Creek
435.8	X				
455.2	X				
467.0	X		X		Cedar Creek Meter Station
473.8	X				
487-					MT-ND State Line
497.0	X	X			
510.4					Bank-Little Missouri River
510.5					Bank-Little Missouri River
526.9	X				
532.3					Interstate 94
543.0					Proposed Action and Alternative Divide
546.5	X				
568.5	X				
583.0	X				
587.8					Bank Little Missouri River
588.0					Bank Little Missouri River
609.5	X	X			
622.0					Proposed Action and Alternative (MP A626) Join
625.5	X				
625.8					South Side Lake Sakakawea
628.0					North Side Lake Sakakawea
629.0	X				
643.5	X	X	X		Tioga Terminal

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

TABLE 14
ACRES DISTURBED, REMOVED, AND RECLAIMED
SINGLE BAIROIL PIPELINE ALTERNATIVE

Alternative Components	Acres Disturbed	Acres Removed	Acres Reclaimed
Pipelines			
111.0 miles @ 9 acres per mile and			
532.5 miles @ 12 acres per mile	7,358.0 ^a	0.0	7,352.7
20.0 miles @ 12 acres per mile	240.0	0.0	240.0
65.0 miles @ 6 acres per mile	390.0	0.0	390.0
Facilities			
Origin Meter/Junction	1 @ 1 acre each	1.0	0.0
Bairoil Junction	1 @ 1 acre each	1.0	0.0
Block Valves	28 @ 1/10 acre each	0.0 ^b	2.8
Scraper Traps w/Block Valves	5 @ 1/2 acre each	0.0 ^b	2.5
Green River Staging Areas	2 @ 2 1/2 acres each	5.0	0.0
Booster Stations	1 @ 3 acres each	9.0	9.0
Staging Area			
South Side-Lake Sakakawea	3.5	0.0	3.5
Staging Area			
North Side-Lake Sakakawea	17.5	0.0	17.5
Staging Areas			
Other Creeks & Rivers	7 @ 5 acres each	35.0	0.0
Tioga Meter (Terminal)	1.0	1.0	0.0
Upgrading Existing Roads	74.0	74.0	0.0
Temporary Access Roads	108.0	0.0	108.0
Bairoil Meter	1.0	1.0	0.0
Bairoil Gas Plant	100.0	100.0	0.0
Bairoil Product Storage Tank Site	3.0	3.0	0.0
Bairoil Field CO ₂ Distribution System	300.0	0.0	300.0
Cedar Creek Receipt Meters (2)/Booster Station	5.0	5.0	0.0
Cedar Creek Delivery Meters	8 @ 2 acres each	16.0	16.0
Power Lines to Junctions, Block Valves, Scraper Traps, Booster Stations & Microwave Sites	132.0	0.0	132.0
Microwave Sites	20 @ 1/4 acre each	5.0	5.0
TOTAL	8,799.0	215.3	8,583.7

^a 31 acres of water (rivers, creeks, and lakes) have been removed from acres disturbed.

^b The disturbed acreage would be within the right-of-way.

three scraper traps, four staging areas at two crossings of the Green River, and two booster stations. About 686 fewer acres would be disturbed and 8 fewer acres would be removed from current use. As a result, 8,799 acres would be disturbed under the Single Bairoil Pipeline Alternative and 215.3 acres would be removed from current use.

During peak construction, 277 fewer employees would be needed, for a total construction crew of 1,584.

U.S. HIGHWAY 85 ALTERNATIVE

The 755.5-mile-long U.S. Highway 85 Alternative would include all components of the composite Proposed Action plus one more block valve. The alternative would provide a different route for a portion of Exxon's proposed Wyoming-Dakota pipeline. The alternative would be the same as Exxon's Proposed Action route from the

U.S. HIGHWAY 85 ALTERNATIVE

**TABLE 15
PIPELINES AND ROADS PARALLELED
BY THE SINGLE BAIROIL PIPELINE ALTERNATIVE**

MILEPOST	PIPELINES		ROADS		NAME
	Miles	State	Miles	State	
Main Pipeline					
0-140.1	140.1	WY			
184.2-185.3	1.1	WY			
278.6-287.6			9.0	WY	State Highway 50
297.6-307.9	10.3	WY			
313.0-355.1	42.1	WY			
355.1-361.8	6.7	MT			
398.0-428.7	30.7	MT			
417.1-420.1			3.0	MT	Chalk Buttes Road
435.8-451.0			15.2	MT	State Highway 7
455.3-459.9			4.6	MT	State Highway 7
468.0-474.0			6.0	MT	State Highway 7
502.6-526.4	23.8	ND			
540.0-543.0			3.0	ND	U.S. Highway 85
577.6-583.5			5.9	ND	State Highway 22
599.0-625.0	26.0	ND			
628.5-643.0	14.5	ND			
SUBTOTAL:	295.3		46.7		
Bairoil Spur					
0.0S-20S	20.0	WY			
SUBTOTAL:	20.0				
Cedar Creek Distribution					
1.8D-25.0D	23.2	MT			
32.0D-63.5D	31.5	MT			
SUBTOTAL:	54.7				
TOTAL:	370.0		46.7	(3 miles of road & pipeline overlap)	

origin point (MP 0.0) to MP 543 in North Dakota. It would then leave the Proposed Action route and head north, paralleling U.S. Highway 85 as it passed through mixed agricultural land and entered the Little Missouri Breaks. From MP 580A to 587A, the route would pass just east of the boundary of the Theodore Roosevelt National Park (Map 3). The route would then leave the Breaks area and swing northeast across mixed agricultural land to rejoin the Proposed Action (Proposed Action—MP 622; U.S. Highway 85 Alternative—MP 626A).

The alternative would involve federal, state, and private lands. Appendix 5 indicates by mileage the ownership

and management of lands crossed by the alternative. See Map A-1, inside back pocket, for land ownership by acres and percentages.

All numbers and locations of ancillary facilities for this alternative would be the same as for the Proposed Action, except for milepost locations beyond the point where it leaves the Proposed Action route.

Table 19 lists all ancillary facilities by milepost for the pipeline portion of the U.S. Highway 85 Alternative. The construction methods would be the same as for the Proposed Action. Table 20 shows the surface disturbance that would result from the project.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

**TABLE 16
DIRECT CONSTRUCTION EMPLOYMENT BY QUARTER
SINGLE BAIROIL PIPELINE ALTERNATIVE**

Component	1986									1987						
	2nd Qtr.			3rd Qtr.			4th Qtr.			1st Qtr.		2nd Qtr.			3rd Qtr.	4th Qtr.
	Exxon	Amoco	Shell	Exxon	Amoco	Shell	Exxon	Amoco	Shell	Exxon	Amoco	Exxon	Amoco	Shell	Amoco	Amoco
Main Pipeline																
Spread 1 (includes Bairoil Spur)	174			199			97									
Spread 2	122			162			62			46		62				
Spread 3	122			162			62			46		62				
Spread 4	122			162			62			46		62				
Spread 5	122			162			62			46		62				
Spread 6	122			162			62			46		62				
Booster Station																
MP 35				16								19				
Lake Crossing				30												
Meter Stations																
Origin	7			16			3									
Bairoil Plant	7			16			3									
Tioga Terminal				16								8				
Cedar Creek				16												
Distribution Pipeline			45			45										
Meter Stations/ Booster Station						25		10						10		
Bairoil Plant & Facilities	245			318			256			411		620		461	267	
Microwave System																
Spread 1 & Spur	35			35			35					58				
All Other Spreads	36			58			28									
TOTAL BY COMPANY:	869	245	45	1,196	318	70	476	256	10	230	411	395	620	10	461	267
QUARTER TOTAL:	1,159			1,584			742			641		1,025			461	267

The U.S. Highway 85 Alternative would cross the same major streams as the Proposed Action. However, the location of the second Little Missouri River crossing would be different and would occur at MP 584.4-584.5.

The alternative would parallel the same roads and pipelines as would the Proposed Action until MP 543, where the two routes split from one another. The alternative would parallel pipelines or roads for 494.5 miles or 65 percent of its length. See Table 21 for a listing by milepost of pipelines and roads that would be parallel.

CROOKS GAP OPTION

The Crooks Gap Option is an 18-mile-long segment that would replace a 13-mile-long segment of the Proposed Action from MP 111 to 124 in Wyoming. The option would head north for about 9 miles, then turn to the east for another 9 miles, rejoining the Proposed Action at MP 124. The Crooks Gap Option is mileposted from MP 111 to 129CG.

The option would disturb about 216 acres, compared to 156 acres along the part of the Proposed Action route it would replace.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

TABLE 17
PIPELINE SPREAD LOCATION
AND LENGTH
SINGLE BAIROIL
PIPELINE ALTERNATIVE

Spreads*	Location by Milepost	Length in Miles
Main Pipeline & Bairoil Spur		
Spread 1	MP 0.0-111 0.0S-20S	131.0
Spread 2	MP 111-203	92.0
Spread 3	MP 203-280	77.0
Spread 4	MP 280-437	157.0
Spread 5	MP 437-567	130.0
Spread 6	MP 567-643.5	76.5
TOTAL (Spreads 1-6):		663.5
Cedar Creek Distribution Pipeline		
Spread 7	MP 0.0-65	65.0

*There are a total of seven construction spreads.

The Crooks Gap Option would cross 9.1 miles of lands administered by BLM, 5 miles of private lands, and 3.9 miles of State of Wyoming lands. Two miles of existing pipelines would be paralleled, from MP 111 to MP 113CG. There would be no ancillary facilities along the Crooks Gap Option.

NO-ACTION ALTERNATIVE

The No-Action Alternative would be the denial of the requested rights-of-way. This means that the proposed projects would not be authorized to cross BLM-administered land. Enhanced oil recovery, which would rely on the pipelines, would not occur as proposed unless alternate sources of CO₂ could be found and developed quickly. Presumably, waterflooding would continue in these fields to extract oil and gas and maintain the field pressure.

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

The following alternatives were considered but eliminated from detailed analysis in this EIS.

Truck Transportation of CO₂

Transporting CO₂ from any of its existing sources would require 14,500 trucks each day at a frequency of over one truck a minute. The existing roads could not handle this traffic volume and would need to be expanded. In addition to the impacts from road construction and maintenance, road safety and the costs of trucking CO₂ were also considered in eliminating this alternative.

Alternative A—Original Proposed Route through the Little Missouri Breaks

Alternative A, Exxon's original route, would have crossed a stretch of land along the Little Missouri River. It was not viewed favorably by various state and federal agencies because of potential conflicts with wildlife and scenic values. Exxon, therefore, modified its right-of-way application to follow a route to the east (the current Proposed Action) with fewer environmental conflicts.

Alternative B—Conceptual (Unmapped) Route

This alternative would have followed another route north from Baker, Montana, through other Montana oil fields, then east to Tioga, North Dakota. It was not considered in detail because, according to industry sources, these oil fields were not as likely to be ready for CO₂ injection as the fields along the Proposed Action route.

Alternative C—Belle Creek Alternative

The Belle Creek Alternative would have bypassed the oil field on the Wyoming-Montana border that surrounds the small oil field community of Belle Creek, Montana. It would have crossed rolling agricultural lands rather than the steeper topography along the Proposed Action route. The alternative route around the oil field would have been 5.6 miles longer and would not have provided significant environmental advantages over the Proposed Action. Also, a 9-mile-long, 8-inch-diameter lateral spur

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

TABLE 18
LOCATION OF PIPELINE WELDING
STORAGE YARDS, AND TRANSPORTATION¹
SINGLE BAIROIL PIPELINE ALTERNATIVE

Pipeline Welding & Storage Yard Location ¹	Items Being Hauled	Size of Vehicle or Load	Loads (one way)	Total Tonnage of Material Handled/ Destination
Rock Springs ²	Pipe and Materials	20-Ton	35/day	42,500 tons for Spread 1
	Workers	Buses, Cars, & Pickups	26/day	
Casper	Pipe and Materials	20-Ton	20/day	26,000 tons for Spread 2
	Workers	Buses, Cars, & Pickups	26/day	
Gillette	Pipe and Materials	20-Ton	45/day	58,000 tons (22,000 to south, Spread 3; 36,000 to north, Spread 4)
	Workers	Buses, Cars, & Pickups	26/day	
Baker ³	Pipe and Materials	20-Ton	Exxon— 23/day	30,000 tons for Spread 5
			Shell— 2/day	5,000 tons for Spread 1 ⁴
	Workers	Buses, Cars, & Pickups	26/day	
Williston	Pipe and Materials	20-Ton	15/day	16,000 tons for Spread 6
	Workers	Buses, Cars, & Pickups	20/day	

Note: Pipe and materials loads based on a 5-day work week and 60 to 65 actual hauling days.

¹ This table would apply to the Proposed Action, the U.S. Highway 85 Alternative, and the Crooks Gap Option. The Proposed Action would require about 60 days of hauling, the U.S. Highway 85 Alternative would require about 63 days and the Crooks Gap Option about 65 days.

² Amoco and Exxon each would have a storage yard.

³ Exxon would have a storage yard; Shell would use an existing facility.

⁴ Shell would haul for about 120 days.

line would have been needed to provide CO₂ to the Belle Creek oil field.

Alternative D—Casper Alternative

This alternative would have followed the Frontier pipeline corridor to Casper and then headed north, in-

stead of passing Casper at a distance to the west. This alternative would have followed existing corridors established in the BLM Casper District Office resource management plans.

Laying the 18-inch-diameter alternative pipeline within the present corridor in Casper would have caused several significant problems. Since the present corridor is

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

TABLE 19
U.S. HIGHWAY 85 ALTERNATIVE MILEPOST LISTING OF
ANCILLARY FACILITIES

Mile Post	Facility								Feature
	Block Valve		Scraper Trap		Meter Station		Booster Station		
	Exxon	Amoco	Exxon	Amoco	Exxon	Amoco	Exxon	Amoco	
49.0R					X ¹				
38.3R		X							
38.2R									East Bank of Green River
38.1R									West Bank of Green River
38.0R		X							
25.0R									End of R Mile Post
0.0	X	X	X	X	X	X		X	Origin
2.6									Southwest Bank Green River
2.7									Northeast Bank Green River
3.2	X	X							
23.0	X	X							
35.5	X	X	X	X				X	
57.7	X	X							
68.1		X		X				X	
80.1	X	X							
98.1	X	X							
111.4/0.0S	X	X	X	X					Bairoil Junction
20.0S					X				Meter Station at Plant
131.3	X								
133.6									Sweet Water River
138.3									Beef Gap
149.1	X								
168.4	X								
172.4	X								
178.3									Middle Fork Casper Creek
187.5	X		X						
205.2	X								
226.4	X								
226.5									Interstate 25
234.3									Salt Creek
244.7	X								
265.0	X								
282.4	X		X						
301.4	X								
312.2	X								
334.7	X								
336.1									Little Powder River
355.0									WY-MT State Line
358.8	X								
375.4	X		X						
395.4	X								

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

**TABLE 19
U.S. HIGHWAY 85 ALTERNATIVE MILEPOST LISTING OF
ANCILLARY FACILITIES (Concluded)**

Mile Post	Facility								Feature
	Block Valve		Scraper Trap		Meter Station		Booster Station		
	Exxon	Amoco	Exxon	Amoco	Exxon	Amoco	Exxon	Amoco	
417.1	X								
433.3									Little Beaver Creek
435.8	X								
455.2	X								
467.0	X				X				Cedar Creek Meter Station
473.8	X								
487.0									MT-ND State Line
497.0	X		X						
510.4									West Bank Little Mo. River
510.5									East Bank Little Mo. River
526.9	X								
532.3									Interstate 94
543.0									PA & Alt. Divide
543.2	X								
565.5	X								
583.0	X								
584.4									South Side Little Mo. River
584.5									North Side Little Mo. River
587.0	X								
604.0	X		X						
605.7	X								
626.0									PA and Alt Join
629.5	X								
628.8									South Side of Lake Sakakawea
632.0									North Side of Lake Sakakawea
632.5	X								
647.5	X		X		X				Tioga Terminal

¹Analyzed in Rangely FEIS.

narrow, building the pipeline would have required crossing other pipelines, power lines, telephone lines, roads, and public utility lines. Disruption of any of the services provided by the facilities would have been significant.

Also, because the pipeline size would have required a larger construction area, the potential for crossing individual homesites would have been higher. In some cases, this impact may not have been acceptable.

Alternative E—Amoco Rock Springs Alternative

This alternative would have extended from MP 49 of the Rangely CO₂ pipeline, passed Rock Springs below White Mountain, and then traveled north until it intersected the Frontier pipeline corridor. From there the

alternative would have followed the same route as the Proposed Action. The alternative was dropped from further consideration because it would have crossed the suburban area of Rock Springs and valuable coal resources.

Alternative F—Alternate Pipeline (Amerada Hess) from Beulah, ND

This alternative would have provided an alternate source of CO₂ for oil fields in eastern Montana and western North Dakota. The source would have been the Great Plains coal gasification plant at Beulah. Amerada Hess is studying a possible CO₂ pipeline from this plant to Tioga, North Dakota and Baker, Montana. The alternative was deleted from detailed study because BLM has not received an application for a right-of-way from

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

**TABLE 20
ACRES DISTURBED, REMOVED, AND RECLAIMED
U.S. HIGHWAY 85 ALTERNATIVE**

Alternative Components		Acres Disturbed	Acres Removed	Acres Reclaimed
Pipelines				
670.5 miles @ 12 acres per mile		8,015.0 ^a	0.0	8,009.0
20.0 miles @ 15 acres per mile		300.0	0.0	300.0
65.0 miles @ 6 acres per mile		390.0	0.0	390.0
Facilities				
Origin Meter/Junction	2 @ 1 acre each	2.0	2.0	0.0
Bairoil Junction	1 @ 1 acre each	1.0	1.0	0.0
Block Valves	35 @ 1/10 acre each	0.0 ^b	3.5	0.0
Scraper Traps w/Block Valves	5 @ 1/2 acre each	0.0 ^b	2.5	0.0
Green River Staging Areas	6 @ 2 1/2 acres each	15.0	0.0	15.0
Booster Stations	3 @ 3 acres each	9.0	9.0	0.0
Staging Area				
South Side-Lake Sakakawea		3.5	0.0	3.5
Staging Area				
North Side-Lake Sakakawea		17.5	0.0	17.5
Staging Areas				
Other Creeks & Rivers	7 @ 5 acres each	35.0	0.0	35.0
Tioga Meter (Terminal)		1.0	1.0	0.0
Upgrading Existing Roads		74.0	74.0	0.0
Temporary Access Roads		108.0	0.0	108.0
Bairoil Meter		1.0	1.0	0.0
Bairoil Gas Plant		100.0	100.0	0.0
Bairoil Product Storage Tank Site		3.0	3.0	0.0
Bairoil Field CO ₂ Distribution System		300.0	0.0	300.0
Cedar Creek Receipt Meters (2)/Booster Station		5.0	5.0	0.0
Cedar Creek Delivery Meters	8 @ 2 acres each	16.0	16.0	0.0
Power Lines to Junctions, Block Valves, Scraper Traps, Booster Stations & Microwave Sites		132.0	0.0	132.0
Microwave Sites	20 @ 1/4 acre each	5.0	5.0	0.0
TOTAL		9,533.0	223.0	9,310.0

^a 31 acres of water (rivers, creeks, and lakes) have been removed from acres disturbed.

^b The disturbed acreage would be within the right-of-way.

Note: *Disturbed* refers to acreages disturbed during construction, which are revegetated and rehabilitated following construction.

Removed refers to acreages removed from present use for the life of the project; these are revegetated and rehabilitated after project abandonment.

Amerada Hess nor has there been any indication that an application would be submitted soon. The alternative would not have provided a way for Exxon to transport CO₂ to the various oil fields in the Williston Basin, thus allowing Exxon to avoid venting the CO₂ produced at the Shute Creek plant. See the analysis in Appendix 3 prepared by the Montana Department of Natural Resources and Conservation for more information.

Alternative G—Deferred Implementation

Under this alternative, the proposed pipeline would not be built soon enough to start deliveries of CO₂ in 1987. Construction would have been deferred until rising oil prices improved, making enhanced oil recovery more

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

**TABLE 21
PIPELINES AND ROADS PARALLELED
BY THE U.S. HIGHWAY 85 ALTERNATIVE**

MILEPOST	PIPELINES		ROADS		NAME
	Miles	State	Miles	State	
Main Pipeline					
49.0R-26.0R	23.0	WY			
0-140.1	140.1	WY			
184.2-185.3	1.1	WY			
278.6-287.6			9.0	WY	State Highway 50
297.6-307.9	10.3	WY			
313.0-355.1	42.1	WY			
355.1-361.8	6.7	MT			
398.0-428.7	30.7	MT			
417.1-420.1			3.0	MT	Chalk Buttes Road
435.8-451.0			15.2	MT	State Highway 7
455.3-459.9			4.6	MT	State Highway 7
468.0-474.0			6.0	MT	State Highway 7
502.6-526.4	23.8	ND			
540.0-553.6			13.6	ND	U.S. Highway 85
552.0-606.0	54.0	ND			
576.8-580.4			3.6	ND	U.S. Highway 85
603.0-629.0	26.0	ND			
633.0-647.5	14.5	ND			
SUBTOTAL:	372.3		55.7		
Bairoil Spur					
0.0S-20S	20.0	WY			
SUBTOTAL:	20.0				
Cedar Creek Distribution					
1.8D-25.0D	23.2	MT			
32.0D-63.5D	31.5	MT			
SUBTOTAL:	54.7				
TOTAL:	447.0		55.7	(8.2 miles of road & pipeline overlap)	

profitable. The decision on when enhanced oil recovery projects would have been made by the owners of the oil fields, based on their assessment of projected oil prices and inflation. In the meantime, waterflooding of the oil fields would continue as long as it was profitable.

If continued production using primary and secondary techniques become unprofitable, field owners would make every attempt to temporarily cap the wells and not use the facilities until the CO₂ pipeline was built. Future enhanced oil recovery could prove considerably more expensive and correspondingly less attractive if attempts to cap wells and temporarily close fields were unsuccessful. Distribution systems would then have to be reinstalled and the capped wells reopened or redrilled.

The commitment of the economic and environmental resources needed to build and operate the proposed pipeline and ancillary distribution and injection equipment would be deferred. The resources would be used by the country during the interim, either for investment or enjoyment, until such time they were committed to the project.

The alternative was deleted from detailed study because the impacts, although similar to those of the Proposed Action, would have been unpredictable since the length of the deferral period is unknown. The alternative offered no environmental advantages over the Proposed Action and it would have required Exxon to continue venting CO₂ into the atmosphere. Reinjection of CO₂ at the LaBarge field would not have been feasible.

Chapter 2

Affected Environment and Environmental Consequences

BAIROIL
POP 100
ELEV 6860

NO
PICKING
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CHAPTER 2 PHOTO:

**View looking down State Highway 73
into the town of Bairoil**

CHAPTER 2

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

The affected environment and environmental consequences (impacts) of the Proposed Action and alternatives are analyzed in this chapter. The affected environment is defined as the baseline environmental, social, or economic conditions that would be affected by the project. Baseline conditions assume normal growth and changes are occurring in the study area. The area of analysis varies for each resource depending on how far-reaching the significant, direct and indirect impacts of the proposed project would be.

Impacts from the Proposed Action and alternatives are discussed at a level of detail corresponding to the anticipated degree or severity of the impacts. Significant impacts are discussed in detail; insignificant impacts are summarized. Cumulative impacts are discussed only for those resources that would be affected.

The following are not discussed in this chapter because they would not be affected by construction or operation of the Proposed Action or the alternatives:

- National Wild and Scenic Rivers, Areas of Critical Environmental Concern, sole sources of drinking water, floodplains or wetlands.
- Neither the Proposed Action nor the alternatives would have any known effects on the cultural or historical values, religious values, or current lifestyles of Native Americans. Access to the Fort Berthold Indian Reservation would also not be affected. North Dakota State Highways 22, 23, and 73, which provide access to the reservation, would be bored under by the Proposed Action at a distance of 4.5 to 6.0 miles from the reservation.
- No federally listed threatened or endangered plant species occur within the project area in Wyoming, Montana, or North Dakota (Appendix 6). The Fish and Wildlife Service lists three candidate (sensitive) plant species occurring in North Dakota, but none are known or expected to occur in the project area. However, several species of plants recognized by the North Dakota Natural Heritage Program as rare and unique species occur in the

area—mainly in the vicinity of Tracy Mountain (North Dakota Parks and Recreation Department 1984).

The Montana Species Rare Plant Project also lists several plant species that occur in the southeastern region of Montana. These species, proposed for listing as threatened or endangered, include the leadplant (*Amorpha canescens*), Platte River Milkvetch (*Astragalus plattensis*), pregnant sedge (*Carex gravida* var. *gravida*), New Jersey tea (*Ceanothus herbaceous* var. *pubescens*), Joe-Pye weed (*Eupatorium maculatum* var. *bruneri*), geyer's spurge (*Euphorbia geyeri*), and few-flowered panic-grass (*Panicum oligosanthes*) (Lesica and other 1984).

The impact analyses assume certain types of mitigation would be implemented that would lessen or avoid adverse impacts (Appendix 4). These measures will have different applications depending on the type of land ownership being crossed:

- Federally managed (public) lands; all measures required of BLM or the Forest Service will be required of the applicants and incorporated into the right-of-way grants.
- State-managed lands; all measures required by each State will be required of the applicants and incorporated into any right-of-way grants and permits issued by each individual state.
- Private land; Exxon has agreed to comply with BLM's general resource measures and Required Reclamation and Erosion Control Procedures for use on private lands, unless the landowner objected. Amoco has determined that the landowners should develop their own measures and if they wanted the BLM General Resource Measures and Required Reclamation and Erosion Control Procedures, Amoco will carry them out. Shell prefers to leave mitigation measure development to the landowner and tie it into monetary compensation.

In Montana, the State Land Board has the authority to require reclamation measures on private lands as a condition of crossing state lands. Reclamation would have

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

to be sufficient to prevent impacts to the public, public lands and lands adjoining the private lands crossed. Private landowners are encouraged to review Appendix 4 to provide a basis for what they would require on their lands. The impact analysis takes into account these differences in mitigation.

PROPOSED ACTION

Socioeconomics

IMPACT SIGNIFICANCE CRITERIA

Socioeconomic impacts were considered significant if changes in the following were projected to be 10 percent or more of the baseline:

- Population of a community or county;
- Total employment or per capita personal income of a county;
- Total revenue or expenses of a community, county, or school district; or
- Requirements for additional capacity, personnel, or equipment for any type of public service or facility.

AFFECTED ENVIRONMENT

The following localities would be affected during the construction phase of the project. (Appendix 7 describes the model that determined the area of influence.)

Montana

Powder River County
Carter County
Fallon County (Baker)
Custer County (Miles City)
Dawson County (Glendive)
Richland County

North Dakota

Golden Valley County
Billings County
Stark County (Belfield, Dickinson)
Dunn County (Killdeer)
McKenzie County (Watford City)
Mountrail County
Williams County (Williston, Tioga)

South Dakota

Butte County (Belle Fourche)
Lawrence County
Pennington County

Wyoming

Sweetwater County
(Green River, Rock Springs, Bairoil)
Fremont County
Carbon County (Rawlins)
Natrona County (Casper)
Converse County
Johnson County (Buffalo)
Sheridan County
Campbell County (Gillette)

The area of influence during project operation would include localities in Carbon, Sweetwater, and Lincoln counties, Wyoming; Fallon County, Montana; and Williams County, North Dakota. Since there are no contracts for delivery of CO₂ to those localities, changes to employment and population from oil production, other than at Bairoil, Wyoming, are not analyzed in this EIS. The Montana Department of Natural Resources and Conservation will analyze in a separate supplement, enhanced oil recovery. (See Preface for additional information.)

Except for Carter and Custer counties, Montana, all counties along the pipeline route have experienced employment and population impacts during the energy developments of the 1970s and early 1980s. In addition, economic conditions have declined in most counties during the recent recession and energy slump. Without the Proposed Action or any interrelated projects, little or no population growth is expected in these counties through 1990.

ENVIRONMENTAL CONSEQUENCES

Pipeline Construction. Since impacts from project construction would peak in the summer of 1986, this analysis focuses on that period. However, construction of the Bairoil oil field facilities would cause another smaller peak in the spring of 1987, with total employment (including direct employment from pipeline construction and secondary employment) at about 1,000 and a population increase around Bairoil of about 220 in Sweetwater County and 1,160 in Carbon County.

See Tables 22 through 26 for changes in employment, income, population, and revenue. Although Converse and Sheridan counties, Wyoming; Richland County, Montana; and Lawrence and Pennington counties, South Dakota would have some short-term employment increases from construction of the Proposed Action,

PROPOSED ACTION—SOCIOECONOMICS

TABLE 22
EFFECTS TO EMPLOYMENT FROM CONSTRUCTION OF THE PROPOSED ACTION

State/ County	Baseline	Proposed Action	INCREASE ABOVE BASELINE		PERCENTAGE INCREASE ABOVE BASELINE		
			Interrelated Projects	Cumulative	Proposed Action	Cumulative	
Wyoming							
Sweetwater	24,000	720	2,640	3,360	3.0	14.0	
Fremont	18,800	30	0	30	0.2	0.2	
Carbon	10,200	460	0	460	4.5	4.5	
Natrona	47,200	320	30	350	0.7	0.7	
Converse	7,700	10	160	170	0.1	2.2	
Johnson	3,700	20	0	20	0.5	0.5	
Sheridan	13,700	10	0	10	0.1	0.1	
Campbell	23,200	150	1,820	1,970	0.6	8.5	
SUBTOTAL:	N/A	1,720	4,650	6,370	N/A	N/A	
Montana							
Carter	790	10	0	10	1.3	1.3	
Fallon	2,170	110	0	110	5.1	5.1	
Custer	7,000	60	0	60	0.9	0.9	
Dawson	6,600	40	0	40	0.6	0.6	
Richland	8,300	10	0	10	0.1	0.1	
SUBTOTAL:	N/A	230	0	230	N/A	N/A	
South Dakota							
Butte	3,600	20	210	230	0.6	6.4	
Lawrence	8,400	10	0	10	0.1	0.1	
Pennington	41,500	20	0	20	*	*	
SUBTOTAL:	N/A	50	210	260	N/A	N/A	
North Dakota							
Billings	1,300	10	0	10	0.8	0.8	
Stark	12,200	140	210	350	1.1	2.9	
Dunn	2,220	10	0	10	0.5	0.5	
McKenzie	4,400	50	0	50	1.1	1.1	
Mountrail	3,600	10	0	10	0.3	0.3	
Williams	13,900	160	0	160	1.2	1.2	
SUBTOTAL:	N/A	380	210	590	N/A	N/A	
TOTAL:	N/A	2,380	5,070	7,450	N/A	N/A	

See Appendix 7 for data sources and methodology.

*Less than 0.05%.

they would not realize any population increases. Likewise, although population would temporarily increase in Custer County, Montana and Butte County, South Dakota, local revenues would not increase in these counties because the pipeline would not pass within their boundaries. However, four other counties—Powder River, Fallon, and Wibaux, Montana and Golden Valley, North Dakota—would realize some increase in revenues because of the proposed construction.

Revenues to localities would not be realized until late 1986 or later because of time lags in tax collection. In addition, most of the revenues would be from mill levies on the in-place value. Wyoming counties and communities, however, would participate in revenues from sales and use taxes during construction. North Dakota also has a sales tax; however, it is not clear how the revenues would be distributed. Montana does not have sales and use taxes.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 23
EFFECTS TO PERSONAL INCOME FROM CONSTRUCTION
OF THE PROPOSED ACTION
(In thousands of dollars)

State/ County	Baseline	Proposed Action	INCREASE ABOVE BASELINE		PERCENTAGE INCREASE ABOVE BASELINE	
			Interrelated Projects	Cumulative	Proposed Action	Cumulative
Wyoming						
Sweetwater	\$ 635,100	\$19,000	\$64,100	\$83,100	3.0	13.1
Fremont	452,900	700	0	700	0.2	0.2
Carbon	220,000	13,100	0	13,100	6.0	6.0
Natrona	1,360,600	8,900	835	9,735	0.7	0.7
Converse	203,700	170	4,100	4,270	0.1	2.1
Johnson	94,700	430	0	430	0.5	0.5
Sheridan	393,600	240	0	240	0.1	0.1
Campbell	538,900	3,900	53,000	56,900	0.7	10.6
SUBTOTAL:	N/A	46,440	122,035	168,475	N/A	N/A
Montana						
Carter	11,200	140	0	140	1.3	1.3
Fallon	40,700	2,700	0	2,700	6.6	6.6
Custer	162,000	1,700	0	1,700	1.0	1.0
Dawson	139,000	1,100	0	1,100	0.8	0.8
Richland	169,800	370	0	370	0.2	0.2
SUBTOTAL:	N/A	6,010	0	6,010	N/A	N/A
South Dakota						
Butte	76,300	570	2,390	2,960	0.7	3.9
Lawrence	191,600	200	0	200	0.1	0.1
Pennington	800,800	620	0	620	0.1	0.1
SUBTOTAL:	N/A	1,390	2,390	3,780	N/A	N/A
North Dakota						
Billings	18,800	150	0	150	0.8	0.8
Stark	278,400	3,800	2,390	6,190	1.4	2.2
Dunn	56,300	360	0	360	0.6	0.6
McKenzie	91,600	1,220	0	1,220	1.3	1.3
Mountrail	94,100	300	0	300	0.3	0.3
Williams	337,700	4,300	0	4,300	1.3	1.3
SUBTOTAL:	N/A	10,130	2,390	12,520	N/A	N/A
TOTAL:	N/A	63,970	126,815	190,785	N/A	N/A

See Appendix 7 for data sources and methodology.

PROPOSED ACTION—SOCIOECONOMICS

**TABLE 24
EFFECTS TO PER CAPITA INCOME FROM CONSTRUCTION
OF THE PROPOSED ACTION**

State/ County	Baseline	With Proposed Action	With Proposed Action and Interrelated Projects	PERCENTAGE INCREASE ABOVE BASELINE	
				Proposed Action	Cumulative
Wyoming					
Sweetwater	\$14,176	\$14,260	\$14,202	0.6	0.2
Fremont	11,887	11,902	11,902	0.1	0.1
Carbon	10,680	10,928	10,928	2.3	2.3
Natrona	17,179	17,226	17,231	0.3	0.3
Converse	14,550	14,562	14,750	0.1	1.4
Johnson	12,973	12,996	12,996	0.2	0.2
Sheridan	13,714	13,723	13,723	0.1	0.1
Campbell	14,684	14,698	15,238	0.1	3.8
Montana					
Carter	6,588	6,632	6,632	0.7	0.7
Fallon	10,711	11,043	11,043	3.1	3.1
Custer	12,000	12,081	12,081	0.7	0.7
Dawson	11,301	11,372	11,372	0.6	0.6
Richland	12,043	12,069	12,069	0.2	0.2
South Dakota					
Butte	9,083	9,129	9,131	0.5	0.5
Lawrence	10,246	10,257	10,257	0.1	0.1
Pennington	10,970	10,978	10,978	0.1	0.1
North Dakota					
Billings	16,491	16,507	16,507	0.1	0.1
Stark	11,747	11,849	11,820	0.9	0.6
Dunn	12,168	12,193	12,193	0.2	0.2
McKenzie	12,844	12,906	12,906	0.5	0.5
Mountrail	12,254	12,293	12,293	0.3	0.3
Williams	15,186	15,256	15,256	0.5	0.5

See Appendix 7 for data sources and methodology.

The following counties and localities would be insignificantly affected, with increases varying from 1 percent to 9 percent:

Employment:

- Sweetwater County, WY
- Carbon County, WY
- Carter County, MT
- Fallon County, MT
- Stark County, ND
- McKenzie County, ND
- Williams County, ND

Personal Income:

- Sweetwater County, WY
- Carbon County, WY
- Carter County, MT

- Fallon County, MT
- Custer County, MT
- Stark County, ND
- McKenzie County, ND
- Williams County, ND

Population:

- Green River, WY
- Rock Springs, WY
- Rawlins, WY
- Gillette, WY
- Baker, MT
- Belfield, ND
- Killdeer, ND
- Watford City, ND
- Williston, ND
- Tioga, ND

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

**TABLE 25
EFFECTS TO POPULATION FROM CONSTRUCTION
OF THE PROPOSED ACTION**

Locality	Baseline	INCREASE ABOVE BASELINE			PERCENTAGE INCREASE ABOVE BASELINE	
		Proposed Action	Interrelated Projects	Cumulative	Proposed Action	Cumulative
Wyoming						
Sweetwater County ^a	44,800	1,070	4,700	5,770	2.4	12.9
Green River	14,250	210	1,410	1,620	1.5	11.4
Rock Springs	20,750	750	2,520	3,270	3.6	15.8
Bairoil	270	60	0	60	22.2	22.2
Camping	—	50	—	—	—	—
Fremont County ^a	38,100	10	0	10	^b	^b
Camping	—	10	—	—	—	—
Carbon County ^a	20,600	730	0	730	3.5	3.5
Rawlins	11,300	730	0	730	6.5	6.5
Natrona County ^a	79,200	300	30	330	0.4	0.4
Casper	56,200	270	30	300	0.5	0.5
Camping	—	30	—	—	—	—
Johnson County ^a	7,300	20	0	20	0.3	0.3
Buffalo	4,100	10	0	10	0.2	0.2
Camping	—	10	—	—	—	—
Campbell County ^a	36,700	230	2,170	2,400	0.6	6.5
Gillette	18,300	210	2,170	2,480	1.1	13.0
Camping	—	20	—	—	—	—
SUBTOTAL:^c	N/A	2,360	6,900	9,260	N/A	N/A
Montana						
Carter County ^a	1,700	10	0	10	0.6	0.6
Camping	—	10	—	—	—	—
Fallon County ^a	3,800	130	0	130	3.4	3.4
Baker	2,380	100	0	100	4.2	4.2
Camping	—	30	—	30	—	—
Custer County ^a	13,500	50	0	50	0.4	0.4
Miles City	9,900	50	0	50	0.5	0.5
Dawson County	12,300	20	0	20	0.2	0.2
Glendive	6,200	20	0	20	0.2	0.2
SUBTOTAL:^c	N/A	210	0	210	N/A	N/A
South Dakota						
Butte County	8,400	20	260	280	0.2	3.3
Belle Fourche	4,700	20	260	280	0.4	6.0
SUBTOTAL:^c	N/A	20	260	280	N/A	N/A
North Dakota						
Billings County ^a	1,138	10	0	10	0.9	0.9
Camping	—	10	—	—	—	—
Stark County	23,697	120	260	380	0.5	1.6
Belfield	1,274	20	0	20	1.6	1.6
Dickinson	15,924	100	260	360	0.6	2.3
Dunn County ^a	4,627	20	0	20	0.4	0.4
Kildeer	790	10	0	10	1.3	1.3
Camping	—	10	—	—	—	—

PROPOSED ACTION—SOCIOECONOMICS

TABLE 25
EFFECTS TO POPULATION FROM CONSTRUCTION
OF THE PROPOSED ACTION (Concluded)

Locality	Baseline	INCREASE ABOVE BASELINE			PERCENTAGE INCREASE ABOVE BASELINE	
		Proposed Action	Interrelated Projects	Cumulative	Proposed Action	Cumulative
McKenzie County ^a	7,132	60	0	60	0.8	0.8
Watford City	2,119	50	0	50	2.4	2.4
Camping	—	10	—	—	—	—
Williams County ^a	22,237	180	0	180	0.8	0.8
Williston	13,336	130	0	130	1.0	1.0
Tioga	1,597	40	0	40	2.5	2.5
Camping	—	10	—	—	—	—
SUBTOTAL:^c	N/A	390	260	650	N/A	N/A
TOTAL:	N/A	2,980	7,420	10,400	N/A	N/A

See Appendix 7 for data sources and methodology.

^a The camping estimate is included in the total change in county population under the Proposed Action. (No camping to occur in the localities that are not identified.)

^b Less than 0.05%.

^c State total (county totals added).

— not measured or identified.

TABLE 26
PROJECTED ANNUAL INCREASE IN PROPERTY TAX REVENUES
TO LOCAL GOVERNMENT FROM CONSTRUCTION
OF THE PROPOSED ACTION
(in thousands of dollars)

Locality	Baseline	INCREASE ABOVE BASELINE			PERCENTAGE INCREASE ABOVE BASELINE	
		Proposed Action	Interrelated Projects	Cumulative	Proposed Action	Cumulative
Wyoming						
Sweetwater County	\$6,044	\$ 550	910	1,460	9.1	24.2
Green River	8,311	560	560	1,120	6.7	13.5
Rock Springs	12,738	850	850	1,700	6.7	13.3
Bairoil	111	11	11	122	9.9	19.8
Schools	43,344	300	1,190	1,490	0.6	3.4
Carbon County	41,424	320	0	320	0.8	0.8
Rawlins	8,771	700	0	700	8.0	8.0
Schools	16,778	170	0	170	1.0	1.0
Fremont County	58,928	90	0	90	0.2	0.2
Schools	22,142	30	0	30	0.1	0.1
Natrona County	53,869	160	0	160	0.3	0.3
Casper	48,358	390	400	790	0.8	1.6
Schools	57,858	90	100	190	0.2	0.3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 26
PROJECTED ANNUAL INCREASE IN PROPERTY TAX REVENUES
TO LOCAL GOVERNMENT FROM CONSTRUCTION
OF THE PROPOSED ACTION (Concluded)
(in thousands of dollars)

Locality	Baseline	INCREASE ABOVE BASELINE			PERCENTAGE INCREASE ABOVE BASELINE	
		Proposed Action	Interrelated Projects	Cumulative	Proposed Action	Cumulative
Johnson County	4,210	80	0	80	1.9	1.9
Buffalo	3,647	100	0	100	2.7	2.7
Schools	7,974	30	0	30	0.4	0.4
Campbell County	38,343	310	5,900	6,210	0.8	16.2
Gillette	24,901	260	2,400	2,660	1.0	10.7
Schools	51,751	110	2,500	2,610	0.2	5.0
SUBTOTAL:	N/A	5,111	14,821	19,932	N/A	N/A
Montana						
Powder River County	1,521	17	0	17	1.1	1.1
Schools	4,038	47	0	47	1.2	1.2
Carter County	549	210	0	210	38.3	38.3
Schools	891	330	0	330	37.0	37.0
Fallon County	2,179	50	0	50	2.3	2.3
Schools	7,107	160	0	160	2.2	2.2
Prairie County	498	3	0	3	0.6	0.6
Schools	571	4	0	4	0.7	0.7
Wilboux County	1,085	8	0	8	0.7	0.7
Schools	1,725	13	0	13	0.8	0.8
Dawson County	1,718	3	0	3	0.2	0.2
Schools	5,449	8	0	8	0.1	0.1
SUBTOTAL:	N/A	853	0	853	N/A	N/A
North Dakota						
Golden Valley County	3,249	10	0	10	0.3	0.3
Schools	152	19	0	19	12.5	12.5
Billings County	9,119	21	0	21	0.2	0.2
Schools	2,301	^a	0	N/A	N/A	N/A
Stark County	12,688	5	0	5	^b	^b
Schools	5,300	13	0	13	0.2	0.2
McKenzie County	6,500	21	0	21	0.3	0.3
Schools	2,287	35	0	35	1.5	1.5
Dunn County	3,213	11	0	11	0.3	0.3
Schools	2,519	20	0	20	0.8	0.8
Williams County	21,484	15	0	15	0.1	0.1
Schools	1,410	25	0	25	1.8	1.8
SUBTOTAL:	N/A	195	0	195	N/A	N/A
TOTAL:	N/A	6,159	14,821	20,980	N/A	N/A

See Appendix 7 for data sources and methodology.

^a No mill levy at present; Billings County schools are running a surplus with oil production taxes.

^b Less than 0.05%.

N/A = not applicable

PROPOSED ACTION—SOCIOECONOMICS

Population in Bairoil would increase by 22 percent during construction. Revenues to Carter County, Montana and Carter County schools would increase by 38 percent and 37 percent, respectively, because the pipeline would add about 37 percent to taxable valuation in the county. Revenues to schools in Golden Valley County would increase about 12.5 percent above a baseline that is relatively lower than other school baseline revenues in that section of North Dakota. These increases would be considered significant.

Project Operation. Table 27 presents the total expected annual production of oil and gas from the Lost Soldier

and Wertz fields through the use of CO₂ enhanced recovery. In 1990, CO₂ injection in the two fields is expected to result in additional production of about 1.65 million barrels per year of oil and 43.2 billion cubic feet per year of natural gas.

Operation of the pipelines would significantly increase revenues as shown on Tables 28 and 29. Revenues in Sweetwater County would increase by 37 percent through mill levies on the pipeline, CO₂ production at the Exxon Shute Creek plant, and additional oil and gas production at Amoco's Lost Soldier and Wertz oil fields near Bairoil (Table 28). The State of Wyoming and the

TABLE 27
ANNUAL PRODUCTION, POPULATION, EMPLOYMENT, AND INCOME ASSOCIATED
WITH THE OPERATION OF THE PROPOSED ACTION (1990)

Characteristic	Baseline	Increase Above Baseline	Percentage Above Baseline
Annual CO ₂ Production (Mcf) ^a			
Lincoln County	b	58,400,000	N/A
Sweetwater County	b	87,600,000	N/A
Annual Oil Production (1,000 bbls)			
Sweetwater County	9,270	1,486 ^c	16.0
Carbon County	3,234	165 ^c	5.1
Annual Gas Production (Mcf)			
Sweetwater County	110,756,980	1,235,100 ^c	1.1
Carbon County	52,026,038	137,200 ^c	0.3
Employment			
Sweetwater County	24,300	25	0.1
Carbon County	10,300	20	0.2
Population			
Sweetwater County	46,200	0	0.0
Carbon County	20,800	125	0.6
Rawlins	11,500	120	1.0
Total Personal Income (\$1,000)			
Sweetwater County	650,000	0	0.0
Carbon County	224,000	1,200	0.5

1990 would be the peak year of production and was thus chosen for this analysis. See Appendix 7 for data sources and methodology.

^a CO₂ produced at Exxon's Shute Creek plant.

^b CO₂ has not been produced for sale prior to this.

^c CO₂ enhanced recovery planned for the Lost Soldier and Wertz fields only, therefore, production estimates are for Amoco's Lost Soldier and Wertz oil fields.

N/A = not applicable

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 28
PROJECTED ANNUAL INCREASE IN REVENUES TO LOCAL GOVERNMENTS
FROM OPERATION OF THE PROPOSED ACTION (1990)
(in thousands of dollars)

State/ County	Baseline	INCREASE ABOVE BASELINE			PERCENTAGE INCREASE ABOVE BASELINE	
		Proposed Action	Interrelated Projects	Cumulative	Proposed Action	Cumulative
Wyoming						
Lincoln County	\$15,800	\$ 870	\$ 0	\$ 870	5.5	5.5
Schools	20,300	910	0	910	4.5	4.5
Sweetwater County	6,200	2,300	700	3,000	27.1	48.4
Schools	44,700	3,400	1,070	4,470	7.6	10.0
Carbon County	41,800	450	0	450	1.1	1.1
Schools	16,900	430	0	430	2.5	2.5
Fremont County	59,000	40	0	40	0.1	0.1
Schools	22,200	40	0	40	0.2	0.2
Natrona County	57,000	70	0	70	0.1	0.1
Schools	61,200	140	0	140	0.2	0.2
Johnson County	4,700	20	0	20	0.4	0.4
Schools	8,800	40	0	40	0.5	0.5
Campbell County	47,600	70	5,100	5,170	0.1	10.9
Schools	64,300	170	8,800	8,970	0.3	14.0
SUBTOTAL:	N/A	8,950	15,670	24,620	N/A	N/A
Montana						
Powder River County	1,600	30	0	30	1.9	1.9
Schools	4,200	90	0	90	2.1	2.1
Carter County	550	380	0	380	69.1	69.1
Schools	890	610	0	610	68.5	68.5
Fallon County	2,200	90	0	90	4.1	4.1
Schools	7,100	290	0	290	4.1	4.1
Wilbax County	1,100	10	0	10	0.9	0.9
Schools	1,700	20	0	20	1.2	1.2
Prairie County	510	10	0	10	2.0	2.0
Schools	580	10	0	10	1.7	1.7
Dawson County	1,700	4	0	4	0.2	0.2
Schools	5,300	10	0	10	0.2	0.2
SUBTOTAL:	N/A	1,554	0	1,554	N/A	N/A
North Dakota						
Golden Valley County	3,249	20	0	20	0.6	0.6
Schools	152	30	0	30	19.7	19.7
Billings County	9,119	30	0	30	0.3	0.3
Schools	2,301	*	0	—	—	—
Stark County	12,688	10	0	10	0.1	0.1
Schools	5,300	20	0	20	0.4	0.4
McKenzie County	6,500	30	0	30	0.5	0.5
Schools	2,287	60	0	60	2.6	2.6
Dunn County	3,213	20	0	20	0.6	0.6
Schools	2,519	30	0	30	1.2	1.2
Williams County	21,484	20	0	20	0.1	0.1
Schools	1,410	40	0	40	2.8	2.8
SUBTOTAL:	N/A	310	0	310	N/A	N/A
TOTAL:	N/A	10,814	15,670	26,484	N/A	N/A

1990 would be the peak year of production and was thus chosen for this analysis. See Appendix 7 for data sources and methodology.

*No mill levy at present; Billings County schools are running a surplus with oil production taxes.

PROPOSED ACTION—SOCIOECONOMICS

TABLE 29
AD VALOREM, SEVERANCE, AND FEDERAL ROYALTY REVENUES
ASSOCIATED WITH OPERATION
OF THE PROPOSED ACTION
(in thousands of dollars)

County	Baseline ^a	PROPOSED ACTION (1990)			Total	Percentage Increase Above Baseline
		Advalorem Tax	Severance Tax	Federal Royalty		
Lincoln County: CO ₂	^b	\$1,200	\$1,200	\$ 2,800	\$ 5,200	N/A
Sweetwater County:	\$130,800	\$4,890	\$4,890	\$ 9,400	\$19,180	14.7
CO ₂	^b	1,900	1,900	4,200	8,000	N/A
Oil	65,300	2,800 ^c	2,800 ^c	4,900 ^c	10,500 ^c	16.1
Gas	65,500	190 ^c	190 ^c	300 ^c	680 ^c	1.0
Carbon County:	\$62,000	\$ 340	\$ 340	\$ 650	\$ 1,330	2.1
Oil	23,200	310 ^c	310 ^c	600 ^c	1,220 ^c	5.3
Gas	38,800	30 ^c	30 ^c	50 ^c	110 ^c	0.3
SUBTOTAL:						
CO ₂	^b	3,100	3,100	7,000	13,200	N/A
Oil	88,500	3,110	3,110	5,500	11,720	13.2
Gas	104,300	220	220	350	790	0.8
TOTAL:	\$192,800	\$6,430	\$6,430	\$12,850	\$25,710	13.3

1990 would be the peak year of production and was thus chosen for this analysis. See Appendix 7 for data sources and methodology.

^a Baseline consists of the summation of estimates for advalorem, severance, and federal royalty revenues for the minerals and counties indicated. Estimates are based on 1982 assessed valuation and derived in the same manner as 1990 projections.

^b CO₂ has not been previously taxed.

^c Revenues resulting from production in Amoco's Lost Soldier and Wertz oil fields only.

N/A = not applicable

Federal Government would realize a substantial increase in ad valorem, severance, and royalty revenues from mineral production in Lincoln, Sweetwater, and Carbon counties (Table 29).

Significant economic benefits would accrue to Carter County in Montana and its school system, as well as to the Golden Valley school system in North Dakota. The full value of the completed pipeline would be part of the tax base of these localities.

Operation of the Exxon pipeline would require 20 persons, with 12 headquartered at Gillette, Wyoming and 8 others at various locations along the pipeline route. An additional 25 persons would be employed at Amoco's Bairoil oil field facilities. Most of these people would reside in nearby Rawlins in Carbon County, Wyoming and would likely generate an additional 20 secondary

jobs, resulting in an increased population in Carbon County of about 125 persons. These impacts would be insignificant.

CUMULATIVE IMPACTS

The on-going, interrelated projects (Exxon's LaBarge and Chevron Phosphate projects, Jim Bridger Power Plant, and Western Wyoming Community College) discussed in Chapter 1 would significantly affect Sweetwater County. Cumulative employment would increase 14 percent (Table 22). Without the Proposed Action, the population increase in Sweetwater County would be about 10.5 percent above baseline, and the population increases in Green River and Rock Springs would be about 10 and 12 percent, respectively. Cumulative population impacts would be significant to

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Sweetwater County and the communities of Green River, Rock Springs, and Bairoil (Table 25).

About 14 percent of the interrelated population impact to Sweetwater County and 24 percent of the interrelated population impact to Rock Springs would be from the Chevron Phosphate Project. The heaviest population increases to the two communities and the county would be from Exxon's La Barge Project. The Chevron Phosphate Project would be mitigated by permit conditions applied by the State of Wyoming, Office of Industrial Siting Administration (ISA). ISA permit conditions would also mitigate impacts from the Exxon project and Amoco's enhanced oil recovery project at Bairoil, Wyoming. The remaining cumulative impacts to Green River, Rock Springs, and Sweetwater County (after subtracting the effects of Chevron Phosphate and Exxon's LaBarge projects) would be about 1.5, 5.5, and 3.3 percent, respectively.

Population increases resulting from the five new coal mines in Campbell County, Wyoming (discussed in Chapter 1) and peak construction of the Proposed Action would cause significant population increases to Gillette (Table 25). Without the Proposed Action, the population increase in Gillette would be 11.9 percent. With the Proposed Action, the population increase would be about 13 percent. ISA's permit conditions would mitigate the impacts resulting from most of the population increases associated with the mines. ISA frequently requires applicants to transfer funds to communities so that adequate community services can be provided to company employees.

Social structures have already been affected in Green River, Rock Springs, and Gillette, Wyoming. Local attitudes favor economic development to relieve the effects of the recent recession and energy slump.

Impacts to the quality of life in Bairoil are likely to be insignificant since Bairoil has a small population and was originally built as a construction town.

After construction ended, some social impact would occur to communities experiencing employment changes. Some workers would leave the area to seek other jobs. Although such changes are familiar occurrences to most construction occupations, some construction workers and families could have difficulty making the transition. After the Exxon La Barge project is built, a post-construction slump could occur, since the work force would decline from 5,000 to only several hundred during operation.

The following significant, cumulative impacts would result from interrelated projects combined with the Proposed Action:

- Employment would increase 14 percent in Sweetwater County, Wyoming;

- During peak construction, population in Wyoming would increase 12.9 percent (countywide) in Sweetwater County, 11.4 percent in Green River, 15.8 percent in Rock Springs, 22.2 percent in Bairoil, and 13.0 percent in Gillette;
- Property tax revenue would increase 24.2 percent in Sweetwater County; 16.2 percent in Campbell County; 38.3 percent in Carter County, Montana; 37 percent in Carter County schools; and 12.5 percent in Golden Valley County, North Dakota schools; and
- Mineral tax assessments would add 48.4 percent to Sweetwater County revenues, 10 percent to Sweetwater County school revenues, 10.9 percent to Campbell County revenues, and 14 percent to Campbell County school revenues.

Cumulative impacts to housing, public services and facilities, and quality of life in Green River, Rock Springs, and Gillette, Wyoming would not be significant because the counties have sufficient housing and experience in handling growth-related problems. However, because of its size, the impacts to Bairoil would be significant.

Soils and Vegetation

IMPACT SIGNIFICANCE CRITERIA

Impacts to soils and vegetation were considered significant if:

- the loss of soil and reduction of soil productivity and stability caused by land disturbance prevented successful restoration and recovery to near-preconstruction conditions within 5 years;
- following construction, more than 5 years were required to reestablish a ground cover to near-preconstruction densities;
- any poisonous plants or noxious weeds became established where none existed before construction; or
- any federally listed threatened, endangered, or sensitive plant species (candidate and state rare species and rare plant associations) were affected or lost.

ASSUMPTIONS

Erosion control and expected reclamation success on lands disturbed by project construction and operation activities are based on the following assumptions:

PROPOSED ACTION—SOILS AND VEGETATION

- The applicants would comply with the proposed erosion control and reclamation program as developed and follow through on their commitment to *comply with appropriate regulations and required plans and stipulations to protect and restore the land disturbed by project construction and operation to a stable, productive, and aesthetically acceptable condition;*
- The applicants, when operating on state lands (Wyoming, Montana, and North Dakota), would prepare and follow approved plans, including applicable measures and procedures to ensure successful reclamation of state-owned lands affected by project construction and operation, as required by each state;
- The applicants would comply with soil protection and land use goals identified by the landowner on private lands;
- The applicants would comply with Required Reclamation and Erosion Control Procedures and General Federal Resource Measures identified in Appendix 4 on federal lands (similar measures would be implemented on other lands, including state and private lands, as agreed to by the applicants and landowners); and
- The applicants would implement a weed control program that would control poisonous plant, noxious weed, and other invader plant (annual weeds) growth. Applicants will be in compliance with regulations and procedures as required by federal, state, and local weed and pest control authorities.

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Setting. The project area is located in nine Major Land Resource Areas (MLRAs) as described by the Soil Conservation Service (1981). The southern portion, milepost (MP) 0 to 205, is located in the Central Deseretic Basin and Plateau area. This area is characterized by broad intermountain basins and piedmont plains with elevations ranging from 5,500 to 6,500 feet, including an area up to 7,400 feet near Green Mountain (MP 109 to 127), with an average annual precipitation of 7 to 9 inches and a frost-free season of 110 to 120 days.

The area between MP 205 and 504 is located in the northern rolling high plains area. This area consists of gently sloping to rolling dissected plains underlain by shale, siltstone, and sandstone, including areas with steep sideslopes bordering major streams and intermittent drainageways. Elevations range from 2,800 to 5,500 feet, with an average annual precipitation of 9 to 12 inches (MP 205 to 266) and 12 to 14 inches (MP 266 to 329) and a frost-free season of about 120 days.

Between MP 504 and 520 and MP 584 and 615, the proposed pipeline route would cross an area of badlands consisting of moderately steep to very steep terrain bordering the Little Missouri River and its tributaries. Elevations range from 1,950 feet to 2,925 feet, with an average annual precipitation of 14 to 15 inches and a frost-free season of about 120 days.

Bordering the badlands are areas of rolling soft shale plains (MP 520 to 584 and MP 615 to 625). These areas consist of gently sloping to rolling dissected plains underlain by calcareous shale and sandstone, including small buttes with moderately steep sideslopes adjacent to major valley cut drainageways. Elevation ranges from 2,800 to 3,000 feet, with an average annual precipitation of 14 to 15 inches and a frost-free season of about 120 days.

The extreme northern portion of the project (MP 625 to 643) would cross the northern glacial plains. This area consists of undulating to rolling tilled plains and strongly sloping to moderately steep sideslopes adjacent to drainageways and stream valleys. Elevations range from 2,000 to 2,400 feet, with an average annual precipitation of 14 to 15 inches and a frost-free season of about 120 to 130 days.

Soils. The Proposed Action would cross a wide variety and complex combination of soils caused by variations in parent material, topography, climate, and vegetation. Soil mapping units from the various soil surveys within the project area were combined into generalized groups of soils to evaluate potential impacts and to determine effective erosion control measures, reclamation, and revegetation potential in the area. These general soil groups and the average annual precipitation (AAP) zone in which they occur are shown on Table 30. (See Appendix 7, Resource Methodologies, for a brief description of each generalized soil group.)

Vegetation. Vegetation types within the project area vary widely according to soil types, topography, climatic conditions, and grazing and land management practices. The predominant vegetation types range from sagebrush-grassland in the southwestern part to grasslands (mixed short and mid-grass), in the northern part. Areas with saline and alkaline soil produce grassland and saltbush vegetation types. Riparian areas are dominated by cottonwood, willows, and grasses. Mixed shrub, limber pine, ponderosa pine, and juniper commonly occur on the higher ridges, sideslopes of buttes, and foothills.

The Proposed Action, including associated ancillary facilities, would affect 11 major vegetation types: sagebrush-grass, saltbush-greasewood, sand dune-forb-grass, juniper woodland, sagebrush-grass-conifer woodland, riparian, grassland, ponderosa pine-juniper-grass, badland shrub, wooded draws, and cropland. See

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**TABLE 30
SOIL GROUPS AND AVERAGE ANNUAL PRECIPITATION
WITHIN THE PROJECT AREA**

General Soil Groups	Main Pipeline and Facilities	Bairoil Spur Pipeline and Facilities	Bairoil Plant and Facilities	Cedar Creek Distribution Pipeline
Soils of the nearly level to gently sloping (0 to 5 percent slope) floodplains, low terraces, and alluvial fans.	7-9 9-12 12-15	7-9	7-9	12-15
Soils of the nearly level to sloping (0 to 9 percent slopes) broad basin and valley floors	7-9	7-9	7-9	
Sandy soils of the undulating to hilly dune-like areas	7-9			
Soils of the undulating to rolling (1 to 15 percent slopes) plains and high terraces dissected by intermittent drainages and underlain by sandstone, siltstone, and shale	9-12 12-15	9-12	9-12	12-15 (mainly clayey soils)
Soils of the undulating to rolling (3 to 15 percent slopes) plains dissected by intermittent drainageways forming from mixed loamy materials	9-12 12-15			12-15
Soils of the strongly sloping to moderately steep sideslopes (15 to 30 percent slopes), including steep foothills	7-9 9-12			12-15
Soils of the undulating to rolling (3 to 9 percent slopes) glaciated till plains	12-15			
Soils of the strongly sloping steep and very steep (15 to 50 percent slopes) hills, sideslopes, and badlands	7-9 9-12 12-15			
Strongly saline and alkaline soils on floodplains, terraces, basins, basins and sideslopes.	7-9 9-12 12-15	7-9	7-9	12-15

Note: Values are given in inches and shown only for soil groups where project components would be built.

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Table 31 for major vegetation types. The following types combine several vegetation communities and range sites and were used to evaluate impacts and determine vegetation potential.

Sagebrush-Grass. This vegetation type most commonly occurs on valley bottoms, plateaus, and benches. Sagebrush-grass is characterized by an overstory of sagebrush, primarily big sagebrush, low sagebrush, black sagebrush, and bud sagebrush, but also includes antelope bitterbrush and rabbitbrush. The main grasses are western wheat, needlegrass, needle-and-thread, Sandberg bluegrass, threadleaf sedge, bluebunch wheatgrass, and Indian ricegrass. Forbs include buckwheat, bluebells, broom snakeweed, and arrowleaf balsam root. Ground cover ranges from 10 to 35 percent.

The sagebrush-grass vegetation type provides forage for domestic livestock and wildlife. Within the project area, it is most commonly used for livestock grazing.

Saltbush-Greasewood. This vegetation type includes two subtypes, saltbush and greasewood. It is generally located on floodplains and low terraces along drainage-ways, on nearly level to gently sloping basin areas, and on gently sloping to sloping areas with saline and alkaline soils. Dominant canopy species include Nuttall saltbush, shadscale, fourwing saltbush, black sagebrush, big sagebrush, greasewood, and rabbitbrush. Dominant grass species include Indian ricegrass, western wheatgrass, needle-and-thread, inland saltgrass, and alkali sacaton.

This vegetation type is used for livestock grazing and wildlife.

Sand Dune-Forb-Grass. This vegetation type occurs on stabilized sand dunes, and some areas with active sand dunes. This type is characterized by perennial forbs, especially lemon scurf-pea, and perennial grasses such as Indian ricegrass. Also included is verbena, Montana wheatgrass, and creeping wildrye. This vegetation type is used for limited livestock grazing and wildlife.

Juniper-Woodland. This vegetation type occurs on the strongly sloping to steep and very steep sideslopes with shallow and rocky soils. The dominant canopy species is Utah juniper, with occasional pinyon pine. Common understory species include big sagebrush, rabbitbrush, western wheatgrass, squirreltail, broom snakeweed, and Indian ricegrass.

Areas of this vegetation type are used for livestock grazing and wildlife. Some juniper is used for firewood.

Sagebrush-Grass/Conifer Woodland. This vegetation type is transitional occurring between sagebrush-grass and montane coniferous forest. It occurs on the strongly sloping to steep sloping foothills areas at higher elevations with more than 9 inches average annual precipitation and shorter frost-free seasons. The species composition is typical of the sagebrush-grass type with the addition of scattered trees, mainly limber pine. Mixed mountain shrub species, including bitterbrush, snowberry, buckbrush, and mountain mahogany, occur in some areas. Needle-and-thread grass, western wheatgrass, and Indian ricegrass are common understory species.

This vegetation type is used for livestock grazing and is important to wildlife.

TABLE 31
VEGETATION TYPES AFFECTED BY PROPOSED ACTION COMPONENTS

Vegetation Types	Main Pipeline and Facilities	Bairoil Spur Pipeline and Facilities	Bairoil Plant and Facilities	Cedar Creek Distribution Pipeline
Sagebrush-Grass	X	X	X	
Saltbrush-Greasewood	X	X	X	
Sand Dune-Forb-Grass	X			
Juniper Woodland	X			
Sagebrush-Grass-Conifer Woodland	X			
Riparian	X	X	X	X
Grassland	X			X
Ponderosa Pine-Juniper-Grass	X			X
Badland Shrub	X			
Wooded Draws	X			
Cropland	X			X

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Grassland. This grass-forb vegetation type occurs on nearly level to rolling plains, plateaus, high terraces, and buttes. The dominant grass species include blue grama, buffalo grass, sideoat grama, needlegrass, western wheatgrass, Sandberg bluegrass, June grass, and Idaho fescue. Characteristic forb species include yarrow, buckwheat, golden aster, blazing star, prickly pear cactus, locoweed, goldenrods, broom snakeweed. This vegetation type includes plains grasslands in the 9- to 12-inch and 12- to 15-inch average annual precipitation zones. Range sites within the grasslands in the 12- to 15-inch precipitation zones (mixed grass prairie communities) consist of more mid-grasses with more ground cover, which provides higher forage production. In many areas, grazing has eliminated a large portion of mid-grasses.

This vegetation type is used mainly for livestock grazing and some wildlife.

Riparian. This vegetation type includes three subtypes: cottonwood, willow-wet meadow, and wet meadow. The riparian vegetation type occurs mainly on bottomlands and low-lying areas of perennial streams. It also occurs along the larger tributaries with poorly drained bottomlands or on floodplains that receive runoff from adjoining slopes. Dominant tree species include narrow leaf cottonwood and willows with box elder, American elm, dogwood, green ash, and hawthorn in the northern part of project area. Silver buffalo berry is a characteristic shrub species. Additional species include bluegrass, sedges, rushes, smooth brome, saltgrass, and a variety of forbs.

The riparian vegetation type yields a high amount of forage per acre and is important for wildlife. Riparian vegetation stabilizes stream banks, helps protect the quality of stream water, and provides vegetation diversity in the area.

Ponderosa Pine-Juniper Grass. This vegetation type most commonly occurs on strongly sloping to steep ridges and hills with shallow and moderately deep soils containing coarse fragments. The ponderosa pine-juniper grass vegetation type is characterized by a canopy of scattered ponderosa pine and Rocky Mountain juniper. Other dominant species include western wheatgrass, bluebunch wheatgrass, blue grama, little bluestem, sideoat grama, and needle-and-thread.

This vegetation type provides forage for livestock grazing and wildlife.

Badland Shrublands. This vegetation type occurs mainly in the badlands along the Little Missouri River, along the border of Lake Sakakawea, and in the steep sideslope (upland breaks) of larger tributary streams leading to the Little Missouri River. Vegetation cover is generally sparse to barren on the steeper sloping to near-vertical faces of bedrock but increases in the gentler

slopes and valley floors. This vegetation type is characterized by Rocky Mountain juniper, creeping juniper, snowberry, skunkbrush, sumac, broom snake-weed, sagebrush, and various other shrubs (depending on slope and aspect). Grass species occur where soils are deeper and include western wheatgrass, sideoat grama, little bluestem, and needlegrass. (Extensive cottonwood woodlands occupy the floodplain along the Little Missouri River, which flows through the badlands.)

This vegetation type is used for limited livestock grazing along stream bottoms and is important to wildlife for food and cover.

Wooded Draws. This vegetation type occurs in narrow draws and narrow drainages within the rolling dissected uplands most commonly containing intermittent streams. The most common tree species include American elm, green ash, box elder, burr oak, aspen, cottonwood, locust, and hawthorne. Shrub species include chokecherry, buffalo berry, and snowberry.

These wooded draws vary in length and are interspersed throughout the rolling grasslands, providing important food and cover for many of the region's wildlife.

Cropland. The Agriculture section (Cropland) provides a description of cropland affected.

ENVIRONMENTAL CONSEQUENCES

Construction and installation of the Proposed Action would create land disturbances associated with (1) right-of-way clearing and grading where needed, (2) access trail and road upgrading, (3) additional road construction, (4) storage and staging areas, and (5) ancillary facility construction. Construction and installation of the pipeline and associated ancillary facilities would disturb 9,485 acres of land, of which 9,262 acres would be reclaimed and 223 acres removed from current land use during the life of the project.

Land disturbance would result in (1) vegetation removal, where grading is needed; (2) compaction of soil by construction equipment; (3) alteration of the soil profile along the excavated trench area of the pipeline, on sidehill cuts in steep-sloping areas, and in borrow areas for roads; (4) reduced vegetation growth from sidestepping of excavated material on steep sideslope grades; and (5) potential reduction in soil stability on steep sidehill areas.

Accelerated wind and water erosion would occur where land has been disturbed and continue until erosion control measures were implemented (within 1 year). Also, access roads required for project construction and maintenance could be used for off-road vehicle (ORV) activities, thus creating problems in controlling and minimizing off-road land disturbance. Vehicles could

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cause ruts in unsurfaced access roads during wet weather and the ruts could concentrate runoff causing gully erosion.

Soils. Reclamation and erosion control would be difficult on some of the soils in the project area, especially in areas with less than 9 inches annual precipitation (southwestern part of the project area—MP 49R to 26R, MP 0 to 205, and Bairoil plant site and well field) and on the steeper sloping areas (15 percent or more) with soils shallow over bedrock (20 inches or less). Soils with unfavorable properties, including thin surface layers, moderate to strong salinity and alkalinity, clayey surface and subsoils, and shallow depths over bedrock, are common and would present problems for erosion control and revegetation. More intensive reclamation measures would be needed for these areas.

Of the 9,485 acres that would be disturbed by the Proposed Action, 796.8 acres of sensitive soils and terrain would be disturbed, and 2,718 acres would be located in areas with less than 9 inches average annual precipitation. These sensitive areas are highly susceptible to erosion hazards and have a low revegetation potential. See Table 32 for locations and extent of these sensitive areas. Appendix 7, Resource Methodologies, describes unfavorable soil properties and terrain characteristics.

The erosion control, reclamation, and revegetation program outlined by the applicants and their compliance with the Required Reclamation and Erosion Control Procedures outlined in Appendix 4 would provide an effective program that would ensure successful erosion control and restoration of all land disturbance.

Some unquantifiable soil loss resulting from accelerated wind and water erosion would occur until erosion control measures were implemented (1 year). In addition to the sensitive areas identified in Table 32, a few small unquantifiable areas (mainly abrupt steep slopes and localized areas with soil containing unfavorable physical and chemical properties) would be subject to accelerated erosion and require intensive and continuing follow-up erosion control measures. However, soil impacts could be significant if applicable erosion control measures were not properly implemented because of noncompliance with approved plans and stipulations, or if adverse weather conditions (mainly heavy rainstorms) occurred during construction before erosion control measures could be implemented.

Vegetation. The estimated acreage of each major vegetation type that would be disturbed by construction and installation of pipelines and occupied by the plant and associated facilities (associated ancillary facilities and roads) are shown on Table 33.

With effective use of the applicable erosion control, reclamation, and revegetation program outlined in Appendix 4, impacts to vegetation would be generally insignificant. Understory vegetation (grasses and forbs) is expected to return to near-preconstruction conditions within 5 years after construction. Overstory vegetation (trees and shrubs) would take longer to become established to near-preconstruction conditions:

Sagebrush types	10 to 20 years
Saltbush and greasewood	20 to 30 years
Juniper	50 to 75 years
Montana shrub types	20 to 40 years
Conifer	50 to 75 years

Generally, the companies would need about a 30-foot-wide area directly over the pipeline kept clear of trees. However, in areas of scattered trees, single trees could be allowed to grow closer to the pipeline.

The significance of impacts and the acreage that would be affected would depend on how well the proposed reclamation program and measures outlined in Appendix 4 were implemented. Areas with low reclamation and revegetation potential would be more susceptible to impacts (Table 32). Significant impacts to vegetation could occur in the low precipitation zone (less than 9 inches annually) located between MP 48R and 26R, MP 0 and 205, and the Bairoil plant site (Table 32). In this zone, understory could require more than 5 years to successfully revegetate and halogeton and other invader plants could exceed 5 percent of the plant cover. In order to ensure that grass cover in this low precipitation zone was reestablished within 5 years, more care would be needed in carrying out the erosion control and revegetation measures. Mulch levels and the number of waterbars may need to be increased and the contractor more closely supervised to ensure strict compliance with the erosion control and revegetation plan.

The invasion of poisonous plants and noxious weeds on disturbed areas where none existed previously would be insignificant through the required use of an effective weed control program during construction (Appendix 4). Where poisonous and noxious weeds existed previously, regrowth is expected to be controlled so the weeds do not hinder existing land use. See Table 34 for noxious weeds that could occur within the project area.

The sensitive plant species identified by the North Dakota Natural Heritage Program (near Tracy Mountain) and those identified by the Montana Species Rare Plant Project (southeastern region) would not be disturbed.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 32
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
PROPOSED ACTION

Project Component	Location by Milepost	Extent		SENSITIVE AREA DESCRIPTION AND COMMENTS			
		Miles	(Acres)	Slope 15% +	Unfavorable Soils	AAP (inches)	Other Comments
Main Pipeline (Portion paralleling Rangely CO ₂ Pipeline)	49.0					7-9	Starting Point
	48.9-47.4	1.5	(18.0)	X	X		Steep escarpments and sideslopes.
	41.4-40.9	0.5	(6.0)	X	X		
	40.4-39.7	0.7	(8.4)	X	X		Drainageway sideslope
	38.8-38.5	0.3	(3.6)	X	X		
	37.7-35.8	1.9	(22.8)	X	X		
	26.0						276 Acres
Main Pipeline	0.0					7-9	
	6.1-6.2	0.1	(1.2)	X	X		
	10.3-10.6	0.3	(3.6)	X	X		Steep sideslope
	19.2-19.4	0.2	(2.4)	X	X		
	26.2-26.8	0.2	(2.4)	X	X		
	33.0-35.2	2.2	(26.4)		X		Sandy soils
	36.3-36.7	0.4	(4.8)	X	X		
	39.9-41.1	1.2	(14.4)	X	X		
	45.4-49.7	4.3	(51.6)		X		Sandy soils, hummocky saline soils
	63.6-64.6	1.0	(12.0)		X		
	71.0-71.1	0.1	(1.2)	X			
	71.5-71.6	0.1	(1.2)	X			
	72.8-73.1	0.8	(9.6)	X	X		Escarpment area
	109.0					9-12	
	110.3-111.0	0.7	(8.4)		X		
	112.0-118.2	6.2	(74.4)	X			Green Mountain area
	127.0-127.1	0.1	(1.2)	X	X		
	128					7-9	
	138.3-138.4	0.1	(1.2)				Beef Gap area (narrow gap)
	158.2-158.4	0.2	(2.4)	X	X		
	158.6-158.8	0.2	(2.4)	X	X		
	164.1-164.9	0.8	(9.6)	X	X		
	174.9-175.2	0.3	(3.6)	X	X		
	201.0-201.2	0.2	(2.4)	X	X		
	201.9-202.1	0.2	(2.4)	X	X		
	202.9-203.2	0.3	(3.6)	X	X		Shale Breaks area
	205.0					9-12	
	210.0-215.9	5.9	(70.8)	X	X		Steep, dissected shale lands
	219.0-219.4	0.4	(4.8)	X	X		
	226.6-227.0	0.4	(4.8)	X	X		Escarpment area
231.6-231.7	0.1	(1.2)	X	X			
235.4-236.3	0.9	(10.8)	X	X			
237.3-237.8	0.5	(6.0)	X	X			
238.4-239.0	1.4	(16.8)	X	X			
240.8-241.0	0.2	(2.4)	X	X		Escarpment	
241.3-242.4	1.1	(13.2)	X	X			
243.4-243.6	0.2	(2.4)	X	X		Escarpment	
253.8-255.4	1.6	(19.2)	X	X			
256.4-257.2	0.8	(9.6)	X	X		Dissected, steep side slopes	

PROPOSED ACTION—SOILS AND VEGETATION

TABLE 32
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
PROPOSED ACTION (Continued)

Project Component	Location by Milepost	Extent		SENSITIVE AREA DESCRIPTION AND COMMENTS			
		Miles	(Acres)	Slope 15% +	Unfavorable Soils	AAP (inches)	Other Comments
	259.3-259.4	0.1	(1.2)	X	X		
	261.3-261.7	0.4	(4.8)	X	X		
	262.2-262.3	0.1	(1.2)	X	X		
	266					12-15	
	266.3-266.5	0.2	(2.4)	X	X		
	277.2-277.7	0.5	(6.0)	X	X		
	294.0-294.2	0.2	(2.4)	X	X		
	304.0-304.4	0.4	(4.8)	X	X		
	316.7-316.9	0.2	(2.4)	X	X		
	319.5-320.0	0.5	(6.0)	X	X		
	337.2-337.5	0.3	(3.6)	X	X		
	348.8-349.4	0.6	(7.2)	X	X		
	359.5-360.9	1.4	(16.8)	X	X		
	366.9-367.8	0.9	(10.8)	X	X		
	368.3-370.7	1.6	(19.2)	X	X		
	377.2-377.7	0.5	(6.0)	X	X		
	415.8-416.0	0.2	(2.4)	X	X		
	453.7-454.1	0.4	(4.8)	X	X		
	455.7-456.0	0.3	(3.6)	X	X		MP 455.9 wooded draw
	456.3-460.5	4.2	(50.4)	X			Deeply dissected area with narrow floodplain
	464.3-464.4	0.1	(1.2)	X	X		
	475.1-475.3	0.2	(2.4)	X	X		Steep ridge
	508.6-508.8	0.2	(2.4)	X	X		Steep ridge
	510.8-511.1	0.3	(3.6)	X	X		Escarpment bordering Little Missouri River
	512.9-513.1	0.2	(2.4)	X	X		
	515.3-515.8	0.5	(6.0)	X	X		
	516.2-517.0	0.8	(9.6)	X	X		
	519.3-519.5	0.2	(2.4)	X	X		
	524.1-524.3	0.2	(2.4)	X	X		Agricultural Experiment Station MP 521.6-521.8
	537.1-537.5	0.4	(4.8)	X	X		Escarpment
	543.0						Proposed Action and Highway 85 Alternative divide
	553.2-553.3	0.1	(1.2)	X	X		
	554.4-555.1	0.7	(8.4)	X	X		Steep ridge—Butte Lake area
	557.2-558.0	0.8	(9.6)	X	X		
	580.7-580.8	0.1	(1.2)	X	X		Wooded draw
	584.4-584.5	0.1	(1.2)	X	X		Steep area bordering Little Missouri River
	584.9-585.3	0.4	(4.8)	X	X		
	585.5-585.8	0.3	(3.6)	X	X		Steep area—North side Little Missouri River
	586.2-587.3	1.1	(13.2)	X	X		MP 587.0-587.1 Extremely Steep

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

**TABLE 32
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
PROPOSED ACTION (Concluded)**

Project Component	Location by Milepost	SENSITIVE AREA DESCRIPTION AND COMMENTS					
		Extent Miles	(Acres)	Slope 15% +	Unfavorable Soils	AAP (inches)	Other Comments
	588.4-589.5	1.1	(13.2)	X	X		
	590.1-590.4	0.3	(3.6)	X	X		
	591.3-591.4	0.1	(1.2)	X	X		
	592.4-593.0	0.6	(7.2)	X	X		
	593.2-593.6	0.4	(3.6)	X	X		
	595.4-595.6	0.2	(2.4)	X	X		Butte sideslope
	598.5-598.7	0.2	(2.4)	X	X		
	602.3-602.5	0.2	(2.4)	X	X		
	607.3-607.4	0.1	(1.2)	X	X		
	608.5-609.0	0.5	(6.0)	X	X		
	609.9-610.2	0.3	(3.6)	X	X		
	611.6-612.6	1.0	(12.0)	X	X		
	613.6-613.9	0.3	(3.6)	X	X		
	622.0						Proposed Action and
	623.1-623.6	0.5	(6.0)	X	X		Highway 85 Alternative join
	625.0-625.3	0.3	(3.6)	X	X		
	625.8-628.0						Lake Sakakawea
	628.6-628.9	0.3	(3.6)	X	X		Escarpment
	634.0-634.1	0.1	(1.2)	X	X		
	636.1-636.7	0.6	(7.2)	X	X		
	637.1-637.6	0.5	(6.0)	X	X		
Bairoil Spur Pipeline	6.0S 20.0S					7-9	14.0 miles (126 acres)
Bairoil Plant and Product Line	6.0S 20.0S					7-9	14.0 miles (42 acres)
Cedar Creek Distribution Line	2.4D-2.5D	0.1	(1.2)	X	X	12-15	
	6.9D-7.1D	0.2	(2.4)	X	X		Drainageway sideslope
	7.9D-8.1D	0.2	(2.4)	X	X		Drainageway sideslope
	9.8D-9.9D	0.1	(1.2)	X	X		
TOTAL:		66.5	796.8				2,718 Acres

Note: Table prepared from soils-terrain analysis and orthophotograph interpretations. Milepost locations are approximate, based on general, preliminary right-of-way information. See Appendix 7, Methodologies for source of inventory data and methodology.

AAP = Average annual precipitation

Average per mile for MP 0 to 111.0 is 9 acres per mile. Acreage per mile for MP 112 to MP 643.5 is 12 acres per mile.

PROPOSED ACTION—AGRICULTURE

TABLE 33
ACRES OF VEGETATION TYPES DISTURBED AND
REMOVED BY THE PROPOSED ACTION

Vegetation Types	Main Pipeline and Facilities		Bairoil Spur Pipeline and Facilities		Bairoil Plant Facilities		Cedar Creek Distribution Pipeline		Total	
	Disturbed	Removed	Disturbed	Removed	Disturbed	Removed	Disturbed	Removed	Disturbed	Removed
Sagebrush-Grass	2,843	29	134	2	312	62			3,333	93
Saltbush-Greasewood	421	14	46	0	150	41			633	55
Sand Dune-Forb-Grass	49	1							49	1
Juniper Woodland	62	2							62	2
Sagebrush-Grass	87	4							87	4
Conifer woodland										
Riparian	121	1	1	0	1	0	12	0	135	1
Grassland	2,588	48					294	13	2,882	61
Ponderosa Pine-Juniper-Grass	25	1					67	0	92	1
Badland Shrub	297	3							297	3
Wooded Draws	18	0							18	0
Cropland	1,867	2					30		1,897	2
TOTAL	8,378*	105	241	2	463	103	403	13	9,485	223

See Appendix 7, Assessment Methodologies, for data sources.

Disturbed refers to acreages disturbed during construction, which are revegetated and rehabilitated following construction.

Removed refers to acreages removed from present use for the life of the project; these are revegetated and rehabilitated after project abandonment.

*Represents total land surface and does not include 31 acres of water areas (Lake Sakakawea and Little Missouri River crossings).

TABLE 34
NOXIOUS WEEDS IN THE
PROJECT AREA

Species
Burdock (<i>Arctium lappa</i>)
Canada thistle (<i>Cirsium arvense</i>)
Field bindweed (<i>Convolvulus arvensis</i>)
Leafy spurge (<i>Euphorbia esula</i>)
Russian knapweed (<i>Centaurea repens</i>)
Sow thistle (<i>Sonchus arvensis</i>)
Whitetop (<i>Cardaria draba</i>)
Yellow toadflax (<i>Cinaria vulgaris</i>)
Spotted knapweed (<i>Centaurea maculosa</i>)
Musk thistle (<i>Carduus nutans</i>)

Source: BLM 1985.

Agriculture

IMPACT SIGNIFICANCE CRITERIA

Impacts to livestock grazing were considered significant if:

- the amount of forage lost to grazing within an allotment exceeded 1 percent;
- the amount of forage loss reduced livestock stocking rates by 1 percent or more in each allotment affected; or
- project construction resulted in an open trench or other obstructions (without crossings), which prevented livestock access to water for more than 1 day or disrupted grazing patterns for longer than 2 weeks.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Impacts to cropland were considered significant if:

- the productivity of any cropland (including prime agricultural land) was diminished within the project area;
- more than 5 acres of cropland within the project area was irreversibly converted to other uses; or
- cropland outside the project area was affected to the extent that more than 5 percent of the total cropland in the area was irreversibly converted to other uses because of project development.

ASSUMPTIONS

The assumptions for agriculture would be the same as identified for Soils and Vegetation. In addition, during construction, applicants will ensure livestock have daily access to water and will not disrupt grazing patterns (through open trenches or other obstacles without crossings) for longer than 14 days.

AFFECTED ENVIRONMENT

Livestock Grazing. The Proposed Action would cross state and federal lands authorized for livestock grazing and private grazing lands. BLM has established grazing allotments that designate parcels of land where grazing privileges are authorized. These allotments also contain land administered by the States of Wyoming, Montana, and North Dakota and land privately owned. The pipeline route would mostly cross grazing allotments in Wyoming (MP 0 to 275), with a few scattered grazing allotments in Montana and North Dakota. Most of the grazing lands along the Montana and North Dakota portions of the route are privately owned. Ranching operations include cow-calf or cow-calf-yearling operations and sheep grazing.

Grazing capacities vary due to vegetation types (range sites), landform, slope and range condition. Grazing capacity ranges from 5 to 12 acres per animal unit month (AUM). Areas with lower carrying capacities occur in the lower average annual precipitation zone (less than 9 inches annually). These areas mainly support a cover of sagebrush, greasewood, and saltbush vegetation, with an average of 10 to 12 acres per AUM. The grasslands in the 9- to 12-inch average annual precipitation zone with loamy soil sites average 8 to 12 acres per AUM. Grasslands in the 12- to 15-inch precipitation zone support a higher forage production which results in a higher carrying capacity averaging 5 to 6 acres per AUM.

Farming (Cropland). The Proposed Action and associated facilities would cross 1,897 acres of non-irrigated cropland, mainly in the area between MP 417

and 643.5. No cropland occurs in the vicinity of the Bairoil plant and well field. Some small localized areas of irrigated cropland and pasture would be affected depending on final route alignment (MP 133.2 to 133.6). Wheat, flax, barley, oats, safflower, and some sunflowers and alfalfa are grown on non-irrigated croplands. Wheat is the principal crop on non-irrigated cropland. Alfalfa hay, small grains (barley and oats), and corn for silage are the main crops grown on irrigated cropland.

About 5 to 8 percent of the cropland in the project area is identified as prime agricultural land (SCS 1984). Most of this land is located in North Dakota, with some also occurring in the Montana portion bordering North Dakota. No prime agricultural lands would be affected in Wyoming.

Field and farmstead windbreaks or shelterbelts commonly occur along the North Dakota and Montana portions of the pipeline route. These windbreaks provide erosion control for croplands and enhance and protect farmsteads.

The State Agricultural Experiment Station, located about 10 miles southwest of Belfield, North Dakota, would be crossed by the main CO₂ pipeline. The crossing (MP 521.5 to 522.1) would parallel an existing pipeline through the station.

Areas outside the pipeline right-of-way would also be affected through project-related urban expansion. Irrigated and non-irrigated cropland would likely be affected in Gillette, Wyoming. The main crops in this area are the same as described for the main pipeline right-of-way.

Other localities where large project-related population increases are expected to occur are not bordered by cropland.

ENVIRONMENTAL CONSEQUENCES

Livestock Grazing. Land disturbed by construction of the Proposed Action would cause a 2- to 5-year loss of forage on 7,562 acres scattered along 751.5 miles of project facilities. During operation, 223 acres (20 AUMs) of forage would be lost for the life of the project.

At most, pipeline construction would affect an average of 12 acres of land per mile for 2 to 5 years. This disturbance represents about 1 AUM per mile in the low forage production area, 1 1/2 AUMs per mile in the moderate forage production areas, and 2 AUMs per mile in the high forage production areas.

About 785 AUMs of forage, spread over 751.5 miles, would be lost during construction of the pipeline and associated access roads. An additional 20 AUMs of

PROPOSED ACTION—AGRICULTURE

forage would be removed by associated surface facilities for the life of the project. Table 35 shows the estimated forage losses by project component. Forage losses would represent less than 1 percent for any allotment or ranching operation, which would be insignificant, based on the significance criteria.

Poisonous plants and noxious weeds could invade disturbed areas where none existed previously. Through the use of an effective weed control program during construction, this impact would be insignificant (Appendix 4). Where poisonous and noxious weeds existed previously, regrowth is expected to be controlled so that the weeds do not hinder existing land use.

Farming (Cropland). Pipeline construction would disturb 1,897 acres of non-irrigated cropland for one growing season. Impacts to cropland from pipeline construction would be insignificant and short term (1 year). The productivity of cropland including prime agricultural land would not be diminished with the use of the erosion control and reclamation procedures outlined in Appendix 4.

About 2 acres of cropland could be removed from production by the proposed surface facilities for the life of the project. Easement negotiations between landowners and the applicant presumably would include compensation to farmers and ranchers for crop losses.

During construction, some trees in a shelterbelt or windbreak may need to be removed. Since trees would not be allowed to grow directly over the pipeline, a small gap, 15 to 30 feet wide, through the windbreak or shelterbelt would occur, slightly lessening the effectiveness of the windbreak or shelterbelt at that point.

Impacts to the State Agricultural Experiment Station are expected to be insignificant, since it contains an existing pipeline corridor and revegetation potential is favorable. However, a request for easement to cross this property requires approval from the State Board of Higher Education (Conlon 1985).

Project-related population increases could cause some cropland to be lost to population expansion. About 13 acres (0.13 acres per capita) (ARS 1970) of additional land for home sites and associated urban development, mainly in the areas of Rock Springs, Rawlins, and Gillette, Wyoming and Baker and Belle Fourche, Montana would be required. Although most urban expansion would be absorbed by existing housing and subdivision areas, native rangeland, idle land, and possibly 3 acres of cropland could be converted to urban uses in the Gillette area. This cropland loss would not be considered significant because it would be much less than 5 percent of the total cropland in the area.

TABLE 35
ESTIMATED FORAGE LOST AND CROPLAND DISTURBED
AND REMOVED BY THE PROPOSED ACTION

PROJECT COMPONENT	FORAGE LOSS (AUMs) ¹		CROPLAND (AUMs) ²	
	Short-Term	Long-Term	Short-Term	Long-Term
Main Pipeline and Facilities	663	9	1,867	2
Bairoil Spur Pipeline and Facilities	20	—	0	0
Bairoil Plant and Facilities	39	10	0	0
Cedar Creek Distribution Pipeline	63	1	30	0
TOTAL:	785	20	1,897	2

¹ Short-term figure represents estimated forage lost annually for (2 to 5 years). Long-term figure is forage removed annually for the life of the project.

² Short-term figure represents cropland disturbance for 1 year. Long-term figure is cropland removed from production for the life of the project.

AUMs = animal unit months; — = less than 1/2 AUM.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

CUMULATIVE IMPACTS

Cumulatively, project-related population increases from the Proposed Action and interrelated projects would cause 35 acres of cropland (none are prime agricultural land) to be converted to urban uses in Gillette, Wyoming and about 4 acres of cropland to be converted in Belle Fourche, South Dakota.

This cropland loss would not be significant because it would be less than 5 percent of the total cropland in the project area.

Transportation Networks

IMPACT SIGNIFICANCE CRITERIA

Impacts to transportation networks were considered significant if:

- project actions resulted in vehicle travel delays of more than 15 minutes per hour;
- the projected average annual traffic increases reduced the *level of service to below Level C* (safe operation level), as defined in the *Highway Capacity Manual* (Highway Research Board 1965);
- the added traffic over baseline accelerated road deterioration, thereby increasing the maintenance costs of area roadways beyond those scheduled by the responsible agency;
- the projected increase in traffic, increased vehicle accidents on project roadways; or
- normal product flow or maintenance of pipelines or power lines were interrupted for any period of time.

ASSUMPTIONS

The following assumptions were used in the analysis:

- The pipe and equipment for construction of the pipeline and Bairoil plant would be shipped to six railhead towns and hauled to the construction site using 20-ton loads.
- The construction would be divided into eight spreads—one for Amoco, six for Exxon, and one for Shell. Construction would all start at the beginning of each spread and work north. This would determine vehicle trip traffic flow.

- The labor force would stagger its vehicle trips coming to the construction site but would leave the construction site at a predesignated time.
- Impacts to roadways and vehicle accidents would be directly related to the number of vehicle miles traveled per trip—the distance to the construction site.

AFFECTED ENVIRONMENT

Level-of-service B is the preferred operating condition for existing roadways in Wyoming, Montana, and North Dakota. *Level-of-service B* traffic is a stable flow condition, with operating speeds and vehicle maneuverability starting to become affected by traffic conditions.

The roadway data was provided by the Wyoming Department of Highways (WDOH), Montana Department of Highways (MDOH), and North Dakota State Highway Department (NDSHD).

Federal (including BLM and Forest Service), state, county, local, and private roadways in Wyoming, Montana, and North Dakota would be used for Proposed Action activities. Major transportation arteries consist of two- and four-lane paved roadways, while secondary roads are gravel and packed soil and include trails ranging from 8 to 20 feet wide. Many of these secondary roads have wooden box culverts and wooden cattle guard footings.

Since some of the terrain along the Proposed Action right-of-way is steep and rough, access to the pipeline would be limited. Areas with limited access can only be reached by using pickups and vehicles with high clearance or four wheel drive. In other areas, roads or bridges would not be able to accommodate traffic because of factors such as number of lanes, lane width, grades, auto-truck vehicle mix, operating speed, and gross vehicle weight. Because of all these constraints, pipe and equipment along some areas of the pipeline route could not be hauled to the construction sites.

The affected environment associated with the construction of the main pipeline, facilities, Bairoil plant and facilities, product line, and Cedar Creek distribution pipeline and facilities would be the same.

ENVIRONMENTAL CONSEQUENCES

Geographic locations of project components, employee home origins, pipe and equipment hauling, and locations of the material storage yards and railheads, were used to analyze potential impacts to through-traffic and population center access on existing roadway systems.

PROPOSED ACTION—TRANSPORTATION NETWORKS

Peak construction during the summers of 1986 and 1987 would generate vehicle trips associated with the movement of the work force and the hauling of pipe and equipment from eight storage yards located in six towns (Table 9).

Amoco's spread would consist of the 154-mile-long, Bairoil pipeline and ancillary facilities between MP 48.9R and 26R, MP 0 and 111, and MP 0S and 20S. Exxon's Spread 1 would be the 131-mile-long segment of Exxon's Wyoming-Dakota pipeline and ancillary facilities between MP 0.0 and 111 and the 20-mile-long spur pipeline to Bairoil, with its ancillary facilities. (Other spreads are described in Chapter 1, Table 8.) Pipeline construction material would be hauled from Rock Springs, Wyoming; construction material for the Bairoil plant and oil field would be hauled from Rawlins.

Amoco's Bairoil pipeline and facilities and Exxon's Spread 1 would be constructed by two contractors, beginning at different times. One contractor would start several weeks before the other since they could not physically work in the same area at the same time. Therefore, construction would be staggered. The storage yard at Rock Springs would service the construction crews. During peak summer construction, these two contractors would generate at least 140, 20-ton truck trips and 104 passenger car, bus, and pickup trips per day.

The 244 total vehicle trips per day would significantly increase the traffic volume on certain roadway segments of Wyoming State Highways 372 and 73, thereby temporarily lowering the level of service. The most significant impacts to these road segments would be related to increased truck traffic volume.

Workers leaving the construction site at the close of each working day would cause a congested traffic flow for about an hour and would cause an unsafe operating level, possibly below Level C. This unsafe level would be significant as stated in the significance criterion.

Since traffic accidents increase directly in proportion to increases in traffic volume, increased project-related passenger and truck traffic on roadway segments of U.S. Highway 191 and Wyoming State Highways 372 and 73 would temporarily increase the number of accidents. Traffic accidents would not be limited to construction traffic but could involve local and through-traffic. Factors such as time of year, weather conditions, time of day, summer transient traffic, and recreation vehicles, would also contribute to traffic accidents. Any increase in traffic accidents would be significant, but traffic accidents would increase only during construction.

Many county, private, BLM, and Forest Service dirt roads would be used for access to the construction site. Wooden box culverts and cattle guard footings normally found under these roads may not be able to sustain

heavy truck loads. In addition, these usually unbladed dirt trails may not be able to sustain increased traffic volume and flow. (At the public scoping meetings, Exxon indicated that it would upgrade or fix roads, cattle guards, bridges, or culverts as necessary—Kunzig 1985.)

Increased project-related traffic could accelerate the deterioration of road structures and roadbeds. County budgets presently allocated for maintenance of these road structures and roadbeds may not be enough to handle the repairs needed after construction. As stated in the significance criterion, this would be significant.

Although access to the construction site seems adequate, some small areas may not be easily accessible. In these areas, some roads may need to be upgraded or new roads built to move pipe and equipment to the site. The use and control of these roads by the contractor and the public during construction and upon completion of the project would be based on the terms of each individual easement obtained by Amoco and Exxon.

The Bairoil plant and ancillary facilities, including oil field facilities, would be built between April 1986 and November 1987. About 50,000 tons of plant construction material and oil field pipe would be hauled to the site from Rawlins, Wyoming. Project-related traffic could add at least 40, 20-ton truck trips and 220 passenger car, bus, and pickup trips per day to segments of U.S. Highway 287 and Wyoming State Highway 789, which would significantly increase traffic volume.

Other impacts associated with construction of the Bairoil plant, facilities, and oil field, such as road accidents or road maintenance costs, would be similar to those associated with construction of the main pipeline.

Construction of Exxon's Spread 2 between MP 111 and 203 would require at least 40 truck trips to haul 26,000 tons of material and equipment from Casper, Wyoming. In addition, 52 passenger car, bus, and pickup trips per day would be required. Because of current road construction, these trips could cause a significant impact to Wyoming State Highway 220 or U.S. Highways 20 and 26. Truck trips would have a significant impact (as described for Spread 1) on the secondary (county) roads serving the construction site.

Construction of Spread 3 between MP 203 and 280 would require at least 40 truck trips to haul 22,000 tons of material and equipment south of Gillette. Also, 52 passenger car, bus, and pickup trips per day would be needed. Construction of Spread 4 between MP 280 and 347 would require at least 50 truck trips to haul 36,000 tons of material and equipment, plus 52 passenger car, bus, and pickup trips per day.

The 92 trips per day required for Spread 3 and 102 trips for Spread 4 would not have any significant impact on

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Interstate Highways 25 and 90, Wyoming State Highways 259 and 387, or U.S. Highways 14 and 16. However, the truck trips could significantly affect road segments of U.S. Highways 20 and 26; Wyoming State Highways 191, 50, 220, and 59; and secondary roads serving the construction site. Other impacts associated with the construction of Spreads 3 and 4 would be similar to those discussed for Spread 1.

Construction of Spread 5 between MP 437 and 567 would generate at least 46 truck trips per day to haul 30,000 tons of material and equipment from Baker, Montana. Also, 52 passenger car, bus, and pickup trips per day would be required. These trips would not significantly affect U.S. Highway 12, since the traffic would not significantly lower the level of service. The truck trips, however, would have a significant impact on Montana State Highways 544, 59, 277, 327 and 7 as well as some of the secondary (county) roads and bridges serving the construction site.

Other impacts associated with the construction of Spread 5 would be similar to those discussed for Spread 1. Construction of Spread 6 between MP 567 and 643 would require at least 30 truck trips per day to haul 16,000 tons of material and equipment from Williston, North Dakota. In addition, 52 passenger car, bus, and pickup trips per day would be needed.

The 82 trips per day for Spread 6 would not have any significant impacts on Interstate Highway 94, North Dakota Highways 40 and 23, or U.S. Highway 85. The truck trips, however, could significantly affect road segments of North Dakota Federal Aid Systems 1711, 1744, 1746, 0419, 0408, 200, and 1804; North Dakota State Highway 16; and Forest Service and county roads serving the construction site.

One segment along Spread 6 between MP 584 and 595, has rough terrain and poor soils, which have limited road building in the area. Temporary roads would need to be built, in order to haul material to the construction site. Other impacts associated with the construction of Spread 6 would be similar to those discussed for Spread 1.

Construction of Shell's Cedar Creek distribution pipeline (Spread 7) would not have any significant impacts to the roads serving the area. Material and equipment would be hauled from Baker, Montana. Other impacts associated with construction of this spread would be similar to those discussed for Spread 1.

Water Resources

IMPACT SIGNIFICANCE CRITERIA

Impacts to water resources were considered significant if:

- the water quality standards for the States of Wyoming, Montana, or North Dakota or the federal standards, whichever are more stringent, were violated (Appendix 7);
- long-term sediment loads in streams increased more than 1 percent; or
- the characteristics of floodplains were changed so that flood flows were impeded.

AFFECTED ENVIRONMENT

The main pipeline route would begin in the Green River drainage basin, cross the Continental Divide through the Great Divide Basin of southwestern Wyoming, and then proceed through the Missouri River Basin, following the Powder and Little Missouri River drainages. At the northern end of the route is the Little Missouri Breaks, which has the largest concentration of the roughest terrain found along the route. Watershed cover varies from saltbush alkali flats in the Great Divide Basin of Wyoming to grassland and dry-land crops in Montana and North Dakota. Runoff is quick from summer thunderstorms and spring snowmelt.

The main proposed route would cross 17 perennial streams 21 times at 19 locations, including their 100-year floodplains, plus Lake Sakakawea on the main stem of the Missouri River. (See Table 36 for perennial streams that would be crossed by the Proposed Action alignment.) The Proposed Action would cross the Green River once at MP 38.1R and twice at MP 2.6—once each by Amoco and Exxon. It would also cross Crooks Creek twice at MP 109.5—once each by Amoco and Exxon. The route also would cross many intermittent and ephemeral streams.

The Bairoil spur portion of the pipeline would cross rolling landscape in the Crooks Creek and Soldier Creek drainages and cross Crooks Creek at MP 3.2S three times—once by Exxon and once each by Amoco's two pipelines. Vegetation cover is mixed sagebrush grass/greasewood saltbush.

PROPOSED ACTION—WATER RESOURCES

TABLE 36
PERENNIAL STREAMS CROSSED

Stream	MILEPOST CROSSING		Existing Pipeline Crossings	State	Water Quality Classification	Fishery Classification	Game Fish Present at Crossing
	Proposed Action	Highway 85 Alternative					
Green River	38.1R	38.1R	yes	WY	II	I	Rainbow, Brown, Brook Trout
Green River*	2.6	2.6	yes	WY	II	I	Rainbow, Brown, Brook Trout
Crooks Creek*	109.5	109.5	yes	WY	II	III	Brook Trout
Crooks Creek*	3.2S	3.2S	no	WY	II	III	Brook Trout
Sheep Creek	115.4	115.4	yes	WY	II		Brook Trout
West Cottonwood Creek	118.8	118.8	yes	WY		IV	Brook Trout
Middle Cottonwood Creek	120.5	120.5	yes	WY		IV	Brook Trout
Sweetwater River	133.6	133.6	yes	WY	II	IV	Rainbow, Brown, Brook Trout
Dry Creek	149.6	149.6	no	WY		IV	Brook Trout
Poison Spider Creek	168.3	168.3	no	WY	IV		None
Middle Fork Casper Creek	180.5	180.5	no	WY	III		None
Salt Creek	234.3	234.3	no	WY	IV		None
Meadow Creek	236.8	236.8	no	WY	III		None
Little Powder River	336.1	336.1	yes	WY	II	IV	None
Ranch Creek	357.8	357.8	yes	MT	0-3		None
Little Beaver Creek	433.4	433.4	no	MT	0-3		None
Sandstone Creek	464.5	464.5	no	MT	0-3		None
Little Beaver Creek	7.2D	7.2D		MT	0-3		None
Cabin Creek	45.5D	45.5D	yes	MT	0-3		None
Beaver Creek	482.8	482.8	no	MT	0-3		None
Little Missouri River	510.4	510.4	yes	ND	II	I	None
Little Missouri River	587.9	584.4	no/yes	ND	II	I	None
Cherry Creek	N/A	602.9	yes	ND		III	Brook Trout
Lake Sakakawea	625.8	630.0	yes	ND	I		Rainbow, Brown Trout, Walleye, Paddlefish

* The Green River and Crooks Creek would be crossed twice at these localities—once each by Amoco and Exxon. The Single Bairoil Pipeline Alternative would be the same as the Proposed Action, except it would cross the Green River only once at MP 2.6; it would not cross at MP 38.1R. The alternative would not cross Crooks Creek twice at MP 109.5 and 3.2S.

WY = Wyoming; MT = Montana; ND = North Dakota

The Bairoil plant site is a sagebrush flat. The Lost Soldier oil field is located in an area crossed by three draws formed by intermittent streams. The Wertz oil field is located in a hilly area with several facilities on top of Camp Creek Hill. This area has a high percentage of steeply sloped areas, with a total relief of 280 feet. These two oil fields are currently disturbed by roads, oil well pads, reserve pits, and pipelines.

The Cedar Creek distribution pipeline would cross two perennial streams: Little Beaver Creek and Cabin Creek. The area is rolling grass-sagebrush, with annual precipitation ranging from 12 to 14 inches. This route would pass many roads, well pads, and pipelines.

Table 37 summarizes flow and quality data for streams in the area where data were collected. Existing water quality is characterized by moderate total dissolved solids (TDS), moderate to high suspended solids (SS), and moderate to high alkalinity. The capacity of these waters to buffer against pH drops (indicated by alkalinity) is high. Rivers that carry water originating from the

mountainous areas of the West (the Green River, Sweetwater River, and Lake Sakakawea) have lower TDS and less (but still high) pH buffering capacity. Streams draining the breaks and sparsely vegetated areas tend to have higher loads of suspended solids.

Ground water along the pipeline route occurs in river alluvium and consolidated geologic deposits of sandstone, lignite, shale, and limestone. Depths to water are generally greater than 50 feet, except in alluvium along the major rivers. In the Bairoil facilities area, shallow ground water occurs in the Battle Springs formation to the west and in some windblown sand deposits to the east of Bairoil. These mainly shallow aquifers are not present in the oil fields at Bairoil. The Tensleep and Madison formations also yield water in areas away from Bairoil. Little is known about water below the formations that are proposed for enhanced oil recovery. Along the proposed main pipeline route, water is used for fisheries, livestock, wildlife, and recreation. Water downstream from the major river crossings is also used for irrigation, industrial purposes, and municipal supplies.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 37
STREAM AND LAKE CHARACTERISTICS¹

Stream/Lake	FLOW (cfs)			TDS (mg/l)			SUSPENDED SOLIDS (mg/l)			pH			ALKALINITY (mg/l)		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum
Green River near Green River, WY	1,751.00	13,600	275	389	561	295	224	6,570	4	8.4	9.1	7.8	145	176	110
Killpecker Creek at Rock Springs, WY	0.36	2.9	0	N/A	N/A	N/A	N/A	N/A	N/A	8.1	9.0	6.8	489	2,640	190
Sweetwater River near Alcova, WY	126.00	2,900	2.4	N/A	N/A	N/A	39	242	4	8.0	8.6	7.5	139	180	82
Dugout Creek Tributary near Midwest, WY	0.14	30	0	N/A	N/A	N/A	32,824	82,300	15,200	N/A	N/A	N/A	N/A	N/A	N/A
Powder River at Sussex, WY	252.00	11,900	11	1,961	4,020	525	9,804	83,500	138	8.1	8.5	6.4	364	640	140
Little Powder River above Dry Creek, WY	29.20	5,000	0	2,185	4,220	389	1,281	11,800	8	8.0	8.5	7.3	311	600	77
Little Beaver Creek near Marmarth, WY	58.70	5,870	0	932	1,880	345	N/A	N/A	N/A	8.4	8.8	8.0	260	400	112
O'Fallon Creek near Ismay, MT	24.50	2,780	0	2,412	4,570	535	221	4,390	26	8.4	8.9	7.6	364	940	58
Beaver Creek at Wibaux, MT	15.10	1,040	0	N/A	N/A	N/A	63	549	6	8.1	9.2	7.6	368	510	120
Little Missouri River at Marmarth, ND	307.00	21,900	0	1,224	2,480	300	N/A	N/A	N/A	8.4	9.0	7.3	331	714	97
Green River near New Hradec, ND	18.50	1,380	0	672	2,140	112	50	222	9	8.0	8.9	6.5	285	409	48
Knife River at Manning, ND	21.00	1,630	0	1,234	2,400	182	67	173	11	8.1	8.9	6.7	478	966	76
Little Missouri River near Watford City, ND	546.00	30,900	0	1,409	3,150	441	3,096	29,500	27	8.4	8.9	7.8	297	580	110
Bear Den Creek near Mandaree, ND	7.90	1,080	0	1,704	2,600	175	128	1,760	8	8.2	9.0	7.1	724	1,070	250
Lake Sakakawea at New Town, ND	N/A	N/A	N/A	428	505	352	10	13	6	8.5	8.8	8.3	151	173	124

Source: Geological Survey 1976-1983; Army Corps of Engineers 1982.

¹Information not available on all streams.

cfs = cubic feet per second; mg/l = milligram per liter; N/A = not applicable; WY = Wyoming; MT = Montana; ND = North Dakota

PROPOSED ACTION—WATER RESOURCES

ENVIRONMENTAL CONSEQUENCES

During construction of the pipelines, the clearing of rights-of-way, digging of trenches, and respreading of excavated material would increase suspended sediment loads in streams, if runoff reached the streams. Construction at stream crossing locations would take from 1 to 4 weeks, depending on the size of the stream. The stream channel and banks would actually be disturbed about 2 to 6 days, during low flow periods. Only the minimum amount of bank vegetation needed to do the work would be disturbed (2 1/2 acres or less per bank). On the numerous intermittent and ephemeral streams, the beds would most likely be dry and no significant change in water quality is expected. On perennial streams (Table 36), the trenching would increase suspended solids and turbidity. This may cause a temporary violation of water quality standards for turbidity at the crossing site and downstream for 1 to 3 miles. Within 5 years, the stream banks would return to their previous stability without having significantly affected water quantity or quality.

Construction at the Lake Sakakawea crossing would take about 2 months. Trenching beneath Lake Sakakawea would be limited to within 100 to 300 yards of the shoreline and last about 1 month. This and the lower flow rate in the lake would limit suspended sediment increases to the area immediately around the shoreline disturbance.

Other materials that had settled in the lake, such as from agricultural runoff or from the inflow to the reservoir, would be stirred up during construction. Disturbance of these materials could cause other chemicals or gases to be released, temporarily blocking oxygen in the water, thereby resulting in localized losses of fish.

Disturbance of soils in upland areas would not cause significant changes in suspended sediment loads. The erosion control procedures identified in Appendix 4 would prevent significant sediment loads from entering streams.

The route would cross several areas with steep slopes, such as the Little Missouri Breaks (See soils section and Map 6). Steep-sloped areas are critical as potential stream sediment sources; extra care in reclamation and maintenance would be required.

The main pipeline and Cedar Creek distribution pipeline would cross numerous 100-year floodplains associated with intermittent and perennial streams. Construction across streams would occur during typical low flow periods, so the potential for flooding would be low. Since the pipeline would be buried below the maximum scour depth and no surface facilities would be located within the floodplain, no significant change in floodplain characteristics should occur after the pipeline was in place.

Although unlikely, the pipeline could break (Chapter 1). If this happened beneath one of the stream crossings, the suspended solids could increase and the pH and temperature in the stream could be lowered. In a leak situation, the CO₂ in the pipeline would be under pressure, which would disrupt the streambed material and increase suspended sediment. As the CO₂ escaped and its pressure dropped, it would cool, thus introducing a plume of CO₂ into the stream that could be as much as 35°F colder than the water (Exxon 1983a). Since CO₂ is soluble in water, it would form acidic conditions (lower pH level) and lower the water temperature. However, most of the CO₂ would bubble to the surface. The escaping gas would have a small potential to change the pH and lower the temperature in the stream water.

Table 37 shows that streams in the area have moderate to high alkalinity, which would highly buffer them against lowering pH levels. Additional buffer would be provided by the streambed material directly over the pipeline.

Mixing from the stream flow would quickly dilute increased suspended sediment, lowered pH, and lowered temperature. The pipeline would be shut off at the nearest block valves, limiting the volume of CO₂ leaked into the water.

State water quality standards for turbidity, pH, and temperature change could potentially be violated. Although the pH and temperature changes would occur only at the pipeline leak, increased turbidity could be measurable for a short distance downstream. These impacts would dissipate as soon as the block valves cut off the flow of CO₂. Impacts from pipeline failure beneath Lake Sakakawea may be more than in streams, because the lake has a lower mixing rate.

Water used for hydrostatic testing and for the temporary increase in population at various towns would not significantly affect other water uses. The test water would be acquired and disposed of in a manner approved by state and local authorities. No significant interference with ground water would occur.

The Bairoil plant and oil field are in upland areas, which are already heavily influenced by development. When the general measures outlined in Appendix 4 are applied, no significant impacts would occur. Annual water use at the Bairoil waterflood project would increase from about 2,600 acre-feet to as much as 4,500 acre-feet during the first year. Water use would then return to at least present levels once CO₂ injection began. Over the life of the enhanced oil recovery program, the amount of water used for flooding is expected to decrease. When Amoco's new plant begins operation, it would require a maximum of 47 acre-feet per year (ac-ft/yr) of water. Amoco currently has water rights for pumping ground water (west of the Bairoil area),

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which are sufficient to supply even peak water requirements for both the plant and enhanced oil recovery operations. No liquid wastes are anticipated; solid waste would be disposed of according to state and local regulations.

Water and CO₂ injected into the Tensleep and Madison formations would be isolated from the shallow fresh-water aquifers by shale layers thousands of feet thick. Since movement along these formations would be restricted by the geologic structure, no significant impacts to ground water resources would occur from enhanced oil recovery.

Wildlife

IMPACT SIGNIFICANCE CRITERIA

Terrestrial Wildlife. Impacts to terrestrial wildlife species were considered significant if:

- more than 10 percent of the total crucial habitats within the 1-mile-wide corridor (such as high priority summer and winter ranges, crucial summer and winter ranges, calving/fawning areas, leks, nesting and brooding areas) was removed;
- any crucial habitats (such as winter ranges, calving/fawning areas, leks, brooding areas, raptor nesting areas, migration routes, riparian areas) were disturbed during the normal season of use;
- more than 1 percent of the total habitat within a 1-mile-wide corridor was disturbed;
- increases in poaching, wanton killing, wildlife/vehicle accidents, and harassment exceeded 15 percent over current levels; or
- more than 1 percent of riparian habitat occurring within the 1-mile-wide corridor was disturbed or removed by project construction or could not regenerate because of the loss of parent rootstock.

Aquatic Wildlife. Impacts to aquatic wildlife were considered significant if:

- CO₂, released into a body of water from a rupture, exceeded tolerance levels of 15 parts per million for most salmonoid species;
- levels of sediment increased by more than 100 milligrams per liter (mg/l) in a fish spawning area; or
- instream construction activities persisted in a flowing stream for more than 8 consecutive hours, oc-

curred within 2,000 feet of a fish spawning area, or crossed a fish spawning area.

Threatened or Endangered Species. Impacts to threatened or endangered species were considered significant if any threatened, endangered, or sensitive wildlife species were affected.

AFFECTED ENVIRONMENT

The various components of this project would be built on or across several kinds of wildlife habitats. Within these various habitats are seasonal ranges (such as breeding grounds, crucial winter ranges, migration routes) that are crucial to the survival of certain local species populations during critical periods of the species' life cycle. These areas provide some factors (food, cover) that are essential to the survival of the local population of species under consideration.

Crucial wildlife seasonal ranges crossed by the main pipeline are listed in Table 38 by milepost and habitat type.

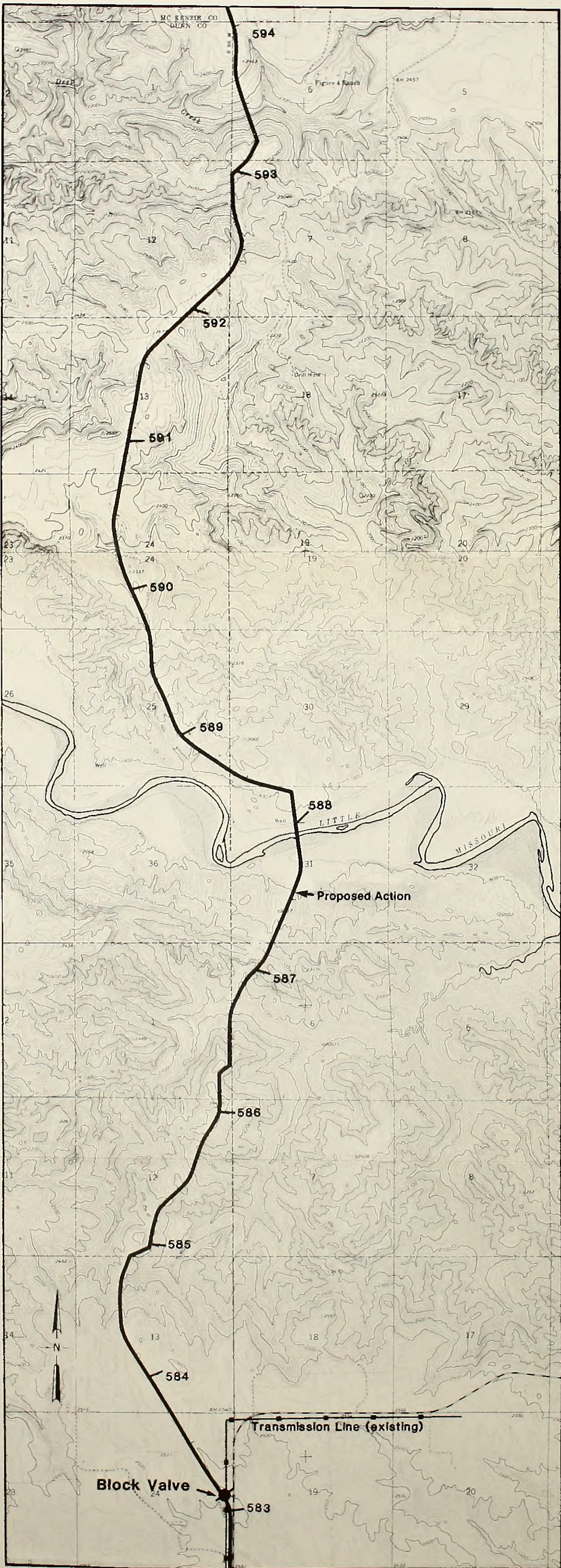
Terrestrial Wildlife. Vegetation types crossed by all components of the Proposed Action are identified and described in the Soils and Vegetation section.

Pronghorn, mule deer, elk, bighorn sheep, and whitetail deer are the principal big game animals found along the main pipeline route. The route would cross few crucial seasonal ranges.

Sage grouse, an important upland game bird, are common throughout most of the main pipeline route. Leks and the associated nesting habitat are crucial areas used for strutting and nesting from March 1 through June 30.

Sharp-tailed grouse are also found along the main pipeline in northern Wyoming, southeast Montana, and portions of North Dakota along the main pipeline route. Populations of these birds have declined slightly in the past 10 years, primarily as a result of habitat losses associated with sagebrush removal programs and extensive energy developments. Some dancing grounds can be found along the main pipeline route and more undiscovered grounds are probably in the same areas. The normal dancing and nesting period is from April 1 to mid-June.

The project area is inhabited by large numbers and varieties of raptors. Nesting raptors include the golden eagle, red-tailed hawk, Swainson's hawk, ferruginous hawk, harrier, prairie falcon, merlin, American kestrel, and great-horned and burrowing owl. The golden eagle, prairie falcon, ferruginous hawk, merlin, and burrowing owl are considered migratory birds of high federal interest and require special consideration. In addition, the ferruginous and Swainson's hawks (Category II) are



MAP 6 PROPOSED ACTION CROSSING - LITTLE MISSOURI RIVER BREAKS AREA

PROPOSED ACTION—WILDLIFE

TABLE 38
CRUCIAL WILDLIFE HABITATS

Habitat Type	Miles Crossed	Acres Affected	Milepost
Mule Deer			
Crucial winter range	14.5	186	37R-48R 35-39.5
Winter concentration area	3.0	36	391-394
Pronghorn			
Crucial winter range	69.0	828	26R-49R 0-2 3.5-7.5 26-37 24-136 180-195 386-388
Fawning range	12.0	144	26-38R
Elk crucial winter range and calving area	1.0	12	114.5-115.5
Whitetail deer crucial winter range	3.0	36	445-448
Bighorn sheep lambing range	14.0	168	505-519
Sage grouse			
Wintering areas	3.5	42	97-98.5 124-126
Breeding/nesting habitat	26.0	312	32-37R 25-29R 97-99 160-164 168-173 181-182 197-199 267-268 296-297 315-316
Sharp-tailed grouse breeding/nesting habitat	2.0	24	375-376 380-381
Raptor nesting habitat	54.0	648	36R-43R 45R-46R 47R-49R 95 165 171 174.5 187.5 224 276 291 305 307 308 310 332 335 348 410 505-520

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

**TABLE 38
CRUCIAL WILDLIFE HABITATS (Concluded)**

Habitat Type	Miles Crossed	Acres Affected	Milepost
			523-525
			555
			560
			576
			606-611
			624
			630
Prairie dog colonies	41.75	501	0
			1.5
			3-4
			10
			11
			13-14
			20
			31-34
			34.5-35
			36-37
			49.5
			50.5
			52
			53-54
			57-57.5
			68-69.5
			70.5-71
			71-72
			72.5-73.5
			75-75.5
			77-77.5
			80.5-81
			81.5-82
			86-93.5
			94-99
			99.5-102.5
			103-106.5
			108.5-109
			109.5
			110.5-111
			111.5-112
			119.5-120.5
			121-121.5
			128-129.5
			146.5-147
			152.5-153
Bald eagle winter habitat	13.0	156	180-191
			511
			588
Wild horse range	121.0	1,452	4-125

Sources: Various BLM Districts and Resource Areas involved with the pipeline route and the U.S. Fish and Wildlife Service in Bismarck, North Dakota.

PROPOSED ACTION—WILDLIFE

under review for possible listing as threatened or endangered species (*Federal Register* 1982).

Numerous small mammals use the various habitats along the main pipeline route. These species populations are highly cyclic and population numbers can vary greatly from year to year.

Not many reptile and amphibian species occur along the main pipeline route, but a few species can be found in the area.

The Bairoil plant, product pipeline, product storage tank, and oil field distribution system would not affect any crucial wildlife habitats. However, these project components would affect habitat for big game, small mammals, reptiles, small nongame birds, and raptors.

The Cedar Creek distribution pipeline would not cross any crucial wildlife habitats. Other wildlife habitats for big game, small mammals, sage grouse, sharp-tailed grouse, small nongame birds, reptiles, and raptors would be crossed by this distribution line.

Aquatic Wildlife. The main pipeline would cross 18 perennial streams (including two crossings each of the Little Missouri River and Green River) contained within the Green River, North Platte, and Missouri River basins (Table 36, Water Resources section). The Proposed Action would cross the 18 different perennial streams 26 times at 21 locations since the Amoco and Exxon pipelines would parallel each other; three streams would be crossed by two pipelines at the same point but at different times.

The Proposed Action would cross two Class I streams (Green River and Little Missouri), one Class III stream (Crooks Creek), and five Class IV streams (West and Middle Cottonwood Creek, Sweetwater River, Dry Creek, and Little Powder River). The remaining perennial streams are unclassified (FWS and Wyoming Game and Fish Department 1978; FWS and Montana Department of Fish, Wildlife and Parks 1980; and FWS and North Dakota Game and Fish Department 1978). These perennial streams support varying sizes of salmonoid fish populations, which include brown, rainbow, brook trout, and kokanee salmon. Rainbow trout spawn in the spring, while brown trout, brook trout, and kokanee spawn in the fall and early winter.

The main pipeline could affect trout in East Cottonwood Creek (MP 122), Willow Creek (MP 130), and Dry Creek (MP 143.5), depending upon the exact crossing locations.

At about MP 159, the proposed pipeline would be about 1,000 feet uphill from the Horse Creek Springs area. These springs form the headwaters of Horse Creek, which supports a good brown trout population.

The Cedar Creek distribution pipeline would cross Little Beaver Creek and Cabin Creek, which are perennial streams. The pipeline would cross Lake Sakakawea from about MP 626 to 628. Fish species of interest that could be affected by construction of the pipeline in and on the lakebed include brown and rainbow trout, walleye, sauger, and paddlefish.

Threatened or Endangered Animal Species. Several federally listed threatened, endangered, or proposed species may occur on or along various components of the main pipeline and Cedar Creek distribution pipeline. These species may include the bald eagle, whooping crane, peregrine falcon, and black-footed ferret. One proposed species, the piping plover, which nests on stream islands and uses other river habitats, could also occur on portions of the route (Appendix 6).

The narrow-footed *Hygrotus* diving beetle, a Category II candidate species, is found in several locations in north-central Natrona County, Wyoming (Cloud, Dead Horse, and Dugout creeks) from about MP 223 to 234 along the Proposed Action route.

Since these species could occur on all the various components of the Proposed Action, they are not repeated for each of the components.

ENVIRONMENTAL CONSEQUENCES

Terrestrial Wildlife. Table 38 shows the acres and miles of crucial wildlife habitats that would be disturbed by construction, operation, and abandonment of the main pipeline route. These amounts of habitat disturbance are not considered significant because they represent less than 1 percent of the total habitat within a 1-mile-wide corridor and would be short term. (See the Vegetation section for estimates of the time required to bring vegetation habitats back to predisturbance production.) In addition, impacts to known crucial big game seasonal ranges (winter range, calving habitat) would be avoided by the proper timing of construction (Appendix 4). ← insert

The main pipeline route would disturb about 42 acres of sage grouse wintering range and about 312 acres of sage grouse breeding/nesting habitat. Additionally, the main pipeline route would disturb an estimated 24 acres of sharp-tailed grouse breeding/nesting habitat. The disturbance would not exceed the significance criteria since it would not occur during the normal season of use. Disturbance during the normal season of use would be prevented with the proper use of the measures identified in Appendix 4.

Each raptor species has a different tolerance to disturbances during the nesting season and will abandon their nests if that tolerance is exceeded. Raptors would abandon eggs and nestlings if construction activities occurred within the buffer zone during the critical period.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

An estimated 54 miles of raptor nesting habitat would be disturbed by construction activities, but proper timing of this work would avoid impacts to nesting raptors (Appendix 4).

Impacts to wintering bald eagles are not expected because the proposed construction schedule would avoid the wintering period.

Impacts to wild horses are not expected to be significant because the amount of habitat disturbed is expected to be less than 1 percent of the total range.

Losses of small burrowing mammals, reptiles, and amphibians from construction activities are not expected to be significant because the amount of habitat disturbance and mortality is estimated to be less than 1 percent of the total habitat. Also, these species reproduce rapidly and would quickly replace any losses from mortality. The more mobile species would temporarily move away from construction areas, while less mobile species could suffer some mortality. Revegetation of the pipeline right-of-way and the high reproductive potential of the smaller species would make these impacts short term and locally insignificant.

Secondary impacts to all species of wildlife caused by increased human population during construction and operation of the main pipeline are not expected to be significant because the total human population increases over the entire pipeline area are not expected to exceed 0.8 percent of total baseline population figures (Table 25). Likewise, poaching, harassment, or wanton killing would not be significant from human population increases during construction. Although random camping locations by construction workers cannot be predicted, adverse impacts to wildlife are not expected to occur because these workers would not stay in one area long enough to significantly harass wildlife species.

Bairoil, Wyoming is the only area along the entire route that is expected to have a significant increase in population from construction of the Proposed Action. Population is estimated to increase by 22.2 percent for 2 years (Table 25). This increase represents 60 persons, so harassment of wildlife, poaching, and other similar types of impacts are not expected to increase significantly over present levels.

The Bairoil plant, product pipeline, product storage tank, and oil field distribution system would not adversely affect either crucial or normal wildlife habitats, since few acres would be disturbed. Also, the oil field was already permanently disturbed during prior oil field activities.

The Cedar Creek distribution pipeline would not cross any crucial wildlife habitats. However, construction of this pipeline would temporarily disturb 384 acres of

normal wildlife habitat. An additional 21 acres of habitat would be permanently lost for the life of the project because of construction of the eight meter stations. All impacts to wildlife species from these facilities would be insignificant, since little habitat would be disturbed. However, construction would generate more traffic, which could temporarily increase animal and vehicle collisions.

Aquatic Wildlife. Since the companies would most likely adhere to their proposed construction schedules (Figure 1), most of the direct impacts to fisheries would be avoided. Also, disturbances to crucial habitats from construction during critical times of the year would be lessened.

If the pipeline crossed East Cottonwood Creek (MP 122), Willow Creek (MP 130), and Dry Creek (MP 143) in the fall, brook trout spawning could be reduced. Construction in the fall could also reduce the spawning success of brown trout because of siltation in the spawning areas of Horse Creek (MP 158) or other disturbances (digging) to spawning beds.

Trench-and-fill activities would remove stream bottom materials, resulting in the loss of about 3 1/2 pounds (dry weight) of invertebrates for every 10 feet of stream crossed (Dehoney and Mancini 1982). However, these species would repopulate within a few months after construction. Impacts, therefore, would be short term and considered insignificant. Similar macroinvertebrate recovery rates have been recently documented by Gartmen (1981) and Tsui and McCart (1981).

General river bank and instream construction are expected to increase stream turbidity and siltation (EPA 1976). Chronic stream siltation contributes to a general decrease in stream productivity (Karr and Schlosser 1978; Stern and Stickle 1978). Under natural conditions, however, fishes and invertebrates do not tend to remain in areas of high turbidity (White and Gammon 1977; Peters 1967; Herbert and others 1961; Burnside 1967) and short-term movements to other areas may occur. Therefore, the most notable impact to fisheries associated with construction-related turbidity would be the potential reduction in reproductive success caused by increased siltation. Most impacts to fisheries from turbidity occur during long-term chronic sedimentation conditions, which would not occur with this project.

Biological aquatic disturbances associated with pipeline construction (including fish spawning and macroinvertebrate impacts), are expected to be localized, short term (1 year's reproduction, at most), and insignificant.

A pipeline break or leak at any of the perennial stream crossings would cause CO₂ to travel in a plume-like pattern downstream. The length and extent of the plume would depend on such factors as size of the leak, water

PROPOSED ACTION—WILDLIFE

temperature, water turbulence, existence of dissolved salts, duration of the leak, buffering, and other factors (BLM 1984a). See Water Resources section for more details on the CO₂ plume and its impacts.

The most probable adverse effect of a CO₂ release into a flowing stream is a lowering of pH and direct toxicity effects. At 25°C, an equilibrium concentration of CO₂ and water would approach 0.55 parts per million which would not constitute a significant adverse impact to most fish species. Over-saturation could occur adjacent to the leak site with CO₂ concentration levels potentially going as high as 1,500 parts per million. While CO₂ concentrations at these levels would be extremely toxic to fish, the possibility of many fish being killed would still be remote or virtually nonexistent because (1) fish tend to avoid CO₂, (2) a bubble stream from a leak would cause fish to avoid the area, (3) a CO₂ leak would be short term because of block valve safety precautions, and (4) a leak or blow-out is unlikely to occur at all.

Fish are able to adjust to increases in CO₂ levels up to 60 mg/l (60 ppm). Above this level, most fish cannot get oxygen from the water and die. Some fish are able to detect and respond to slight CO₂ increases and may avoid CO₂ levels as low as 1 to 6 mg/l (1 to 6 ppm) (Berry 1984).

In the unlikely event of a pipeline rupture in Lake Sakakawea, most of the escaping CO₂ would bubble to the surface. The CO₂ absorbed near the break would lower the pH near the break; this would be short term because of dilution and the shutoff valves on each shore of the lake. The plume of gas that would form in the lake near a break or leak would have concentrations of CO₂ ranging from pure gas in the center of the plume to over-saturated areas at the top and sides of the plume. The over-saturated areas would have concentrations of CO₂ gas ranging from 1,500 to 3,000 parts per million. This concentration zone would be small and would quickly dissipate. Since fish tend to avoid bubble streams in a body of water, they would quickly leave the area; therefore, losses are not expected to be significant. In the event a fish was directly over the pipe when a leak occurred, the pure stream of CO₂ gas could be fatal, but significant losses are unlikely to occur.

The Cedar Creek distribution pipeline would affect Little Beaver and Cabin creeks as described for the main pipeline route.

Threatened or Endangered Species. The Proposed Action would disturb some threatened or endangered species, including about 501 acres of prairie dog colonies that could furnish habitat for the endangered black-footed ferret (Table 38). Impacts to the federally listed black-footed ferret by removal of prairie dog colonies could include mortality to any ferret underground in the

path of construction machinery. Because current populations of this animal are low, any losses would be significant. Short-term removal of prairie dog habitat should cause no other significant impacts to the ferret. The permanent facilities would remove only a small amount of prairie dog habitat, so no significant impacts to the ferret are expected.

No adverse impacts to whooping cranes are anticipated since project facilities would not be near any known resting or staging areas. No adverse impacts to the peregrine falcons are anticipated because none of the project facilities would be near any known active eyries. Since construction is planned during the summer months, no adverse impacts to bald eagles are anticipated. However, construction could destroy winter roost trees.

The piping plover (Category II) is proposed for listing and care should be taken in the planning process to protect this bird and its habitats.

Since the narrow-footed Hygrotus diving beetle is a Category II candidate species, there are no legal constraints to protect it. However, care should be taken in the planning process to protect this beetle and its habitat in Dugout Creek.

CUMULATIVE IMPACTS

Cumulative impacts to wildlife from construction of the Proposed Action and other related projects are not expected to be significant because construction would not disturb more than 1 percent of the total wildlife habitats. Human population increases, however, would increase poaching, harassment, and wanton killing of wildlife over current levels.

The only significant impacts to wildlife from human population increases during construction of the Proposed Action and other projects may be in Sweetwater County, Wyoming. Countywide population would increase by 12.9 percent. When a straight line projection is used, poaching and harassment, particularly to sage grouse and pronghorn, would increase 12.9 percent over current levels, which would not exceed the significance criteria of 15 percent.

However, since the populations of Green River, Rock Springs, and Bairoil (Sweetwater County, Wyoming) are predicted to increase 11.4, 15.8, and 22.2 percent respectively, poaching, harassment, and wanton killing could also increase by these percentages over current levels. In addition, legal hunting and fishing could increase locally at the same percentage levels. The population increase in Gillette, Wyoming (Campbell County) is estimated to be 13 percent; therefore, increases in poaching over current

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

levels could approach the significance criterion. While these population increases could cause significant, local increases in both illegal and legal hunting, their effects would most likely be short term.

No cumulative impacts would occur to fish species from perennial stream crossings because the timing of the crossings would be controlled to protect trout spawning (Appendix 4, General Measures).

Cultural Resources

IMPACT SIGNIFICANCE CRITERIA

Impacts to cultural resources were considered significant if:

- any information was lost that impeded efforts to reconstruct the prehistory or history of this region; or
- impacts occurred to any cultural resources on or eligible for inclusion on the National Register of Historic Places.

AFFECTED ENVIRONMENT

An overview study of the project area was performed by reviewing previous archaeological and historical works. For the purposes of this analysis, a 1-mile-wide corridor was analyzed, except between MP 356 and 375 in Montana, where a 2-mile-wide corridor was examined. Although the entire length of the Proposed Action was analyzed, milepost intervals are listed only for those areas where sites are known.

Most of the project area has not been intensively surveyed for cultural resources; therefore, the actual number of sites and associated density are unknown. Table 39 lists known archaeological and historic sites in the project area and Table 40, known historic trails and roads. The tables also show the National Register eligibility status for those sites and portions of historic trails and roads that have been investigated.

The Proposed Action begins between MP 49R and 26R of the Rangely CO₂ pipeline. An overview of cultural resources for this portion of the Proposed Action was prepared by Woodward-Clyde Consultants for the Chevron Phosphate Project (BLM 1983). As shown on Tables 39 and 40, this portion of the alignment would cross five archaeological sites and three historic trails or roads.

The portion of the Proposed Action that would parallel the existing Frontier pipeline (MP 0 to 140.1) has had numerous surveys and inventories, including Class I and

Class III studies (Commonwealth Associates 1982; 1983). The results of a trench inspection of the Frontier pipeline were recently reported in *Archaeological Investigations Along the Frontier Pipeline, Southern Wyoming* (Powers Elevations 1984).

Southwestern Wyoming lies on the periphery of the Northwestern Plains and the Great Basin culture areas as defined by Frison (1978) and Willey (1966). The region has been influenced by various cultural trends. The project area in central Wyoming is within the heartland of the northwestern plains culture area.

Based on the Class I, Class III, and trench inspection studies cited for the Frontier pipeline, many archaeological and historic sites as well as several historic trails and roads were identified (Tables 39 and 40). The portion of the pipeline route between MP 0 and 140 has been previously disturbed; it has been intensively surveyed and inventoried, with some sites already tested through sample excavations. Several areas were excluded from survey for the Class III survey, including several small portions between MP 0 and 140.

Corridor surveys for disturbed areas (MP 17.8 to 19.6), including other roads and pipelines, have identified numerous sites falling within the Lost Soldier and Wertz oil fields.

The area between MP 177 and 355.2 lies in the Eastern Powder River Basin in Wyoming. The general cultural chronology for this subregion is similar to that defined by Frison (1978) for the Northwestern Plains; however, some minor subregional variation exists. The most comprehensive project for inventorying cultural resources in this region was a Class II for the Eastern Powder River Basin, Wyoming (Metcalf 1981) prepared for BLM. Since surveys are limited, no reliable statements can be made of site density or the probability of sites occurring between MP 177 and 355.2.

The pipeline would cross portions of eight historic trails and roads located in the Eastern Powder River Basin of Wyoming. All are potentially eligible for placement on the National Register, depending on the condition (integrity) of the specific road or trail segment. The eligibility of each specific trail or road segment crossed by the pipeline is unknown. Although many of the segments no longer contain any physical remains, the exact locations of most of the routes are known.

A good prehistoric overview of the Montana region is found in the *Prehistory of the Custer National Forest: An Overview* (Beckes and Keyser 1983). A recent Class II study entitled *Site Distribution and Lithic Resource Utilization in the Powder River Resource Area, Southeast Montana* (Deaver 1983) was designed to yield a general understanding of the density and diversity of cultural sites in southeastern Montana by using a

PROPOSED ACTION—CULTURAL RESOURCES

**TABLE 39
KNOWN ARCHAEOLOGICAL AND HISTORIC SITES
POTENTIALLY AFFECTED BY THE PROPOSED ACTION**

MILEPOST	NUMBER OF KNOWN SITES	GENERAL SITE TYPE	NUMBER OF SITES ELIGIBLE FOR NATIONAL REGISTER OF HISTORIC PLACES	COMMENTS*
Main Pipeline and Facilities				
26R-49R	5	Lithic Scatters, Camps	2	Three sites are potentially eligible, pending further investigation.
0-20.9	6	Lithic Scatters	1	May have subsurface features*
21.0-41.9	11	Lithic Scatters	4	Represent Paleo-Indian, Middle and Late Archaic, Late Prehistoric, and Historic periods
42.0-62.9	13	Lithic Scatters	1	Subsurface features exist
63.0-83.9	8	Lithic Scatters	3	Represent Paleo-Indian, Early, Middle, and Late Archaic, Late Prehistoric periods
84.0-104.9	19	Lithic Scatters	6	Represent Paleo-Indian, Early, Middle, and Late Archaic, Late Prehistoric periods
105.0-125.9	24	Lithic Scatters	10	Represent Paleo Indian, Early, Middle, and Late Archaic, Late Prehistoric, and Historic periods
126-140.1	12	Lithic Scatters	6	Represent Paleo-Indian, Early, Middle, and Late Prehistoric, and Historic periods
140.1-176.9	10	Stone Rings, Lithic Scatters, Cairns, Historic Trash Dump	1	The eligible site has 54 stone rings, stone cairns, and evidence of quarry activity
177-181.9	7	Camps, Stone Rings, Lithic Scatters, Historic Structure	3	Another site potentially eligible, pending further investigation
213-262.9	11	Camps, Lithic Scatters	0	Two sites potentially eligible, pending further investigation
264.0-296.9	5	Lithic Scatters, Camps, Historic Rock Cairns, Historic Stone Wall Features	1	Eligibility of one site is unknown, pending further investigation
303.0-316.9	8	Lithic Scatters, Historic Homestead, Trash Dump	0	Eligibility of one site is unknown, pending further investigation
325.0-341.0	2	Lithic Scatters, Historic Structure	0	Historic Structure—Duck Creek Dance Hall—potentially eligible, pending further investigation
349.0-355.2	3	Camps	2	Late Prehistoric Period
412-414.5	3	Lithic Scatters, Historic Structure	0	One site potentially eligible, pending further investigation
463-464	1	Lithic Scatter	0	

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

**TABLE 39
KNOWN ARCHAEOLOGICAL AND HISTORIC SITES
POTENTIALLY AFFECTED BY THE PROPOSED ACTION (Concluded)**

MILEPOST	NUMBER OF KNOWN SITES	GENERAL SITE TYPE	NUMBER OF SITES ELIGIBLE FOR NATIONAL REGISTER OF HISTORIC PLACES	COMMENTS*
473-481	1	Camps	0	
499-522	3	Lithic Scatter	0	
524-543	2	Lithic Scatter, Historic Clay and Log Structure	1	Historic Clay and Log Structure is eligible for the National Register
543-576	3	Lithic Scatters, Historic Homesteads	0	Homesteads represent Euro-American settlement patterns
577-587	5	Lithic Scatters	0	Represent Middle and Late Archaic periods. Two sites potentially eligible pending further investigation
608-619	3	Lithic Scatters	0	Eligibility of the sites is unknown, pending further investigation
622-626	11	Lithic Scatters with Stone Cairns, Stone Rings, Historic Homesteads, Historic Trash Scatters	2	The two eligible sites are lithic scatters with stone rings and a site with 35 stone rings.
641-644	2	Stone Circles	0	Eligibility unknown pending further investigation
Bairoil Spur and Plant Site				
0S-10.9S	4	Lithic Scatter	0	
11.0S-17.7S	28	Lithic Scatters, Historic Stage Station	5	Lost Soldier Creek, focus No. 1, is a series of hearth clusters
17.8S-19.6S	8	Camps, Lithic Scatters	7	Remaining seven sites eligible: subsurface features exist for many of them
Plant Facility				
19.6S	1	Lithic Scatter	1	
Cedar Creek Distribution Pipeline				
25D-30D	3	Lithic Scatters	0	Eligibility of three sites unknown, pending further investigation
54D-62D	2	Lithic Scatters	0	Eligibility of both sites unknown, pending further investigation Two other lithic sites lie within mile of pipeline corridor

Sources: Commonwealth Associates 1982, 1983; Powers Elevation 1984; BLM archaeologists 1985; Wyoming State Preservation Office 1985; BLM Miles City District Office and North Dakota State Preservation Office 1985.

Notes: Comments refer to eligible sites in general terms. Sites listed as having unknown eligibility pending further investigation are based on field report recommendations.

Subsurface features include fire pits, charcoal stains, fire hearths.

PROPOSED ACTION—CULTURAL RESOURCES

statistically drawn random sample in Powder River and Carter counties.

Few surveys have been conducted within or near the corridor itself. A small Class III survey was done near MP 412 through 414 for a pipeline. The survey located one potentially eligible lithic and habitation site. Site types associated with particular environmental factors cannot be determined.

The route in the Belle Creek area would pass close to a site that is eligible for listing on the National Register. No reliable estimates of site density have been made for the Belle Creek area. In addition, the area around Medicine Rocks State Park appears to have a high potential for cultural sites. Preservation in the Lone Tree area (MP 400 to 415) is generally poor due to geologic conditions; however, some significant site remnants may occur on soil pedestals in some locations.

Some areas of the Cedar Creek distribution pipeline have been surveyed for various well pads, access roads, and other pipelines as part of a BLM-sponsored sampling survey. Two full sections and several small parcels in the project area have also been surveyed. Since few statistically valid, intensive surveys have been done in the project area, the total number of existing sites is unknown.

The prehistoric and historic cultural periods for North Dakota are similar to those described for Wyoming and Montana (Northwestern Plains culture), with some specific regional and date variations.

Specific information for regional prehistoric cultural variation in the North Dakota portion of the Northwestern Plains can be found in: the *Class I Cultural Resources Inventory of the Dickinson District, Bureau of Land Management* (Gregg and Davidson 1983) and the *Northern Border Pipeline Report, North Dakota* (Gregg and others 1984).

Some historic sites have been reported within or near the project corridor in North Dakota, but exact locations cannot be verified since no site reports exist. Although no written records of the reports have been found, the area should be carefully surveyed for cultural remains.

Like the eastern Powder River Basin in northern Wyoming and southeastern Montana, few surveys have been conducted within or near the proposed corridor. The few that have been done were conducted mainly for oil and gas exploration and clearance for access roads. Thus, site inventory in this area is incomplete so no reliable estimates of site density can be made. Numerous significant, presently undiscovered sites may occur in the area.

Locations for power line facilities have not been intensively surveyed in Wyoming, Montana, or North

Dakota. Likewise, none of the microwave repeater station sites have been surveyed, except Station 4 in Wyoming, where a few lithic scatters were discovered, and Station 11 in North Dakota (Table 39). In addition, two unverified reports were made of an historic grave and coal mine occurring near Station 11 in North Dakota. These reports were not field-checked because the information was provided long ago by an informant who did not document exact locations.

ENVIRONMENTAL CONSEQUENCES

Construction of the main pipeline, Bairoil plant, and Cedar Creek distribution pipeline, with their associated facilities and access roads, would cause land disturbance and modification of any cultural resources in the area. Impacts could include the destruction or alteration of cultural resources or the surrounding environment and the introduction of visual, audible, and atmospheric elements out of character with the present environment. Any impacts or even a portion of the resource base would result in a loss of scientific and cultural information for future research. If compliance procedures were not followed, the loss of any information could have a significant impact on efforts to reconstruct the prehistory and history of the regions.

Since the exact locations of the pipelines and facilities are unknown and much of the project area has not been surveyed to identify cultural resources, specific impacts cannot be predicted. The Proposed Action would directly affect a number of sites eligible for listing on the National Register, some of which have already been disturbed. Where sites have been previously disturbed and cultural values lessened, impacts would be less significant. Sites with evidence of cultural remains discovered during the required Class III surveys would be avoided or the impacts mitigated prior to construction; this would also apply to areas having no surface evidence of cultural materials. Based on the cultural resource survey and compliance procedures described in Appendix 4, impacts to cultural resources should not be significant.

Increased population could result in some short-term, indirect impacts, such as illegal collection or displacement of artifacts, vandalism, or alteration of sites. However, the resource commitment would be permanent and, therefore, irreversible and irretrievable. (See Socioeconomic section for details on expected population increases.)

The Proposed Action would directly affect some historic trails and roads (Table 40). Impacts would vary, depending on existing conditions of portions of trails or roads that would be crossed. Since the condition of many of the crossings is unknown, exact impacts would have to be assessed through a Class III survey, on a case-by-case basis.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

**TABLE 40
KNOWN HISTORIC TRAILS AND ROADS CROSSED BY THE PROPOSED ACTION**

MILEPOST CROSSING	SITE NAME	ELIGIBILITY STATUS OF SEGMENT FOR NATIONAL REGISTER OF HISTORIC PLACES	CONDITION OF CROSSING
Wyoming			
32.1R	Bryan-South Pass Stage Road	Ineligible	Ruts: not intact
32.5R	Bryan-South Pass Stage Road	Ineligible	Ruts: not intact
39R	Green River-South Pass Stage Road	Ineligible	Ruts: not intact
49R ^a	Overland Trail	Undetermined	Unknown
11.2	Bryan-South Pass Stage Road	Eligible	Ruts: not intact
23.1	Rock Springs-Lander Stage Road	Ineligible	Ruts: not intact
48.1	Point of Rocks-Lewiston Stage Road	Ineligible	Ruts: not intact: modern road use
50.6	Point of Rocks-South Pass City Road	Undetermined	Physical Integrity good
109.6	Rawlins-Ft. Washakie Stage and Freight Road	Eligible	Ruts: not intact: modern road use
131.3	Oregon Trail	Undetermined	Ruts: not intact: two-track road
131.5	Oregon Trail	Undetermined	Ruts: not intact: two-track road
133	Oregon Trail	Undetermined	Ruts: not intact: two-track road
168.7	Ft. Bridger-Ft. Casper Military Road	Undetermined	Unknown
172-175 ^b	Bridger Emigrant Trail	Undetermined	Unknown
233-239 ^b	Fort Casper-Powder River Military Road	Undetermined	Unknown
250-258 ^b	Bozeman Trail	Undetermined	Unknown
291-297 ^b	Sawyer Expedition Route	Undetermined	Unknown
331-336 ^b	Hunt Expedition Route of 1811	Undetermined	Unknown
331-336 ^b	Texas Trail	Undetermined	Unknown
331-336 ^b	Winterling Ranch Road	Undetermined	Unknown
374	Ft. Keogh to Ft. Mead Stage and Military Road	Undetermined	Not intact: paved road
6S	Rawlins-Ft. Washakie Stage Road	Eligible	Unknown
6.2S	Rawlins-Ft. Washakie Stage Road	Eligible	Unknown
7.8S	Rawlins-Ft. Washakie Stage Road	Eligible	Unknown
11.9S	Rawlins-Ft. Washakie Stage Road	Eligible	Unknown
13.8S	Rawlins-Ft. Washakie Stage Road	Eligible	Unknown
17.2S	Rawlins-Ft. Washakie Stage Road	Eligible	Unknown

Sources: Commonwealth Associates 1982 and 1983; Powers Elevation 1984; BLM archaeologists 1985; Wyoming State Historic Preservation Office 1985.

^aOverland Trail Segment is within 1/8 of a mile of MP 49, but will not be crossed.

^bPipeline right-of-way will cross this historic trail/road at a location between these mileposts.

PROPOSED ACTION—AIR QUALITY

A Memorandum of Agreement, which details specific avoidance and mitigation procedures, is being developed through negotiation between BLM and the State Historic Preservation Offices, Advisory Council on Historic Preservation, and applicants. (See Appendix 8 for a draft copy of the Memorandum of Agreement.)

CUMULATIVE IMPACTS

The Proposed Action and interrelated projects would cause cumulative, indirect impacts similar to those identified for the Proposed Action alone, except more so. Most of the impacts would occur near population centers, such as Green River, Rock Springs, or Bairoil, Wyoming. (See Socioeconomic section for data on project-related population increases.)

Air Quality

IMPACT SIGNIFICANCE CRITERIA

Impacts to air quality were considered significant if federal or state standards for allowable atmospheric concentrations of various pollutants were reached or exceeded. These standards are of several types. Ambient standards are absolute concentration maximums, designed to protect the health and safety (primary standards) and welfare (secondary standards) of the public. The prevention of significant deterioration (PSD) standards are designed to ensure that air resources in an area will not be degraded beyond acceptable limits. PSD standards generally apply to point sources of significant pollutants, which could include the new proposed gas plant at Bairoil, while ambient standards are not to be violated by any source of pollution. Tables 41 and 42 show federal and state ambient and PSD standards.

AFFECTED ENVIRONMENT

The climate in the southern part of project area is semiarid, mid-continental. Winds, generally from the west or southwest, are persistent and generally strong. Most of the moderate precipitation received is of Pacific origin (7 to 9 inches annual mean). The low precipitation, coupled with a relatively short growing season (about 100 days), results in a predominant ecotype of short grass prairie. Strong winds in the area normally create dust storms, which would add to the potential for wind erosion during pipeline construction.

The condition of the air resource in the area is very good (Class II under State PSD regulations). Ambient concentrations of pollutants are far below Wyoming and federal standards. Because of high winds, some local high ambient concentrations of total suspended particulate (TSP) have been measured from non-anthropogenic

(not man-made) sources, but ambient concentrations are generally considered to be 13 to 15 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for particulates. Sulfur oxides and nitrogen oxides are of such low concentration that they are almost unmeasurable except in towns such as Rock Springs. Acid rain has been of special interest in the Class I, Jim Bridger Wilderness to the northwest of the proposed pipeline (about 45 miles). Monitors near Pinedale and Lander, Wyoming have not determined baseline pH levels of rain in the area, but measured rain pH varied from 4.73 to 6.98 in 1981. (A rain pH of below 5.6 could be considered acidic, but each area must be monitored for several years before a normal value for rainfall pH can be established.)

The Bairoil plant facilities share the same climatic setting as the pipelines. Air quality is very good, designated as Class II under Wyoming's PSD regulations. Background concentrations for pollutants for which standards have been established are presently below significance levels.

The climatic setting of the Williston Basin can generally be characterized as semiarid, mid-continental. However, local influences, such as elevation and slope variations, influence climate causing dramatic vegetation changes in various limited areas. Air masses moving through this region originate in the Arctic, the Pacific, and sometimes the Gulf of Mexico. Short growing seasons along with relatively low precipitation result in a general short to mid-grass prairie ecology.

Air quality can be considered good throughout the project area, categorized as Class II or unclassified for purposes of PSD. Most of the TSP would be produced during pipeline construction. Background concentrations for TSP are between 13 to 18 $\mu\text{g}/\text{m}^3$ annual geometric mean.

ENVIRONMENTAL CONSEQUENCES

Short-term impacts to air quality from the project would depend on pipeline construction activities and accidental releases of CO_2 . A small amount of pollutants would be added to the region's atmosphere for the long term, during routine pipeline operation.

Construction would result in wind-borne dust from wind erosion on areas where vegetation had been removed. Small amounts of hydrocarbons, nitrogen oxides, and other pollutants from construction equipment would be released into the atmosphere. Wind erosion would cause about 6,194 tons of fugitive dust in the smaller suspended particle sizes to be produced (0.66 tons/acre-year), a small amount of which would be from vehicle travel. About 8 tons of dust could be created for each mile of pipeline built, which would be insignificant to

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 41
STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS
 ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Time	FEDERAL		NORTH DAKOTA		MONTANA		WYOMING	
		Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
TSP	24 hour ²	260	150	150	-	200	-	150	-
	Annual ³	75	60	60	-	75	-	60	-
Dust Fall	3 Mo. Max Res.	-	-	15 Ton/mi ²		10 g/m ³ (30-day avg)		-	-
	3 Mo. Max Ind	-	-	30 Ton/mi ²		-		-	-
SO ₂	3-hour ²		1,300	715		1,300 (1-hour avg) ⁹		1,300	-
	24-hour ²	365	-	260	-	260	-	260	-
	Annual ⁴	80	-	60	-	60	-	60	-
NO ₂	Annual ⁴	100	100	100				100-	-
	1-hour(Not more than 1% of the time in 3 mo. period)			200		200 (hourly avg)			
CO	3-hour	-	-	10	-	-	-	40,000	-
	1-hour ²	40,000	40,000	40	-	26,300	-	-	-
	8-hour ²	10,000	10,000	-	-	10,000	-	10,000	-
H ₂ S ⁵	0.5-hour ⁶	-	-	75	-	0.05ppm hourly ²		70	-
	0.5-hour ⁷	-	-	45	-	-	-	40	-
HF ⁵	24-hour	-	-	-	-	-	-	0.8	-
Photochemical Oxidants(O ₃)	1-hour	235	235	235 ²	-	0.10ppm hourly avg ²		-	-
VOC (Non-Methane) ⁸	3-hour ²	-	-	160	-	-	-	160	-
Lead	3-month	1.5	1.5	1.5	-	1.5 90-day avg		1.5	-

¹ Temporary construction-related emissions as well as the more permanent operation-related impacts are subject to NAAQS and WAAQS. However, emissions resulting from emergency upsets and start-up and shut-down activities are exempted from NAAQS and WAAQS compliance.

²Not to be exceeded more than once per year.

³Annual geometric mean, never to be exceeded.

⁴Annual arithmetic mean, never to be exceeded.

⁵Wyoming ambient standard only.

⁶Not to be exceeded more than twice per year.

⁷Not to be exceeded more than twice in any five consecutive days.

⁸Wyoming ambient standard. Federal hydrocarbon standard was repealed by EPA on January 5, 1983.

⁹One hour average not to be exceeded more than 18 times in any 12 months.

TABLE 42
PREVENTION OF SIGNIFICANT DETERIORATION INCREMENTS
 ($\mu\text{g}/\text{m}^3$)

Pollutant	Averaging Time	WYOMING			NORTH DAKOTA			MONTANA			FEDERAL		
		Class I	Class II	Class III	Class I	Class II	Class III	Class I	Class II	Class III	Class I	Class II	Class III
Total Suspended Particulates (TSP)	Annual geometric mean	5	19	37	5	10	37	5	19	37	5	19	37
	24-hour maximum	10	37	75	10	30	75	10	37	75	10	37	75
Sulfur Dioxide (SO ₂)	Annual arithmetic mean	2	20	40	2	15	40	2	20	40	2	20	40
	24-hour maximum	5	91	182	5	91	182	5	91	182	5	91	182
	3-hour maximum	25	512	700	25	512	700	25	512	700	25	512	700

Source: Environmental Research and Technology, Inc. 1983; BLM 1982

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

the air resource on a regional scale. This level of emission would also be controlled by watering, limiting vehicle travel where possible, and ensuring concurrent reclamation. Based on standard Environmental Protection Agency (EPA) emission factors (1979), 14 tons of hydrocarbons, 1.5 tons of carbon monoxide, 0.09 tons of nitrogen oxide, 0.01 tons of sulfur dioxide, and 0.01 tons of additional particulates could be emitted by vehicle engines during pipeline construction. These emissions would also be insignificant on a regional scale.

During construction of the plant, small amounts of TSP (about 279 tons) from wind erosion and vehicle travel would occur for a short period. Emissions from internal combustion engines driving heavy equipment would also occur, but these emissions would not violate ambient standards or be significant on a regional scale.

Operation of the pipeline would generally reduce air pollutant emissions once disturbed areas were reclaimed. The potential for leaks or ruptures releasing CO₂ would be slight (one chance in 10,000 per mile per year). Uncontrolled releases of CO₂ into the atmosphere would be unlikely because the automatic block valves would limit flow. However, if CO₂ was released into the atmosphere, impacts would be insignificant because CO₂ is non-toxic and only a relatively small amount would be released.

Operation of the Bairoil plant would generally improve air resources in the project area. The plant would release about 9 percent of the annual sulfur dioxide emitted by the present plant (45 tons per year versus 509 tons per year). Modeling from EPA guideline Industrial Source Complex (ISC) and Complex I models shows that little of the PSD Class II increment would be consumed and no ambient standards would be exceeded. Special interest was placed on potential impacts to Ferris Mountain Wilderness Study Area, 15 miles northeast of the proposed plant site. Table 43 shows estimates from the model simulations.

The predicted concentrations indicate that the Bairoil plant would have little or no effect on vegetation, wildlife, surface water, or other components of the environment. In addition, visibility and other air resource values would be enhanced due to overall reduced emissions.

CUMULATIVE IMPACTS

Cumulative impacts would not be significant. As reclamation progresses during pipeline construction, fugitive dust and pollutants would drop to about existing levels. Vehicles used for inspection and maintenance would cause some emissions, but these would be insignificant and similar to those occurring with hunting and agriculture. Since the permanent

population would increase only slightly, air quality impacts from secondary growth would be insignificant.

There are no permitted or significant sources of air pollution within 30 km (18.6 miles) of the Bairoil plant site. Since emissions from the new plant would be less than the existing plant, air quality would improve. This improvement would be difficult to measure on a regional scale since the atmosphere of rural Wyoming already contains extremely low ambient concentrations of man-made air pollutants.

Pollutants may increase slightly in Bairoil or other communities within commuting distance because of small increases in employment. These impacts would not be measurable on a regional scale and would be considered insignificant.

During pipeline construction, emitted pollutants would be short term and would not interact significantly with other regional air pollution sources. Since almost no emissions would occur during operation, there would be little or no interaction with other sources.

Mineral and Paleontological Resources

IMPACT SIGNIFICANCE CRITERIA

Impacts to mineral resources were considered significant if mineral development (uranium, coal, trona) was delayed or precluded.

Impacts to paleontological resources were considered significant if fossils of scientific value were destroyed without having been recorded.

AFFECTED ENVIRONMENT

From the southwest to the northeast, the main pipeline route would cross the Green River Basin, Rock Springs Uplift, Great Divide Basin, Sweetwater Uplift, Wind River Basin, Casper Arch, Powder River Basin, Black Hills Uplift, Cedar Creek Anticline, and the Williston Basin. The surface geological units range from Pre-Cambrian to Recent; however, most of the formations in the project area were deposited during the Cretaceous and Tertiary periods. Tables 44 through 46 show the geologic formations that occur at the land surface and the number of miles each would be crossed by the main pipeline and other facilities.

The route would cross many fault lines, mostly in Wyoming, that are associated with the Rock Springs Uplift, Granite Mountains, and the Casper Arch. The route would also cross Muddy Gap Junction, which is located in the fault zone along the Seminole, Ferris,

PROPOSED ACTION—MINERALS & PALEONTOLOGY

TABLE 43
ESTIMATED POLLUTANT CONCENTRATIONS
RESULTING FROM THE NEW BAIROIL PLANT
 ($\mu\text{g}/\text{m}^3$)

Receptor	SULFUR DIOXIDE			NITROGEN		TOTAL SUSPENDED PARTICULATE	
	Max Annual Average	Max 24-hour Average	3-hour Average	Annual Average	Ambient NO ₂ Standard	Annual Average	24-hour Average
Black Canyon ¹	0.17 (20)	0.85 (91)	1.78 (512)	1.47	100	0.03 (19)	0.17 (37)
Ferris Mountains ²	0.07 (20)	0.33 (91)	1.31 (512)	0.51	100	0.01 (19)	0.07 (37)
Plant Site ³	0.13 (20)	8.60 (91)	32.41 (512)	1.05	100	0.02 (19)	1.85 (37)
Plant Site ⁴	0.13 (20)	4.85 (91)	24.71 (512)	1.26	100	0.03 (19)	0.82 (37)
0.7 Km NE of Plant Boilers ⁵	-	21.3 (91)	-	15.80	100	0.35 (19)	1.2 (37)

¹Underlined receptors denote Complex I model used.

²Values in parentheses are Wyoming Class II PSD increments. Wyoming ambient standards are less restrictive.

³Meteorology data for all model runs: Rawlins, Wyoming 1964.

⁴Maximum 3-hour SO₂ average predicted by ISC model was 67.1 $\mu\text{g}/\text{m}^3$ at 0.3 Ku SSW of plant boilers.

⁵Maximum annual SO₂ average predicted by ISC model was 2.6 $\mu\text{g}/\text{m}^3$ at 0.5 Ku ENE of plant boilers.

⁶Universal Transverse Mercator coordinates for receptors: 1. East 301.3, West 4684.801, 2. East 303.2, West 4685.00, 3. East 291.25 West 4679.0, 4. East 293.0, West 4680.0 with receptors 1 and 2 in or near Ferris Mountain WSA.

Green Mountain, and Crooks Mountain uplift. Little recent movement has been reported along these faults.

Four coal basins would be crossed by the main pipeline: the Green River, Wind River, Powder River, and Fort Union. Table 47 shows the coal areas that would be crossed. About 104 miles of demonstrated reserves and an additional 223 miles of hypothetical resources would be crossed. Demonstrated reserves occur in areas with high or moderate potential for coal development as identified from field measurements. Hypothetical resources occur in areas where coal is known to occur because of the geology but have not been measured to determine development potential. No coal occurs where the Bairoil spur, plant facilities, or Cedar Creek distribution pipeline would be located.

Trona occurs in beds of the Green River formation in the southwestern Wyoming portion of the main pipeline route. Trona is generally mined by underground room

and pillar techniques for sodium. One area of existing trona leases has been identified between MP 2 and 6. BLM knows of no immediate plans for development.

The main pipeline route would cross uranium deposits in the coal and sandstone beds of the Fort Union formation in the Great Divide, Green River, and Powder River basins. In these types of geological settings, open pit or in situ mining of uranium is usually proposed, depending upon the host bed material. Claims for uranium are staked on much of the main pipeline route, particularly in the Wyoming section. However, the economics of uranium production are currently unfavorable and immediate or near future development of uranium along the pipeline route is not expected.

Most of the area that would be crossed by the proposed route has not been inventoried for paleontological resources. As more areas are inventoried, new fossil locations probably would be found. Generally, the route

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 44
GEOLOGY CROSSED BY THE MAIN
PROPOSED ACTION PIPELINE

Formation	Proposed Action Miles	Alternative Miles	Paleontological Sensitivity
Glacial and Alluvial Sediments	50.0	60.0	Low
Bridger Formation	18.0	18.0	High
Green River Formation	40.0	40.0	High
Wasatch Formation	124.0	124.0	High
Wind River Formation	13.5	13.5	Moderate
Fort Union Formation	194.5	188.5	Moderate
Tullock Member	21.0	21.0	High
Other Tertiary	42.0	42.0	Mod/Low
Lance Formation	5.0	5.0	Moderate
Hell Creek Formation	40.5	40.5	High
Fox Hills Formation	7.5	7.5	Moderate
Lewis Shale	2.5	2.5	Low

would cross Tertiary geology in the basins and Cretaceous geology around the uplifts, arches, and anticlines. During the Cretaceous time, vertebrate life in the project area was dominated by reptiles, with the dinosaur era at its peak. The transition to the Tertiary period marked the disappearance of the dinosaurs and many other types of reptiles and the beginning of dominance by mammals. The fossils of the Cretaceous and Tertiary periods record the transition in dominant vertebrate life, as well as the continuing development of invertebrate and plant life forms. The western United States is the primary place where this transition and early Tertiary period is recorded in the fossil remains in geologic formations.

TABLE 44 (Concluded)
GEOLOGY CROSSED BY THE MAIN
PROPOSED ACTION PIPELINE

Formation	Proposed Action Miles	Alternative Miles	Paleontological Sensitivity
Mesa Verde Formation	9.0	9.0	Low
Pierre Shale	36.0	36.0	Low
Cody Formation	52.5	52.5	Low
Frontier Formation	3.5	3.5	Moderate
Mowry and Thermopolis Shales	0.5	0.5	Moderate
Triassic and Permian Rocks	0.5	0.5	Moderate
Tensleep and Amsden Formations	0.5	0.5	Moderate
Madison Formation	0.5	0.5	Moderate
Precambrian Rocks	5.0	5.0	Low

Source: Geologic maps of Wyoming, Montana, and North Dakota, compiled by BLM: Frontier Pipeline EIS BLM 1982a; Hanson 1985; Minnesota Museum of Science 1985.

*Sensitivity is based on the significance of the fossils, their condition, and their abundance within the area.

All geologic formations crossed by the Proposed Action and Cedar Creek pipeline routes are known to contain fossils. Most have significant sites in areas outside of the route corridor. Tables 45 through 46 show the geologic formations that have high, moderate, or low potential for containing fossils of significant value.

ENVIRONMENTAL CONSEQUENCES

The Proposed Action would cross areas where coal has been identified as having high or moderate development potential (Table 47). In the Rock Springs, Wyoming deposit, the route would cross an area with underground

PROPOSED ACTION—MINERALS & PALEONTOLOGY

TABLE 45
GEOLOGY AFFECTED BY
OTHER COMPONENTS OF THE
PROPOSED ACTION

Formation	Miles	Paleontological Sensitivity
Bairoil Spur		
Eocene Conglomerates	11.5	Moderate
Wasatch Formation	3.0	High
Mesa Verde Formation	1.0	Low
Cody Formation	4.0	Low
Bairoil Facilities		
Quaternary Deposits	N/A	Low
Mesa Verde Formation	N/A	Low
Cody Formation	N/A	Low
Cedar Creek Distribution Pipeline		
Pierre Shale	64.0	Low

Source: Geologic maps of Wyoming, Montana, and North Dakota, compiled by BLM.

mining potential. No significant impacts would occur in this area. Northeast of Gillette, Wyoming the route would cross the Gillette deposit. The proposed 50-foot-wide, permanent right-of-way between MP 309 and 318 would cover about 27 million tons of surface minable subbituminous coal. Generally the coal in this area is thick and of good quality, so the pipeline may need to be temporarily relocated in order for coal to be mined. The only impact would be the extra expense to relocate the pipeline. This coal is currently unleased.

The Carlyle, Montana and Dickinson, Keene, and Williston, North Dakota coal areas have lignite deposits varying from 5 to 20 feet thick. In these areas, the value of coal may not justify relocating the pipeline. The pipeline would cross the Keene and Williston deposits where federal leasing for coal has already been delayed until oil and gas recovery was completed. Since this pipeline's use would also end at that time, no impact on coal recoverability is expected. In the Carlyle and Dickinson deposits, recovery of about 16 million tons of

TABLE 46
GEOLOGY AT MICROWAVE SITES

Formation	Number of Microwave Sites	Acres	Paleontological Sensitivity
Glacial Sediment	1	0.25	Low
Bridger Formation	1	0.25	High
Wasatch Formation	1	0.25	High
Crooks Gap Conglomerate	2	0.50	Low
Wind River Formation	1	0.25	Moderate
Fort Union Formation	6	1.50	Moderate
Lance Formation	1	0.25	Moderate
Hell Creek Formation	1	0.25	High
Mesa Verde Formation	1	0.25	Low
Pierre Shale	1	0.25	Low
Cody Formation	1	0.25	Low
Belle Fourche Shale	1	0.25	Low
Precambrian	2	0.50	Low

Source: Geologic maps of Wyoming, Montana, and North Dakota, compiled by BLM; Frontier Pipeline EIS BLM 1982a; Hanson 1985; Minnesota Museum of Science 1985.

lignite beneath the proposed 50-foot-wide permanent right-of-way could be precluded. The lignite in these areas would not likely be developed within the useful lifetime of this pipeline. However, if coal development occurred around the pipeline and lignite beneath the pipeline was bypassed, future recovery of lignite probably would not be economical.

The potential exists for subsidence along the pipeline route from future room and pillar or solution mining of trona. The Industry has no immediate plans to develop

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

**TABLE 47
COAL AREAS CROSSED BY THE MAIN PIPELINE**

Coal Area	Milepost	Miles	Coal Rank	Surface (S) or Underground (U) Mining	Existing Pipeline	Coal Data Classification
Wyoming						
Rock Springs Deposit	30-49	19	Subbituminous	U	All	Demonstrated
Wind River Basin	164-194	30	Subbituminous	U/S	1.1 miles	Hypothetical
Powder River Region	250-309	59	Subbituminous	S	10 miles	Hypothetical
Gillette Deposit	309-318	9	Subbituminous	S	5 miles	Demonstrated
Powder River Region	318-330	12	Subbituminous	S	All	Hypothetical
Montana						
Fort Union Region	425-455	30	Lignite	S	4 miles	Hypothetical
Carlyle	475-487.5	12.5	Lignite	S	None	Demonstrated
North Dakota						
Fort Union Region	487.5-524	36.5	Lignite	S	21 miles	Hypothetical
Dickinson	524-558	34	Lignite	S	3 miles	Demonstrated
Fort Union Region	558-598	40	Lignite	S	None	Hypothetical
Keene	597-621	24	Lignite	S	21 miles	Demonstrated
Fort Union Region	621-628.5	7.5	Lignite	S	None	Hypothetical
Williston	629-635	6	Lignite	S	None	Demonstrated
Fort Union Region	635-643	8	Lignite	S	None	Hypothetical

Source: Geological maps of Wyoming, Montana and North Dakota, compiled by BLM.

the trona beneath the route, and whether or not subsidence would significantly affect the pipeline cannot be determined until details on solution mining become available. The Frontier pipeline already crosses this area, so the potential for conflict already occurs.

Uranium development would not cause subsidence but would introduce potential surface facility problems. With a large pipeline crossing a uranium area, the complexity of placing distribution and collection lines for uranium in situ development would increase. This would not significantly affect actual uranium extraction.

Fossils may be disrupted or destroyed during right-of-way clearing, trenching, or access road construction. As

a result, irreplaceable knowledge could be lost. Table 44 shows that about 37 percent of the main route has high potential for impacts to fossils and all of the route has some potential for impacts. Three of the 20 proposed microwave sites would be located on highly sensitive geology (Table 46). The Bairoil spur route would cross 3 miles of highly sensitive geology and 11.5 miles of moderately sensitive geology (Table 38). The Cedar Creek distribution pipeline route and the Bairoil facility and oil fields are all on areas with low sensitivity (Table 46).

Many significant fossils and much knowledge could be lost if adequate mitigation was not provided. However, with the use of the survey procedures discussed in

PROPOSED ACTION—VISUAL RESOURCES

Appendix 4, the pipeline could be constructed without significantly affecting paleontological resources. Even with this mitigation in place, some fossils could be overlooked and destroyed; however, paleontological knowledge would probably be enhanced by the additional inventory.

CUMULATIVE IMPACTS

The cumulative impacts to mineral and paleontological resources would not be significantly different from those identified for the Proposed Action alone.

Visual Resources

IMPACT SIGNIFICANCE CRITERIA

Impacts to visual resources were considered significant if modifications in the landform and vegetation or the addition of a structure did not meet the minimum standards of the BLM Visual Resource Management (VRM) Class or the Forest Service Visual Quality Objective (VQO) for the area where the project component would be located. VRM criteria were applied equally to all lands, regardless of ownership.

AFFECTED ENVIRONMENT

The Proposed Action would occur within two physiographic provinces containing a characteristic set of landscape features including landform and vegetation (Fenneman 1931). These features are used to determine existing visual values.

The Proposed Action, from its beginning to about MP 205, would be located within the Wyoming Basin physiographic province. The province is characterized by elevated plains in various stages of erosion, with isolated low mountains. Vegetation is predominantly desertic mixed shrub-grasslands. Evidence of human occupancy is sparse and scattered, consisting mainly of ranching and other rural structures, with occasional evidence of mineral development, such as oil and gas, and existing pipelines.

The remainder of the route (MP 205 to Tioga), would be within the Great Plains physiographic province. Topography consists of old rolling plateaus and terrace lands with isolated mountains. Local badlands occur south of the Missouri River, while the area has been glaciated north of the river. Vegetation consists primarily of natural prairie grasslands and local agricultural crops. Diversity in vegetation patterns is provided by conifers on isolated mountains and hills, mature cottonwood stands in floodplains of major rivers and steep

wooded draws. Human occupancy is similar to that found in the Wyoming Basin.

The Proposed Action would cross VRM Classes II, III, and IV and corresponding VQOs of Retention, Partial Retention, and Modification. Class II areas generally correspond to the most visually sensitive and highly scenic portions of the project areas. Such areas include nearby residential areas, major highways, recreation-oriented rivers and use areas, trails of national or regional significance, and diversified landforms such as mountainous areas and badlands. Class III includes areas of lesser visual sensitivity and natural landscape diversity in landform and vegetation. Class IV areas include the vast majority of the project area and generally display little visual sensitivity by the viewing public and lack much visual diversity in the natural landscape features. Table 48 identifies areas that tend to be most sensitive and in need of special attention. It does not contain a complete listing of VRM classes that would be crossed by the Proposed Action since classifications have not been completed for most of the project area or areas would be beyond what can be seen from sensitive viewing points.

ENVIRONMENTAL CONSEQUENCES

All components of the Proposed Action would be built during the same time period (2 years), so disturbances to the land would be evident. In some places (where the proposed pipeline parallels existing pipelines and roadways), the quality of the visual resources has already been reduced. Impacts from the proposed pipeline and other facilities in these previously disturbed areas would be less significant than the impacts in naturally-appearing areas. However, in particularly sensitive landscapes (areas easily viewed or with little vegetation or topographic diversity) the impacts would be significant.

Construction of the Proposed Action would remove vegetation, disturb existing topographic features, or add new facilities to the landscape. Construction of the pipelines would create an unnatural line of vegetation across the landscape, which would contrast noticeably with the existing vegetation and topographic features. After a season or two of growth, revegetation would lessen most of the visual impacts to an acceptable level. The impacts in these areas would generally be considered insignificant. The areas shown on Table 49, fall into the significant category.

Long-term changes in vegetation and topography would occur in landscapes that were slow to revegetate, rocky and steep-sloping terrain that was difficult to restore, and unstable soils or where structures would be added in visually sensitive areas. In these areas, about 546 acres, visually acceptable revegetation may take 3 or more years. This would be a long-term impact and would, therefore, not meet the objectives of the VRM classes

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 48
IMPORTANT VISUAL RESOURCES NEAR THE PROPOSED ACTION

Project Component by Milepost	VRM Class or VQO	Description
Main Pipeline		
MP 49R-48R ^a	III	Viewed as foreground/midground from Interstate Highway 80; high sensitivity. Linear unit consisting of dominant color and texture changes in soil and vegetation. Scenic quality "C" area shows signs of human intrusions on the landscape. ^b
MP 38.5R-37.5R ^{ac}	II	Green River crossing; high sensitivity; heavy recreational use (float-boating, fishing). Linear unit consisting of dominant color and textural change from cottonwoods along river banks. Scenic quality "B".
MP 1.5-3.5 ^c	II	Green River crossing; high sensitivity; heavy recreational use (float-boating, fishing). Linear unit consisting of dominant color and texture from cottonwoods along river bank. Scenic quality "B". Stauffer Chemical Plant north of crossing—major human intrusion of landscape.
MP 24.5-28.5 ^c	III	Set of Indian drawings known as White Mountain Petroglyphs (Sec. 11, T22W, R105W) located in the upper Wasatch formation provide educational and historic resources. Surrounding landscape is predominantly undisturbed and natural, providing a realistic context for visitors to the petroglyphs.
MP 65-95 ^c	III	Traverses Red Desert; a VRM Class "C" scenic area noted for its red coloration. Numerous energy activities have intruded on the naturalness of the southern portion, while the majority of the northern portion is natural. This desert is known for its expanses of barren land.
MP 110.5 ^c	II/V	Continental Divide National Scenic Trail corridor. Skirts the northwest boundary of Green Mt. (VRM II Class "A" landscape) through an area with uranium mining activity. The form and color of the mountain and upper elevation vegetation dominate.
MP 127.5-140 ^c	II/III	<p>Right-of-way would cross Highway 287 about 1/2 mile southeast of Split Rock Interpretive Site and Viewing Area.</p> <p>The Split Rock-Lankin Dome area is a VRM II Class "A" landscape of high sensitivity because of its scenic recreational and historical value. This area of the Sweetwater Rocks WSAs has been nominated for consideration as a National Historic Landmark because of its proximity and tie to the Oregon and Mormon Trail which passes between the viewing area and rock formation. The Sweetwater River, another prominent visual feature in the midground, winds its way across the Valley floor south of the Sweetwater Rocks. Riparian vegetation along the river offers interesting color and texture to the landscape scene. This river has been identified in the Phase I inventory by the former HCRS for protection as a national, natural, scenic and recreational river.</p> <p>Right-of-way would traverse Beef Gap following an existing unimproved dirt road and pipeline right-of-way through the Sweetwater Rocks formation.</p>

PROPOSED ACTION—VISUAL RESOURCES

TABLE 48
 IMPORTANT VISUAL RESOURCES NEAR THE PROPOSED ACTION (Continued)

Project Component by Milepost	VRM Class or VQO	Description
MP 156-160	III/II	Southeastern portion of Rattlesnake Hills area is VRM Class II/III because of Class "A" landscape of medium to high sensitivity based on its scenic and recreational value. Excellent viewing area to the south.
MP 224-228	III	Right-of-way crosses Interstate Highway 25 which creates high visual sensitivity in the Class "B" landscape. Area is rolling grassland, with occasional small shrubs in bottom of local relief areas.
MP 279-289	IV	Parallels Wyoming State Highway 50 through VRM Class IV consisting of Class "C" scenery of medium visual sensitivity. Gently rolling, grass-covered landscape.
MP 295-298	III	Viewed as foreground/middleground from Interstate Highway 90. Consists of Class "C" scenery with high visual sensitivity in gently rolling, grass-covered landscape.
MP 334-338	III	Little Powder River Valley viewed as foreground/middleground from Wyoming State Highway 59. Consists of generally, flat grassy, open landscape with riparian vegetation and has medium visual sensitivity.
MP 375-376	IV	Viewed as foreground/middleground from U.S. Highway 212. Consists of Class "C" scenery of moderate visual sensitivity, with low, rolling, grass-covered landscape.
MP 435-439.5	IV	Would cross and parallel Montana State Highway 7 as foreground/middleground. Scenic quality is Class "C", with low to moderate visual sensitivity. Consists of gently rolling grasslands, with interspersed agricultural croplands and buttes.
MP 439.5-441	II	Passes within 1/2 mile of Medicine Rocks State Park, the closest point to the park being less than 1/8 mile from its entry off Montana State Highway 7. Viewed as foreground middleground from residences adjacent to highway. Scenic quality is Class "B" with high visual sensitivity for gently rolling, grass-covered plains. Includes scattered butte-like landforms and agricultural croplands.
MP 441-460.5	III/IV	Same descriptions as MP 435-439.5 Moderate to high visual sensitivity where viewed from residences as foreground.
MP 464-465	III	Crosses U.S. Highway 12 through a scenic quality Class "C" area of high visual sensitivity as viewed from the highway and community of Baker, Montana. Landform is gently rolling, grass covered prairie, with noticeable modifications to the landscape, such as sewage ponds and other signs of community infrastructure.
MP 468-475	III/IV	Same descriptions as MP 435-439.5. Moderate to high visual sensitivity where viewed from residences as foreground.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 48
IMPORTANT VISUAL RESOURCES NEAR THE PROPOSED ACTION (Concluded)

Project Component by Milepost	VRM Class or VQO	Description
MP 509-511	II, Retention	Crosses Little Missouri River and "seen area" viewed from the river, designated as a State Scenic River by the State of North Dakota which must remain in a natural state. Scenic quality is of Class "A" because of natural landscape diversity of landform, water, and vegetation, and the free-flowing qualities of the Little Missouri River. Visual sensitivity is high because of use by canoeists and float boaters and the designation as a State Scenic river. A pipeline and road are present.
MP 532-532.5	III, Partial Retention	ROW crosses Interstate Highway 94 in a Class "C" area of high visual sensitivity. Landform is common in the area, consisting of rolling prairie covered by crops and grasslands.
MP 558-590	II	ROW crosses upper reaches of Lake Sakakawea where the Little Missouri River flows into the reservoir. Class "A" scenery of the water features and the steep sideslopes and badlands above the river and reservoir couple with the moderate to high visual sensitivity of the recreation users within the foreground/midground view from the VRM Class II area.
MP 629.5-633.5	II, Retention	ROW crosses Lake Sakakawea. Class "A" scenery of the water feature and old river terrace visually enclosed by steep sideslopes and badlands couple with the high visual sensitivity of the recreation users within the foreground/midground view of the recreationists to form the VRM Class II area.
Bairoil Spur	Crude Oil Storage Tank, IV	Visible from Continental Divide National Scenic Trail corridor and Green Mountain. Visual Sensitivity is moderate to high in VRM IV, Class B area.
Bairoil Plant	IV	Plant site not identified as an area of visual resource importance.
Cedar Creek Distribution Line		
MP 21D-22D	IV	Right-of-way would cross U.S. Highway 12 near the community of Baker, Montana. Scenery quality Class "C", combined with a moderate visual sensitivity and a foreground/midground view of the gently rolling landscape with few distinguishing features, is classified as VRM Class IV. Local modifications include highways, community development, another pipeline, mineral development, and agriculture.
MP 22.5D-23.5D	IV	Same descriptions as for MP 21D-22D, except that the right-of-way would cross Montana State Highway 7.
Microwave Sites		
Alzada Montana Site	III/IV	Tower of 160 feet would be seen in the foreground/midground zone by passersby on U.S. Highway 212.
Willard, Montana Site	III/IV	Tower of 120 feet would be seen in the foreground/midground zone by passersby on Montana Highway 7.

See Glossary for definitions of scenic quality classes.

^a Source: Rangely Carbon Dioxide Pipeline Draft EIS (BLM 1984a).

^b Source: Frontier Pipeline Draft EIS (BLM 1982a).

PROPOSED ACTION—VISUAL RESOURCES

TABLE 49
VISUAL RESOURCES SIGNIFICANTLY AFFECTED BY
THE PROPOSED ACTION

Milepost	Acres Disturbed	VRM Class or VQO	Impacts
Pipeline			
MP 49R-49R ^a	12	III	The right-of-way would cross Interstate Highway 80. Visual contrasts in line and color resulting from vegetation removal would be viewed from the highly sensitive viewing point.
MP 38.5R-37.5R ^a	12	II	Vegetation clearing would create a contrast in line, form, color, and texture as viewed from the Green River, a highly sensitive viewing point.
MP 24.5-28.5 ^b	48	III	The right-of-way would cross the White Mountain rim and pass within 2 miles of the White Mountain petroglyphs (Sec. 11, T22N, R105W). Visual contrasts in line and color resulting from soil disturbance could be visible from this historic and educational site. Modifications to the landscape surrounding the petroglyphs would significantly affect the natural setting. Visual contrasts in the element of line would exceed BLM VRM objectives for this landscape.
MP 65-95 ^b	360	III	The segment crossing the Red Desert would result in noticeable visual contrasts in line and color caused by soil disturbance during pipeline construction. The unnatural line introduced by disturbed soils would result in short-term visual contrasts that would exceed an acceptable degree of contrast.
MP 439.5-441	18	II	This segment of the right-of-way would parallel Montana State Highway 7 near the entrance to Medicine Rocks State Park. The linear disturbance in landform (soil color) and vegetation (color and texture) of the construction area would contrast with the natural-appearing landscape and be a visible distraction to visitors to the state park. Visual contrasts would exceed BLM VRM objectives for the area.
MP 509-511	24	II, Retention	The right-of-way would cross the Little Retention Missouri River, a State Scenic River. The badlands and steep sideslopes bordering the river would display sharp contrasts in color and texture. Soil and vegetation changes from pipeline construction would modify the natural landscape. Because the contrast would be easily noticed by floatboaters and canoeists on the river, the controls would exceed the BLM VRM class objectives for the area.
MP 588-590	24	II	The right-of-way would cross the upper reaches of Lake Sakakawea where the Little Missouri River flows into the reservoir. The impacts would be the same as described for segment MP 509-511.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 49
VISUAL RESOURCES SIGNIFICANTLY AFFECTED BY
THE PROPOSED ACTION (Concluded)

Milepost	Acres Disturbed	VRM Class or VQO	Impacts
MP 629.5-633.5	48	II, Retention	The segment would cross Lake Sakakawea. Impacts would be the same as described for segment between MP 509-511.
Bairoil Spur			
Crude Oil Storage Tank	3	IV	The size and color of the storage tank would dominate the landscape in terms of scale, form, color, and texture. Impacts would be long term for the life of the project or until the tank was removed.
Microwave Sites			
Alzada, Montana site	1/2	III or IV	Site would be located on an area of sagebrush of sagebrush grassland, on the foreground/middle ground viewing zone from U.S. Highway 212.
Willard, Montana site	1/2	III or IV	Site would be located on foreground/middle ground zone of Montana Highway 7.

^a Source: *Rangely Carbon Dioxide Pipeline draft EIS* (BLM 1984).

^b Source: *Frontier Pipeline Company, Crude Oil and Condensate Pipeline Draft EIS* (BLM 1982a).

for the areas identified. As shown on Table 49, impacts would exceed the significance criteria. After successful revegetation and reclamation, long-term visual impacts would be reduced to an acceptable or insignificant level.

The 50- by 50-foot microwave sites would contain a building and a 20- to 300-foot high tower. The towers and site clearings would adversely affect the form, line, and color of the landscape and vegetation. All but six of the sites would be near existing sites. Impacts associated with sites in areas containing communication facilities would be less than those in new areas, but they would add to the cumulative impacts of the area.

The six new sites would introduce towers and other elements to the landscape. The sites contain mostly sagebrush/grassland vegetation type with few trees. These areas are rated as VRM Class III or IV. The towers and other facilities would not blend in with the natural landscape and thus would attract the attention of a viewer. See Table 49 for areas significantly affected by microwave facilities.

Recreation

IMPACT SIGNIFICANCE CRITERIA

Impacts to recreation were considered significant if:

- demand for use of a recreation area or facility increased by 10 percent or more over baseline conditions because of increased project-related populations; or
- 10 percent or more of the land presently used or planned for developed recreation facilities or visually sensitive areas were permanently altered.

AFFECTED ENVIRONMENT

Recreation resources are areas for the enjoyment and relaxation of both residents and visitors. The areas include lands formally managed for recreation purposes

PROPOSED ACTION—RECREATION

(such as recreation sites or parks) and other areas where no facilities are provided (such as sightseeing, hiking, off-road vehicle (ORV) use, hunting, fishing). Recreation resources can further be categorized as non-urban resources (rural parks, campgrounds, rivers, undeveloped open lands, and other visitor attractions) and urban-oriented resources (parks and recreation facilities within the boundaries of cities and towns).

Non-urban recreation resources in the project area include both managed areas and non-facility use areas. Included are recreation lands that would actually be crossed by the proposed route or affected by increased visitor use from the project work force.

Various areas in the project area are used for recreation. These are the Continental Divide National Scenic Trail corridor, the Green River, the Green Mountain area, Split Rock Viewing Area, the Oregon and Mormon Pioneer National Historic Trails, the Sweetwater Rocks area, and 11 wilderness study areas (WSAs) in Wyoming; Medicine Rocks State Park in Montana; and the Little Missouri River designated as a State Scenic River, the south and north units of Theodore Roosevelt National Park, and Lake Sakakawea in North Dakota.

The primary urban recreation resources in the project area occur in the communities and cities of Green River, Rock Springs, Bairoil, Rawlins, Casper, Buffalo, and Gillette, Wyoming; Baker and Miles City, Montana; Belle Fourche, South Dakota; and Belfield, Dickinson, Killdeer, Watford City, Williston, and Tioga, North Dakota. Camping by project workers and their families could occur in many associated counties where communities are not nearby or where workers would otherwise prefer to camp. (See the Socioeconomics section for details.) A recent population decline in many of the affected communities because of decreased mineral development has resulted in less demand for recreational facilities. Even though the expansion of recreation facilities often lags behind population growth and needs, current needs within the communities apparently are being met. However, some of the more popular recreation facilities, such as softball fields and gymnasiums, may still be overcrowded.

ENVIRONMENTAL CONSEQUENCES

Except for Bairoil, Wyoming, population would not increase by more than 10 percent during construction. Rawlins could experience a 6.5 percent increase with most communities experiencing less than a 1 percent increase. Bairoil, with a projected 22.2 percent increase, could place heavy demands on camping facilities. Camping related to Proposed Action population increases is shown on Table 25 in the Socioeconomics section.

An increase of 10 campers could be expected in each of eight counties and communities, with 20 campers ex-

pected near Gillette, 30 near Casper, and 50 near Bairoil, Wyoming. In most cases, camping would be voluntary, since other housing would be available. Camping in nondesignated campgrounds could potentially increase litter, create sanitation problems, and cause similar impacts to the affected area. Such impacts, although unquantifiable, would be significant for a season or two, but only for the actual area affected.

Demand for recreation opportunities could exceed supply. However, increases would be temporary, lasting less than 2 years, with most increases lasting less than a season or portions of two seasons, at most. Population increases during operation would be insignificant.

Crews would work five to seven days a week on 10-hour shifts, thereby having little leisure time to spend with community recreation programs or non-urban recreational pursuits. Since the demand for most recreation facilities has leveled, a temporary increase in demand probably could be met.

No significant adverse impacts would occur to land presently used or planned for developed recreation facilities, since only a few acres would be unreclaimed following construction. Few visually sensitive areas, if any, would be permanently altered by the project. Although disturbances to landform and vegetation would be visible until the area was successfully reclaimed, the changes would eventually become acceptable (Visual Resource section).

Since most visually sensitive areas along the Frontier pipeline (Wyoming) were rehabilitated to an acceptable condition within a reasonable time, rehabilitation after construction of the Proposed Action is also expected to be acceptable in most areas. Areas of particular concern where successful rehabilitation has occurred include areas viewed along the Green River, in the Green Mountain area, along the Continental Divide National Scenic Trail Corridor, near and crossing the Oregon and Mormon Pioneer National Historic Trails (including the Split Rock viewing area), and affected WSAs. Areas of high visual sensitivity for the remainder of the Proposed Action route are further discussed in the Visual Resource section.

The Proposed Action rights-of-way and access roads may provide new and improved access for ORV use. Although this would have a positive impact on ORV recreation use, it may also have negative impacts on sightseeing, revegetation, wildlife (hunting), and other resources.

CUMULATIVE IMPACTS

Cumulative impacts would occur only in areas where population would increase by more than 10 percent:

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Sweetwater County, Wyoming (Green River, Rock Springs, and Bairoil) and Gillette, Wyoming (Socioeconomic section). The types of impacts would be the same as previously described.

With the Proposed Action, impacts to Bairoil would exceed the 10 percent criterion as well. With population increases approaching 16 percent in Rock Springs and 22 percent in Bairoil, demand for urban recreation would likely exceed supply. However, impacts would be short term, occurring during portions of 2 years. Additional impacts on non-urban recreation opportunities cannot be predicted, but would most likely occur in the above-mentioned communities. ORV demand may increase, as could hunting and fishing demand.

Wilderness

IMPACT SIGNIFICANCE CRITERIA

Impacts to the wilderness resources were considered significant if:

- Any project component(s) crossed the boundary of a WSA, managed under the BLM Interim Management Policy and Guidelines for Lands Under Wilderness Review (BLM 1979) and Section 603(c) of the Federal Land Policy and Management Act of 1976, causing permanent and substantially noticeable intrusions upon wilderness characteristics; or
- Outside sights and sounds permanently and substantially intruded upon the long-term quality of the wilderness or WSA units' naturalness or users' opportunities for solitude or primitive recreation.

AFFECTED ENVIRONMENT

Wilderness values are those areas either formally designated or identified for study (such as WSAs or Roadless Area Review and Evaluation (RARE II) areas) because they have particular natural or ecological characteristics of such quality as to be set aside and managed for the purposes of preservation and for historical, scientific, scenic, educational, unconfined, or primitive recreational use by the public. Since no RARE II areas occur within 10 miles of the Proposed Action, only WSAs are discussed.

The Proposed Action pipelines would be within 10 miles of 12 WSAs: Buffalo Hump (WY-040-306); Sand Dunes (WY-040-307); Alkali Draw (WY-040-311); South Pinnacles (WY-040-313); Alkali Basin-East Sand Dunes (WY-040-316 and 317); Red Lake (WY-040-318); Sweetwater Rocks (WY-030-120, 122,

123a, and 123b), and the Ferris Mountains WSA (WY-030-407), all within Wyoming (BLM 1981). The Proposed Action route would cross between Sweetwater Rocks WSAs 122 and 123b, about 100 feet from each WSA. The western-most portion of the Ferris Mountain WSA is 8 miles east-northeast of the community of Bairoil and the Bairoil plant. No WSAs in Montana or North Dakota are within 10 miles of the Proposed Action or the Cedar Creek distribution pipeline.

ENVIRONMENTAL CONSEQUENCES

The Proposed Action would not impair the wilderness characteristics of the 12 WSAs within 10 miles of the Proposed Action route. Interim management guidelines for these WSAs would not be violated if the Proposed Action was implemented, because outside sights and sounds, if any, would be short term. The same would be true where the pipelines passed between the two Sweetwater Rocks WSAs. No WSA boundaries would be crossed by the proposed route. The Ferris Mountains WSA would not be affected by the Bairoil spur, Bairoil plant, or other facilities because the WSA is at least 8 miles from the project area and partially screened by the topography.

Land Use Plans, Controls, and Constraints

IMPACT SIGNIFICANCE CRITERIA

Impacts to land use plans were considered significant if any conflicts were identified between proposed project facilities or activities and land use plans, regulations, or controls (adopted or under official consideration by local, state, and federal governments) that would prohibit or forbid construction of the project or require modification of the plan(s).

AFFECTED ENVIRONMENT

The Proposed Action would cross or occupy lands under the regulatory control of the BLM; Forest Service; Corps of Engineers; and the States of Wyoming, Montana, and North Dakota and private land, which is regulated by county and community land use plans and ordinances. The only plans that specifically cover rights-of-way are the BLM Platte River and Buffalo Resource Management Plans in Wyoming.

The Platte River plan, which designated five corridors in Natrona County, places the following restrictions on proposed rights-of-way outside designated corridors:

1. Placement would be adjacent to existing facilities or disturbances.

PROPOSED ACTION—HEALTH AND SAFETY

2. Cross-country right-of-way placement would be allowed only when placement in a designated corridor or adjacent to an existing facility is not practical or feasible.
3. New corridors would be designated only when placement along existing facilities is not protected and when the environmental impacts can be adequately mitigated.

The Buffalo Resource Management Plan, which designated several corridors, places the following restrictions on corridor adjustments and new corridor designations: all corridor adjustments and new designations will be made only when facility placement within an existing designated corridor is incompatible or unfeasible and when the environmental consequences can be adequately mitigated.

ENVIRONMENTAL CONSEQUENCES

The location of the proposed Bairoil/Dakota pipeline project was analyzed in relation to the corridors established in the Platte River and Buffalo Resource Management Plans. The Proposed Action route could not make use of the designated corridors because the corridors would not reach potential markets.

The analysis contained in this EIS indicates that potential impacts from placing the proposed pipeline outside designated corridors can be adequately mitigated. Therefore, the resource management plan restrictions are satisfied and there are no plan conflicts. The decision, if made to grant the proposed rights-of-way, will result in the designation of a new corridor through the Platte River and Buffalo Resource planning areas.

Health and Safety

AFFECTED ENVIRONMENT

The general public in the project area and the construction and operation workforce would be the affected environment for the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

CO₂ Pipelines. CO₂ gas by itself would pose no health hazard either to oil field workers or the general public. The fact that the gas would be under relatively high pressure, 1,800 to 2,400 psi, could pose a risk if the pipe accidentally ruptured.

If the pipeline was ruptured by a piece of earth-moving equipment such as a backhoe, the resulting flying rocks and pieces of broken pipe could be fatal to the operator and any close observers. In addition, anyone trapped in the hole around the pipe would probably be asphyxiated or frozen by the rapidly expanding CO₂.

Bairoil Field and Plant Area. Normal risks and hazards associated with the oil and gas industry could occur to the Bairoil field and plant area. Of general concern to both employees and the public would be hydrogen sulfide (H₂S), a colorless gas with an offensive odor of rotten eggs. H₂S is flammable when mixed with air, 4.3 to 46 percent by volume. It is also toxic and causes loss of smell at 250 to 350 parts per million (ppm) and death at concentrations between 500 and 600 ppm (BLM and FS 1983).

After several years of waterflooding in an oil field and as water production increases, the water-oil ratios and the H₂S production also commonly increase. The H₂S is produced by sulfate-reducing bacteria introduced during drilling, workovers, and injection operations. Bacteria use sulfates in the oil-producing formation and injection waters during their metabolic process, with H₂S released as a by-product. Most of the H₂S transfers from the water to the oil and is released into the gas phase during production and surface separation. The H₂S concentration in the present Bairoil field production stream is about 9,500 ppm of the water, oil, and gas mixture.

Since the metabolic production rate of H₂S would be fairly constant, the concentration would depend on the volume of oil, gas, and water produced. When EOR was implemented, total production would go up, thereby bringing the concentration of H₂S down through dilution. No more than 8,000 ppm is expected in the production stream after the process begins.

If the mixture spilled on the ground during a pipeline rupture, only a small concentration of H₂S would be released into surrounding open air. As H₂S slowly came out of solution, it would be diluted by the air, at a rate well below the 500 ppm rate that is usually fatal.

Since the concentration of H₂S is expected to decrease, no additional H₂S safety problems or hazards are expected to result from the CO₂ injection project. In fact, as old pipe and equipment was replaced, the risks of having an oil field or plant-related rupture would be greatly reduced. If a rupture occurred, Amoco would implement a contingency plan (Spill Prevention Control and Countermeasures). A copy of the plan is kept at Bairoil and at Amoco's Casper office.

Risk to the general public is now very low and is not expected to change. There is little reason for the public to be at the field, even though the field is not closed to the public.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

SINGLE BAIROIL PIPELINE ALTERNATIVE

The Single Bairoil Pipeline Alternative primarily differs from the Proposed Action in that one pipeline, rather than two, would be built to Bairoil, Wyoming (Spread 1).

Thus, in most cases, the alternative would be similar to the Proposed Action, for each resource. Only the environmental consequences (impacts) that would be different from the Proposed Action are discussed for this alternative. The affected environment and impacts to known land use plans, controls, or constraints and to health and safety would be the same as identified for the Proposed Action.

Socioeconomics

AFFECTED ENVIRONMENT

The affected environment for socioeconomics would be the same as described for the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

Impacts from construction of this alternative would be the same as described for the Proposed Action, except in Sweetwater, Fremont, and Carbon counties, Wyoming. The employment would increase by 400 in Sweetwater County, 20 in Fremont County, and 430 in Carbon County. Total personal income would increase by \$10.3 million in Sweetwater County, \$0.33 million in Fremont County, and \$12.2 million in Carbon County. Per capita income would be the same as for the Proposed Action.

Population changes in Fremont and Carbon counties would be the same as the Proposed Action. Population would increase by 580 in Sweetwater County, 110 in Green River, 390 in Rock Springs, and 50 in Bairoil. Bairoil, with an 18.5 percent increase in population, would be the only community to have a significant population impact under this alternative. (See Tables 22 through 25 for a comparison of baseline employment, population, and income.)

Impacts during operation would be the same as described for the Proposed Action.

Cumulative impacts of significance would occur at the same localities as the Proposed Action. However, impacts would be less in Sweetwater County.

Soils and Vegetation

AFFECTED ENVIRONMENT

The Single Bairoil Pipeline Alternative would cross landscape and terrain similar to that of the Proposed Action. This alternative would also be located on the same soil groups and vegetation types as the Proposed Action. Table 50 shows the locations and extent of the larger areas of unfavorable soils and terrain requiring more intensive reclamation and erosion control. Table 51 shows the major vegetation types that would be affected. See the Proposed Action section for a brief description of vegetation types.

Revegetation potential and erosion control needs would be the same for the soils and vegetation types affected by this alternative as for those affected by the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

The Single Bairoil Pipeline Alternative would disturb 8,799 acres, of which 8,583.7 acres would be reclaimed and 215.3 acres occupied by ancillary facilities. Types of land disturbance would be the same as those from the Proposed Action.

Of the total 8,799 acres that would be disturbed by this alternative, 703.7 acres of sensitive soils and terrain would be disturbed and 2,534 acres would be located in areas with less than 9 inches average annual precipitation. These areas are sensitive because they contain less favorable soils, slopes, and climatic conditions than other areas along the route; are more susceptible to erosion hazards; and have a lower revegetation potential. Soil impact potential would be the same as for the Proposed Action. See Table 50 for the approximate locations and extent of sensitive soil and terrain areas.

The potential for soil and vegetation impacts would be similar to those described for the Proposed Action. However, since only one pipeline would be built, less land and vegetation would be disturbed. The disturbed areas would be reclaimed within a shorter time. Table 51 shows the estimated acreage of each major vegetation type that would be disturbed by construction of the alternative.

The Single Bairoil Pipeline Alternative would not significantly affect soils. The loss of soil, soil productivity, and soil stability would be minimized with effective use of the erosion control and reclamation measures outlined in Appendix 4. Such measures would allow disturbed land to return to near-preconstruction conditions. Some unquantifiable soil loss would result from accelerated wind and water erosion until erosion control measures could be implemented.

SINGLE BAIROIL PIPELINE ALTERNATIVE—SOILS AND VEGETATION

**TABLE 50
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
SINGLE BAIROIL PIPELINE ALTERNATIVE**

Project Component	Location by Milepost	Extent		SENSITIVE AREA DESCRIPTION AND COMMENTS			
		Miles	(Acres)	Slope 15% +	Unfavorable Soils	AAP (inches)	Other Comments
Main Pipeline	0.0					7-9	
	6.1-6.2	0.1	(0.9)	X	X		
	10.3-10.6	0.3	(2.7)	X	X		Steep sideslope
	19.2-19.4	0.2	(1.8)	X	X		
	26.2-26.8	0.2	(1.8)	X	X		
	33.0-35.2	2.2	(19.8)		X		Sandy soils
	36.3-36.7	0.4	(3.6)	X	X		
	39.9-41.1	1.2	(10.8)	X	X		
	45.4-49.7	4.3	(38.7)		X		Sandy soils, hummocky saline soils
	63.6-64.6	1.0	(9.0)		X		
	71.0-71.1	0.1	(0.9)	X			
	71.5-71.6	0.1	(0.9)	X			
	72.8-73.1	0.8	(7.2)	X	X		Escarpment area
	0-109.0					9-12	1,308 Acres
	110.3-111.0	0.7	(6.3)		X		
	112.0-118.2	6.2	(74.4)	X			Green Mountain area
	127.0-127.1	0.1	(1.2)	X	X		
	128					7-9	
	138.3-138.4	0.1	(1.2)				Beef Gap area (narrow gap)
	158.2-158.4	0.2	(2.4)	X	X		
	158.6-158.8	0.2	(2.4)	X	X		
	164.1-164.9	0.8	(9.6)	X	X		
	174.9-175.2	0.3	(3.6)	X	X		
	201.0-201.2	0.2	(2.4)	X	X		
	201.9-202.1	0.2	(2.4)	X	X		
	202.9-203.2	0.3	(3.6)	X	X		Shale Breaks area
	205.0					9-12	924 Acres
	210.0-215.9	5.9	(70.8)	X	X		Steep, dissected shale lands
	219.0-219.4	0.4	(4.8)	X	X		
	226.6-227.0	0.4	(4.8)	X	X		Escarpment area
	231.6-231.7	0.1	(1.2)	X	X		
	235.4-236.3	0.9	(10.8)	X	X		
	237.3-237.8	0.5	(6.0)	X	X		
	238.4-239.0	1.4	(16.8)	X	X		
	240.8-241.0	0.2	(2.4)	X	X		Escarpment
	241.3-242.4	1.1	(13.2)	X	X		Escarpment
	243.4-243.6	0.2	(2.4)	X	X		
	253.8-255.4	1.6	(19.2)	X	X		
	256.4-257.2	0.8	(9.6)	X	X		Dissected, steep side slopes
	259.3-259.4	0.1	(1.2)	X	X		
	261.3-261.7	0.4	(4.8)	X	X		
	262.2-262.3	0.1	(1.2)	X	X		
	266					12-15	
	266.3-266.5	0.2	(2.4)	X	X		
	277.2-277.7	0.5	(6.0)	X	X		
	294.0-294.2	0.2	(2.4)	X	X		
	304.0-304.4	0.4	(4.8)	X	X		
	316.7-316.9	0.2	(2.4)	X	X		

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

**TABLE 50
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
SINGLE BAIROIL PIPELINE ALTERNATIVE (Continued)**

Project Component	Location by Milepost	Extent Miles	(Acres)	SENSITIVE AREA DESCRIPTION AND COMMENTS			
				Slope 15% +	Unfavorable Soils	AAP (inches)	Other Comments
	319.5-320.0	0.5	(6.0)	X	X		
	337.2-337.5	0.3	(3.6)	X	X		
	348.8-349.4	0.6	(7.2)	X	X		
	359.5-360.9	1.4	(16.8)	X	X		
	366.9-367.8	0.9	(10.8)	X	X		
	368.3-370.7	1.6	(19.2)	X	X		
	377.2-377.7	0.5	(6.0)	X	X		
	415.8-416.0	0.2	(2.4)	X	X		
	453.7-454.1	0.4	(4.8)	X	X		
	455.7-456.0	0.3	(3.6)	X	X		MP 455.9 wooded draw
	456.3-460.5	4.2	(50.4)	X			Deeply dissected area with narrow floodplain
	464.3-464.4	0.1	(1.2)	X	X		
	475.1-475.3	0.2	(2.4)	X	X		Steep ridge
	508.6-508.8	0.2	(2.4)	X	X		Steep ridge
	510.8-511.1	0.3	(3.6)	X	X		Escarpment bordering Little Missouri River
	512.9-513.1	0.2	(2.4)	X	X		
	515.3-515.8	0.5	(6.0)	X	X		
	516.2-517.0	0.8	(9.6)	X	X		
	519.3-519.5	0.2	(2.4)	X	X		
	524.1-524.3	0.2	(2.4)	X	X		Agricultural Experiment Station MP 521.6-521.8
	537.1-537.5	0.4	(4.8)	X	X		Escarpment
	543.0						Proposed Action and Highway 85 Alternative divide
	553.2-553.3	0.1	(1.2)	X	X		
	554.4-555.1	0.7	(8.4)	X	X		Steep ridge—Butte Lake area
	557.2-558.0	0.8	(9.6)	X	X		
	580.7-580.8	0.1	(1.2)	X	X		Wooded draw
	584.4-584.5	0.1	(1.2)	X	X		Steep area bordering Little Missouri River
	584.9-585.3	0.4	(4.8)	X	X		
	585.5-585.8	0.3	(3.6)	X	X		Steep area—North side Little Missouri River
	586.2-587.3	1.1	(13.2)	X	X		MP 587.0-587.1 Extremely Steep
	588.4-589.5	1.1	(13.2)	X	X		
	590.1-590.4	0.3	(3.6)	X	X		
	591.3-591.4	0.1	(1.2)	X	X		
	592.4-593.0	0.6	(7.2)	X	X		
	593.2-593.6	0.4	(3.6)	X	X		
	595.4-595.6	0.2	(2.4)	X	X		Butte sideslope
	598.5-598.7	0.2	(2.4)	X	X		
	602.3-602.5	0.2	(2.4)	X	X		
	607.3-607.4	0.1	(1.2)	X	X		

SINGLE BAIROIL PIPELINE ALTERNATIVE—AGRICULTURE

**TABLE 50
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
SINGLE BAIROIL PIPELINE ALTERNATIVE (Concluded)**

Project Component	Location by Milepost	Extent		SENSITIVE AREA DESCRIPTION AND COMMENTS			
		Miles	(Acres)	Slope 15% +	Unfavorable Soils	AAP (inches)	Other Comments
MP622.0	608.5-609.0	0.5	(6.0)	X	X		
	609.9-610.2	0.3	(3.6)	X	X		
	611.6-612.6	1.0	(12.0)	X	X		
	613.6-613.9	0.3	(3.6)	X	X		
	623.1-623.6	0.5	(6.0)	X	X		Proposed Action and Highway 85 Alternative join
	625.0-625.3	0.3	(3.6)	X	X		
	625.8-628.0						Lake Sakakawea Escarpment
	628.6-628.9	0.3	(3.6)	X	X		
	634.0-634.1	0.1	(1.2)	X	X		
	636.1-636.7	0.6	(7.2)	X	X		
637.1-637.6	0.5	(6.0)	X	X			
SUBTOTAL:							
Bairoil Spur Pipeline	6.0S 20.0S					7-9	14.0 miles (126 acres)
Bairoil Plant and Product Line	6.0S 20.0S					7-9	14.0 miles (42 acres)
Cedar Creek Distribution Line	2.4D-2.5D 6.9D-7.1D 7.9D-8.1D 9.8D-9.9D	0.1 0.2 0.2 0.1	(1.2) (2.4) (2.4) (1.2)	X X X X	X X X X	12-15	Drainageway sideslope Drainageway sideslope
TOTAL:		66.5	703.7				2,534 Acres

Note: Table prepared from soils-terrain analysis and orthophotograph interpretations. Milepost locations are approximate, based on general, preliminary right-of-way information. See Appendix 6, Appendix Methodologies for source of inventory data and methodology.

AAP = Average annual precipitation

Average per mile for MP 0 to 111.0 is 9 acres per mile. Acreage per mile for MP 112 to MP 643.5 is 12 acres per mile.

Impacts to vegetation would generally be insignificant. Understory vegetation would return to preconstruction conditions within 5 years after construction, assuming the procedures outlined in Appendix 4 were followed. Overstory vegetation (trees and shrubs) would take longer to become established to near-preconstruction conditions. See Proposed Action section for a discussion of overstory vegetation establishment periods.

Agriculture

AFFECTED ENVIRONMENT

The ranching operations, grazing-carrying capacity, and ownership of lands along the Single Bairoil Pipeline Alternative route are the same as to those along the

TABLE 51
ACRES OF VEGETATION TYPES DISTURBED AND
REMOVED BY THE SINGLE BAIROIL PIPELINE ALTERNATIVE

Vegetation Types	Main Pipeline and Facilities*		Bairoil Spur		Bairoil Plant and Facilities		Cedar Creek Distribution Pipeline		Total
	Disturbed	Removed	Disturbed	Removed	Disturbed	Removed	Disturbed	Removed	
Sagebrush-Grass	2,309	21	134	2	312	62	2,755	85	2,755
Saltbush-Greasewood	329	14	46	0	150	41	525	55	525
Sand Dune-Forb-Grass	49	1					49	1	49
Juniper Woodland	62	2					62	2	62
Sagebrush-Grass-Conifer Woodland	87	4					87	4	87
Riparian	121	1	1	0	1	0	12	0	135
Grassland	2,588	48					294	13	2,882
Ponderosa Pine-Juniper-Grass	25	1					67	0	92
Badland Shrub	297	3					297	3	297
Wooded Draws	18	0						0	18
Cropland	1,867	2					30		1,897
TOTAL:	7,752*	97	181	2	463	103	403	13	8,799

See Appendix 7, Assessment Methodologies, for data sources.

*Represents total land surface and does not include 31 acres of water areas (Lake Sakakawea, Little Missouri River crossings).

Note: *Disturbed* refers to acreages disturbed during construction, which are revegetated and rehabilitated following construction. *Removed* refers to acreages removed from present use for the life of the project; these are revegetated and rehabilitated after project abandonment.

SINGLE BAIROIL PIPELINE ALTERNATIVE—TRANSPORTATION NETWORKS

Proposed Action route, except that the alternative would not include MP 49R to 26R and the agricultural activities along that stretch.

The kinds of cropland and crops grown along this alternative route are also similar to those along the Proposed Action route. This route would affect the same unknown number and types of shelterbelts and windbreaks as the Proposed Action.

The North Dakota State Agricultural Experiment Station would also be affected by this alternative.

ENVIRONMENTAL CONSEQUENCES

The land disturbance from this alternative would cause a short-term (2- to 5-year) loss of forage on about 6,869 acres. This would amount to about 722 AUMS per year spread over 728.5 miles. See Table 52 for estimated forage losses by project component. During operation, 215.3 acres of forage would be lost for the life of project (20 AUMs). In addition, land would be disturbed for a shorter period since only one pipeline would be built. Disturbed acres would be reclaimed sooner and not redisturbed.

The forage loss would be below the 1 percent significance criterion and is, therefore, considered insignificant for any allotments or pastures and ranching operations. The potential for poisonous plant or noxious weed growth on disturbed areas would be the same as the for the Proposed Action.

Impacts to farming (cropland), windbreaks or shelterbelts, and the State Agricultural Experiment Station would be the same as described for the Proposed Action.

CUMULATIVE IMPACTS

Cumulatively, the Single Bairoil Pipeline Alternative plus the interrelated projects would cause the same acreage of cropland (no prime agricultural land) to be converted to urban uses as the Proposed Action (35 acres in the Gillette, Wyoming area and 4 acres in the Belle Fourche, South Dakota area).

Cropland loss would be insignificant because it represents less than 5 percent of the total cropland in the area.

Transportation Networks

AFFECTED ENVIRONMENT

The affected environment for transportation networks would be the same as described for the Proposed Action. The same roads would be used.

TABLE 52
ESTIMATED FORAGE LOST AND CROPLAND DISTURBED
AND REMOVED BY THE SINGLE BAIROIL PIPELINE ALTERNATIVE

PROJECT COMPONENT	FORAGE LOSS (AUMs) ¹		CROPLAND (AUMs) ²	
	Short-Term	Long-Term	Short-Term	Long-Term
Main Pipeline and Facilities	606	9	1,867	2
Bairoil Spur Pipeline and Facilities	15	—	0	0
Bairoil Plant and Facilities	39	10	0	0
Cedar Creek Distribution Pipeline	62	1	30	0
TOTAL:	722	20	1,897	2

¹ Short-term figure represents estimated forage lost annually for (2 to 5 years). Long-term figure is forage removed annually for the life of the project.

² Short-term figure represents cropland disturbance for 1 year. Long-term figure is cropland removed from production for the life of the project.

AUMs = animal unit months; — = less than 1/2 AUM.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

ENVIRONMENTAL CONSEQUENCES

The type of impacts associated with the Single Bairoil Pipeline Alternative would be the same as the Proposed Action between MP 0 to MP 111.4, except for degree. Impacts from the alternative would be based on hauling 42,000 tons of pipe from the pipeline, including trips to the storage yard at Rock Springs, Wyoming (70 truck trips per day), and moving the labor force (52 passenger cars, buses and pickup trips per day).

Water Resources

AFFECTED ENVIRONMENT

The affected environment would be the same as the Proposed Action except the Green River would be crossed only once. See Table 37, Stream and Lake characteristics.

ENVIRONMENTAL CONSEQUENCES

Impacts from this alternative would be the same as those identified for the Proposed Action, except for four fewer crossings; the Green River would not be crossed at MP 38.1R, one of the two crossings of the Green River at (MP 2.6) would not occur, and one of the two crossings of Crooks Creek (MP 109.5 and 3.2S) would not occur.

Wildlife

AFFECTED ENVIRONMENT

The affected environment for wildlife would be the same as described for the Proposed Action. See Table 53 for crucial wildlife habitats crossed by this pipeline alternative.

ENVIRONMENTAL CONSEQUENCES

Impacts to habitats and wildlife populations from construction of this alternative would be the same as described for the Proposed Action route. However, since the route would consist of only one buried pipeline, a total of 8,799 acres of wildlife habitats would be disturbed.

Cultural Resources

AFFECTED ENVIRONMENT

The Single Bairoil Pipeline Alternative route would cross historic roads and trails 23 times. The rest of the known cultural resources are the same type as described for the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

Impacts to cultural resources would be similar to those described for the Proposed Action, except for a slightly lesser degree of impact on each site and number of sites potentially affected. This alternative would potentially affect 219 sites. Since the Rangely pipeline corridor would not be affected by this alternative, the four crossings of the historic roads and trails in this area would not occur. In addition, the width needed for pipeline construction would be less between MP 0 and 111 and between MP 0S and 20S; therefore, less land would be disturbed.

Air Quality

AFFECTED ENVIRONMENT

The affected environment for air quality would be the same as described for the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

Air quality impacts from the Single Bairoil Pipeline Alternative would be similar to those from the Proposed Action, except along some areas of the pipelines emissions would be less. The alternative would produce about 5,741 tons of fugitive dust resulting from wind erosion (8,699 acres of disturbance times 0.66 tons/acre emission). This amount of dust, spread the length of the pipelines during construction, would not violate ambient standards for particulates and would not be significant over the region. By reducing the number of needed compressor stations by two the amount of released pollutants from internal combustion engines (construction machinery) and wind erosion on the cleared sites would also be reduced. In areas where transportation would be less (50 percent between MP 0 and MP 111.4), fugitive dust emissions resulting from vehicle travel would be cut proportionately. These reductions would generally not be measurable on a regional scale. Construction of the plant would create the same total of total suspended particulates (TSP) as the Proposed Action, 279 tons.

SINGLE BAIROIL PIPELINE ALTERNATIVE—AIR QUALITY

TABLE 53
 CRUCIAL WILDLIFE HABITATS
 SINGLE BAIROIL PIPELINE ALTERNATIVE

Habitat Type	Miles Crossed	Acres Affected	Milepost
Mule Deer			
Crucial winter range	4.5	40.5	35-39.5
Winter concentration area	3.0	36	391-394
Pronghorn			
Crucial winter range	46.0	501	0-2 3.5-7.5 26-37 26-37 124-136 180-195 386-388
Elk crucial winter range and calving area	1.0	12	114.5-115.5
Whitetail deer crucial winter range	3.0	36	445-448
Bighorn sheep lambing range	14.0	168	505-519
Sage grouse			
Wintering areas	3.5	37.5	97-98.5 124-126
Breeding/nesting habitat	22.0	243	97-99 103-108 160-164 168-173 181-182 197-199 267-268 296-297 315-316
Sharp-tailed grouse breeding/nesting habitat	2.0	24	375-376 380-381
Raptor nesting habitat	44.0	525	95 165 171 187.5 224 276 291 305 307 308 310 332 335 348 410 505-520 523-525 555 560 576 606-611 624 630

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 53
CRUCIAL WILDLIFE HABITATS
SINGLE BAIROIL PIPELINE ALTERNATIVE (Concluded)

Habitat Type	Miles Crossed	Acres Affected	Milepost
Prairie dog colonies	41.75	394	0 1.5 3-4 10 11 13-14 20 31-34 34.5-35 36-37 49.5 50.5 52 53-54 57-57.5 68-69.5 70.5-71 71-72 72.5-73.5 75-75.5 77-77.5 80.5-81 81.5-82 86-93.5 94-99 99.5-102.5 103-106.5 108.5-109 109.5 110.5-111 111.5-112 119.5-120.5 121-121.5 128-129.5 146.5-147 152.5-153
Bald eagle winter habitat	13.0	156	180-191 511 588
Wild horse range	121.0	1,131	4-125

U.S. HIGHWAY 85 ALTERNATIVE—SOILS AND VEGETATION

Mineral and Paleontological Resources

AFFECTED ENVIRONMENT

The affected environment would be the same as described for the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

Impacts to mineral resources would be the same as described for the Proposed Action.

Along Spread 1, the main pipeline would cross 25 percent less geology having high paleontological sensitivity than the Proposed Action. This would reduce the potential for disturbing fossils but would probably not significantly reduce the benefits of doing additional survey work.

Visual Resources

AFFECTED ENVIRONMENT

The Single Bairoil Pipeline Alternative would cross the same important visual areas crossed by the Proposed Action except for two, which are along the Rangely segment (MP 49R to 48R and MP 38.5R to 37.5R). These would not be crossed.

ENVIRONMENTAL CONSEQUENCES

Significant impacts to the visual resource would be similar to those of the Proposed Action (Table 49). The only difference is that fewer acres would be disturbed during construction of Spread 1. Instead of assuming that 12 acres per mile would be disturbed during pipeline construction (as was done with the Proposed Action), only 9 acres per mile would be disturbed along Spread 1 for this alternative. At MP 24.5 and 28.5, 36 acres would be significantly affected and from MP 65 to 95, 270 acres would be significantly affected. The visually sensitive areas along the Rangely segment would not be affected, so no impacts would occur. Therefore, about 424 acres would be significantly disturbed for visual resources.

Recreation

AFFECTED ENVIRONMENT

The affected environment for recreation would be the same as described for the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

Since only one CO₂ pipeline would be built along Spread 1, impacts to the recreation resource from this alternative would be, in most cases, greatly reduced in the vicinity of Spread 1. Population increases to Sweetwater County, Green River, and Rock Springs, Wyoming from construction would be reduced by half. Since the Bairoil plant would be built during the same period, population increases to the communities in the area would significantly stress the already inadequate recreation resources in these communities.

Wilderness

AFFECTED ENVIRONMENT

The affected environment for wilderness would be the same as described for the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

The wilderness values potentially affected by this alternative would be the same as described for the Proposed Action, except impacts to the wilderness values from this alternative along Spread 1 would be less than the insignificant, short-term impacts described for the Proposed Action.

U.S. HIGHWAY 85 ALTERNATIVE

The affected environment and impacts from this alternative would be the same for socioeconomics; wilderness; land use plans, controls, and constraints; and health and safety as described for the Proposed Action. Cumulative impacts from this alternative and other interrelated projects would be essentially the same as those identified for the Proposed Action.

Soils and Vegetation

AFFECTED ENVIRONMENT

The U.S. Highway 85 Alternative would cross landscape and terrain similar to those of the Proposed Action. This alternative would also be located on the same soil groups and vegetation types as the Proposed Action. Table 54 shows the locations and extent of the larger areas of unfavorable soils and terrain requiring more intensive reclamation and erosion control. Table 55 shows the major vegetation types that would be affected. See Proposed Action section for a brief description of vegetation types.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Revegetation potential and erosion control needs would be the same for the soils and vegetation types affected by this alternative as for those affected by the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

The U.S. Highway 85 Alternative would disturb 9,533 acres, of which 9,310 acres would be reclaimed and 223 acres occupied by ancillary facilities. Types of land disturbance would be the same as those from the Proposed Action. Of the total 9,533 acres that would be disturbed by this alternative, 778.8 acres of sensitive soils and terrain would be disturbed and 2,718 acres

would be located in areas with less than 9 inches average annual precipitation. These areas are sensitive because they contain less favorable soils, slopes, and climatic conditions than other areas along the route; are more susceptible to erosion hazards; and have a lower revegetation potential. Soil impact potential would be the same as for the Proposed Action. See Table 54 for the approximate locations and extent of sensitive soil and terrain areas.

The U.S. Highway 85 Alternative would not significantly affect soils. The loss of soil, soil productivity, and soil stability would be minimized with effective use of the erosion control and reclamation measures outlined in Appendix 4. Such measures would allow disturbed land

TABLE 54
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
U.S. HIGHWAY 85 ALTERNATIVE

Project Component	Location by Milepost	Extent		SENSITIVE AREA DESCRIPTION AND COMMENTS			
		Miles	Acres	Slope (15% +)	Unfavorable Soils	AAP Inches	Other Comments
Main Pipeline*							
MP 0-543.0							
Bairoil Spur*							
Bairoil Plant* & Facilities							
Cedar Creek Distribution Line							
SUBTOTAL:		54.7	(656.4)				2,718 Acres
Main Pipeline	MP A543.0						
	A548.5-A548.8	0.3	(3.6)	X	X	12-15"	Alternative separates from Proposed Action Butte Ridge
	A552.7-A553.4	0.7	(8.4)	X	X		
	A555.5-A555.7	0.2	(2.4)	X	X		
	A556.6-A556.9	0.3	(3.6)	X	X		
	A564.8-A565.1	0.3	(3.6)	X	X		
	A566.3-A566.4	0.1	(1.2)	X	X		
	A577.4-A577.8	0.4	(4.8)	X	X		MP A580.0 through A585.6, identified here, occur in the Breaks area along the Little Missouri River
	A580.0-A579.0	1.0	(12.0)	X	X		
	A579.2-A580.7	1.5	(18.0)	X	X		Buttes & Steep Sideslopes
	A581.0-A581.4	0.4	(4.8)	X	X		
	A581.7-A582.6	0.9	(10.8)	X	X		
	A585.0-A585.6	0.6	(7.2)	X	X		
	A589.3-A590.0	0.7	(8.4)	X	X		

U.S. HIGHWAY 85 ALTERNATIVE—AGRICULTURE

**TABLE 54 (Concluded)
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
U.S. HIGHWAY 85 ALTERNATIVE**

Project Component	Location by Milepost	Extent		SENSITIVE AREA DESCRIPTION AND COMMENTS			
		Miles	Acres	Slope (15% +)	Unfavorable Soils	AAP Inches	Other Comments
	A595.4-A595.6	0.2	(2.4)	X	X		
	A608.5-A608.6	0.1	(1.2)	X	X		
	A609.2-A609.4	0.2	(2.4)	X	X		Drainage way
	A611.9-A612.1	0.2	(2.4)		X		Sideslope
	A614.2-A614.3	0.1	(1.2)	X	X		Poorly drained
	A626						Soils
	A627.1-A627.6	0.5	(6.0)	X	X		Alternative joins
	A629.0-A629.3	0.3	(3.6)	X	X		Proposed Action
	A629.8-A632.0						Lake Sakakawea
	A632.7-A633.0	0.3	(3.6)	X	X		
	A638.0-A638.1	0.1	(1.2)	X	X		
	A640.1-A640.7	0.6	(7.2)	X	X		
	A641.4-A641.6	0.2	(2.4)	X	X		
	A647.5						
TOTAL:		64.9	778.8			12-15"	2,718 Acres

Table prepared from soils-terrain analysis and orthophotograph interpretations. Milepost locations are approximate, based on general, preliminary right-of-way information. See Appendix 7, Assessment Methodologies, for source of inventory data and methodology.

*Refer to Table 32 for data on these project components.

AAP= average annual precipitation

to return to near-preconstruction conditions. Some unquantifiable soil loss would result from accelerated wind and water erosion until erosion control measures could be implemented.

Impacts to vegetation would generally be insignificant. Understory vegetation would return to near-preconstruction conditions within 5 years after construction, assuming the procedures outlined in Appendix 4 were followed.

Overstory vegetation (trees and shrubs) would take longer to become established to near-preconstruction conditions. See Proposed Action for a discussion of overstory vegetation establishment periods.

See Table 55 for the estimated acreage of each major vegetation type by project component that would be

disturbed by construction and installation of the pipeline and acreage occupied by the associated facilities.

Agriculture

AFFECTED ENVIRONMENT

The ranching operations, grazing-carrying capacity, and ownership of lands along this alternative route are similar to those along the Proposed Action route.

The kinds of cropland and crops grown along this alternative route are also similar to those along the Proposed Action route. This alternative would have somewhat less cropland occurring in the area between MP A543 and MP A622. See Table 56 for cropland acreage affected.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TABLE 55
ACRES OF VEGETATION TYPES DISTURBED
AND REMOVED BY THE U.S HIGHWAY 85 ALTERNATIVE

Vegetation Types	Main Pipeline and Facilities*		Bairoil Spur		Bairoil Plant and Facilities		Cedar Creek Distribution Pipeline		Total	
	Disturbed	Removed	Disturbed	Removed	Disturbed	Removed	Disturbed	Removed	Disturbed	Removed
Sagebrush-Grass	2,843	29	178	2	312	62			3,333	93
Saltbush-Greasewood	421	14	62	0	150	41			633	55
Sand Dune-Forb-Grass	49	1							49	1
Juniper Woodland	62	2							62	2
Sagebrush-Grass Conifer woodland	87	4							87	4
Riparian	124	1	1	0	1	0	12	0	138	1
Grassland	2,671	48					294	13	2,965	61
Ponderosa Pine-Juniper-Grass	25	1					67	0	92	1
Badland Shrub	321	3							321	3
Wooded Draws	24	0							24	0
Cropland	1,799	2					30		1,829	2
TOTAL:	8,426*	105	241	2	463	103	403	13	9,533	223

See Appendix 7, Assessment Methodologies, for data sources.

*Represents total land surface and does not include 31 acres of water areas (Lake Sakakawea and Little Missouri River crossings).

Note: *Disturbed* refers to acreages disturbed during construction, which are revegetated and rehabilitated following construction. *Removed* refers to acreages removed from present use for the life of the project: these are revegetated and rehabilitated after project abandonment.

This route would affect about the same number and types of shelterbelts and windbreaks as the Proposed Action.

The State Agricultural Experiment Station would also be affected by this alternative.

ENVIRONMENTAL CONSEQUENCES

Livestock Grazing. The land disturbance from this alternative would cause a short-term (2- to 5-year) loss of

forage on about 7,688 acres. This would amount to about 800 AUMs per year spread over 755.5 miles. See Table 56 for estimated forage losses by project component. During operation, a forage loss for the life of project would occur on 211 acres (20 AUMs).

The forage loss would be below the 1 percent significance criterion and is therefore considered insignificant for any allotments, pastures, or ranching operations. The potential for invasion of poisonous plants or noxious weeds on disturbed areas would be the same as for the Proposed Action.

U.S. HIGHWAY 85 ALTERNATIVE—WATER RESOURCES

TABLE 56
ESTIMATED FORAGE LOST AND CROPLAND DISTURBED
AND REMOVED BY THE U.S. HIGHWAY 85 ALTERNATIVE

PROJECT COMPONENT	FORAGE LOSS (AUMs) ¹		CROPLAND (AUMs) ²	
	Short-Term	Long-Term	Short-Term	Long-Term
Main Pipeline and Facilities	678	9	1,789	2
Bairoil Spur Pipeline and Facilities	20	—	0	0
Bairoil Plant and Facilities	39	10	0	0
Cedar Creek Distribution Pipeline	63	1	30	0
TOTAL:	800	20	1,819	2

¹ Short-term figure represents estimated forage lost annually for (2 to 5 years). Long-term figure is forage removed annually for the life of the project.

² Short-term figure represents cropland disturbance for 1 year. Long-term figure is cropland removed from production for the life of the project.

AUMs = animal unit months; — = less than 1/2 AUM.

Farming (Cropland). Pipeline construction would disturb 1,819 acres of nonirrigated cropland for the growing season. Impacts to cropland from construction would be insignificant and short term (1 year). The productivity of cropland including prime agricultural land would not be diminished when the erosion control and reclamation procedures (Appendix 4) were used. About 2 acres of cropland would be removed from production by associated surface facilities.

Cropland removed for urban development to accommodate project-related population increases would be the same as described for the Proposed Action—insignificant.

Impacts to the State Agricultural Experiment Station would be the same as identified for the Proposed Action.

Transportation Networks

AFFECTED ENVIRONMENT

The affected environment for the U.S. Highway 85 Alternative would be the same as the Proposed Action segment except the alternative would affect U.S. Highway 85 and North Dakota State Highways 73 and 200.

ENVIRONMENTAL CONSEQUENCES

Traffic volume on project-related roadway segments of U.S. Highway 85 and North Dakota State Highways 73 and 200 would increase for the short term during construction (April through July 1986). Table 9 (Chapter 1) shows the number of vehicle trips from storage yards.

Impacts for the U.S. Highway 85 Alternative would be the same as the Proposed Action along U.S. Highway 85 and North Dakota State Highways 73 and 200. Concentrations of pipeline truck traffic along these roadways would result in significant impacts. Truck traffic volume would increase from 26 to 27 percent on U.S. Highway 85, from 26 to 39 percent on North Dakota State Highway 73 and an undetermined amount on North Dakota State Highway 200.

Water Resources

AFFECTED ENVIRONMENT

The affected environment would be the same as from the Proposed Action except for the main pipeline route between MP A543 and MP A621.5. Through this area, the alternative would cross the Little Missouri Breaks and the Little Missouri River in different locations than

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

the Proposed Action but under similar hydrologic conditions (see Map 7). The alternative would also cross Cherry Creek, a perennial stream, which the Proposed Action would not cross.

ENVIRONMENTAL CONSEQUENCES

Impacts from the alternative would be the same as identified for the Proposed Action, except that Cherry Creek would also be crossed.

Wildlife

AFFECTED ENVIRONMENT

The affected environment for wildlife along the alternative route would be similar to that discussed for the Proposed Action route from MP 0 to MP A543. After the alternative left the Proposed Action route, no crucial wildlife habitats would be crossed until it rejoined the Proposed Action route at MP A622. Vegetation habitats that would be crossed by components of this alternative are identified and described in the Soils and Vegetation section. Species of wildlife found along the 85 miles of this right-of-way would be similar to those discussed for the Proposed Action, even though the route would be located in a different area.

The alternative would cross perennial streams 26 times and Lake Sakakawea. This total includes the Class III Cherry Creek. (See Table 36 and Water Resources sections for identification of streams.) The same fish species would be encountered as with the Proposed Action.

ENVIRONMENTAL CONSEQUENCES

Impacts to habitats and wildlife populations from construction of this alternative would be similar to those described for the Proposed Action route. However, since the alternative is 4 miles longer, a total of 9,533 acres of habitat would be disturbed.

Impacts to habitats and wildlife species (including threatened or endangered species) from the alternative would be similar to those from the Proposed Action, Bairoil plant, and Cedar Creek distribution pipeline.

Cultural Resources

AFFECTED ENVIRONMENT

The cultural chronology for the U.S. Highway 85 Alternative would be the same as described for the

Proposed Action. In addition, the numbers and types of archaeological and historic sites would be the same from MP 0 to A543. From MP A543 to A626 of the alternative route, 16 known sites occur. (See Table 57 for milepost locations and types of sites.) Site types include lithic scatters, quarries, flake chipping stations, and historic homesteads representing the Euro-American period (1900–1930). The prehistoric flakes and tools at some of the sites can be traced to the Knife River flint quarries in south-central North Dakota.

ENVIRONMENTAL CONSEQUENCES

Impacts to cultural resources occurring within the alternative corridor would be similar to those described for the Proposed Action.

Air Quality

Impacts from construction of the U.S. Highway 85 Alternative would be the same as from the Proposed Action, except that fugitive dust emissions would be about 6,505 tons. Impacts from operation would be the same as from the Proposed Action.

Mineral and Paleontological Resources

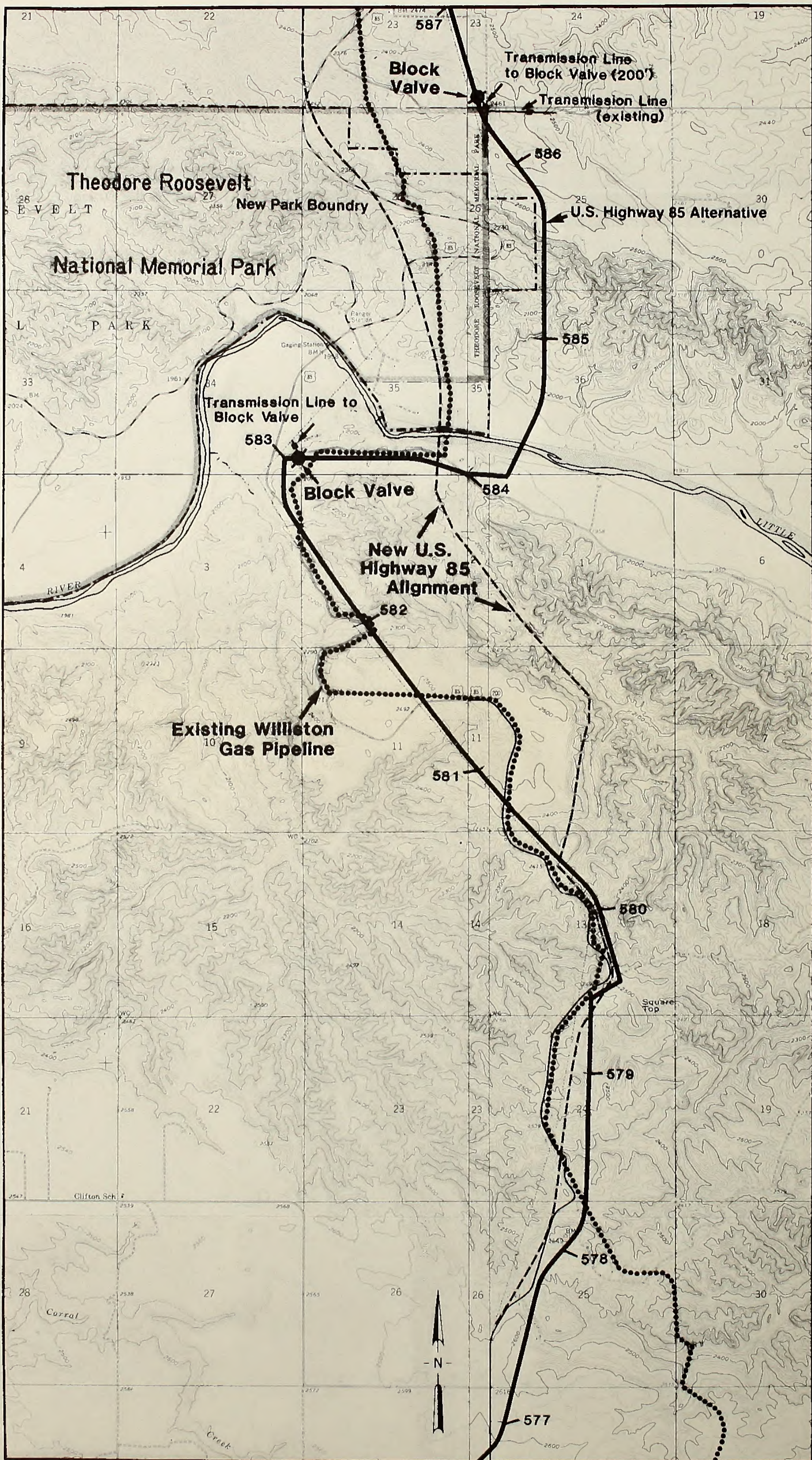
AFFECTED ENVIRONMENT

The affected environment for this alternative would generally be the same as described for the Proposed Action. In North Dakota, the main pipeline would cross the Watford City lignite deposit in addition to the deposits identified for the Proposed Action. (See Table 58 for coal areas crossed by the main alternative pipeline.) Since the alternative route would not cross as much of the Dickinson or Keene deposits (North Dakota) as the Proposed Action route, 4.5 less miles of alternative route would cross demonstrated coal resources.

The geology crossed by both the proposed and alternative routes in North Dakota has low to moderate sensitivity for paleontological resources. The alternative would cross 255 more miles of low sensitivity geology, 252.5 miles of moderate sensitivity geology, and 246.5 miles of high sensitivity geology.

ENVIRONMENTAL CONSEQUENCES

Impacts to mineral resources would be the same as described for the Proposed Action, except that 15 million tons of lignite reserves could be precluded from recovery. The alternative would cross geology that is



MAP 7 U.S. HIGHWAY 85 ALTERNATIVE CROSSING - LITTLE MISSOURI RIVER BREAKS AREA

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U.S. HIGHWAY 85 ALTERNATIVE—MINERALS & PALEONTOLOGY

**TABLE 57
KNOWN ARCHAEOLOGICAL AND HISTORIC SITES
POTENTIALLY AFFECTED BY THE U.S. HIGHWAY 85 ALTERNATIVE¹**

Milepost	Number of Known Sites	General Site Type	Number of Sites Eligible for National Register of Historic Places	Comments
A548.3-A560	12	Lithic scatters Quarries Historic	1	The eligible site is an historic homestead. The eligibility status of the remaining sites is unknown, pending further investigation.
A583-A584	3	Lithic scatters Chipping stations	1	These three sites lie within 1/2 mile of the corridor. The eligible site is an historic homestead.
A591-A606	1	Lithic scatter	0	Early Archaic site with eligibility status unknown, pending further investigation.

Source: North Dakota Historic Preservation Office.

¹ Other sites potentially affected by the alternative are the same as the Proposed Action from MP 0.0-543 and Proposed Action MP 622 to the end.

**TABLE 58
COAL AREAS CROSSED BY THE MAIN
U.S. HIGHWAY 85 ALTERNATIVE PIPELINE**

Deposit Name	Miles	Milepost	Coal Rank	Surface(S) or Underground(u) Mining	Existing Pipeline	Data Classification
Rock Springs	19	30-49	Subbituminous	U	All	Demonstrated
Wind River Basin	30	164-194	Subbituminous	U/S	1.1 miles	Hypothetical
Powder River Region	59	250-309	Subbituminous	S	10 miles	Hypothetical
Gillette	9	309-318	Subbituminous	S	5 miles	Demonstrated
Powder River Region	12	318-330	Subbituminous	S	All	Hypothetical
Fort Union Region	30	425-455	Lignite	S	4 miles	Hypothetical
Carlyle	12.5	475-487.5	Lignite	S	None	Demonstrated
Fort Union Region	36.5	487.5-524	Lignite	S	21 miles	Hypothetical
Dickinson	20	524-A544	Lignite	S	3 miles	Demonstrated
Fort Union Region	44	A544-A588	Lignite	S	36 miles	Hypothetical
Watford City	12	A588-A600	Lignite	S	All	Demonstrated
Fort Union Region	5	A600-A605	Lignite	S	All	Hypothetical
Keene	20.5	A605-A625.5	Lignite	S	9 miles	Demonstrated
Fort Union Region	7.5	A625.5-A633	Lignite	S	None	Hypothetical
Williston	6.5	A633-A939.5	Lignite	S	None	Demonstrated
Fort Union Region	7	A639.5-A647.5	Lignite	S	None	Hypothetical

Source: Geological maps of Wyoming, Montana, and North Dakota, compiled by BLM.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

slightly less sensitive to fossil disturbance; however, no known sites have been identified for either the proposed or alternative routes along this segment.

Differences in impacts to minerals and paleontological resources would not be significant between the Proposed Action and the U.S. Highway 85 Alternative.

Visual Resources

AFFECTED ENVIRONMENT

The affected environment along the U.S. Highway 85 Alternative is essentially the same as described for the Proposed Action. Differences are shown in Table 59.

ENVIRONMENTAL CONSEQUENCES

The impacts to visual resources from this alternative would be similar to those described in Table 49 for the Proposed Action. Table 59 shows the areas where significant impacts would be different with this alternative, if the objectives for the VRM class in which they occurred were not met.

All significant impacts would result from construction of the main pipelines, which would significantly disturb about 550 acres. The areas would eventually return to a visually acceptable condition, as revegetation blended with natural landscape conditions.

Recreation

AFFECTED ENVIRONMENT

The affected environment along the U.S. Highway 85 Alternative would be similar to that described for the Proposed Action. The primary difference is that this alternative would be located along the east boundary of the north unit of Theodore Roosevelt National Park.

ENVIRONMENTAL CONSEQUENCES

Impacts to recreation from this alternative would be the same as described for the Proposed Action. Visits to Theodore Roosevelt National Park may increase slightly because of construction workers in the area. A more significant impact would be construction sights and sounds, affecting park visitors. These impacts, however, would be temporary and insignificant.

TABLE 59
IMPORTANT VISUAL RESOURCES NEAR
THE U.S. HIGHWAY 85 ALTERNATIVE

Project Component by Milepost	VRM Class or VQO	Description
Main Pipeline		
MP A583-A585	II, Retention	Little Missouri River crossing includes <i>seen-area</i> as viewed by canoeists and floatboaters from the river. The Little Missouri River is designated as a State Scenic River by the State of North Dakota and must remain in a natural state. Scenic quality is Class "A" because of natural landscape diversity of landform and vegetation and the free-flowing qualities of the Little Missouri River. Visual sensitivity is high because it is used by canoeists and floatboaters and is designated as a State Scenic River. A pipeline and road are present.
MP A585-A586.5	II, Retention	Passes within 1/8 mile of the North Unit of the Theodore Roosevelt National Park. Scenic quality is Class "B" with high visual sensitivity for the gently rolling, grass-covered plains because it would be near the National Park.

Note: Components not listed here would be the same as described for the Proposed Action, Bairoil Spur and plant, and Cedar Creek distribution pipeline.

CROOKS GAP OPTION—SOILS AND VEGETATION

CROOKS GAP OPTION

Impacts to socioeconomics, cropland, air quality, mineral resources, wilderness, recreation, visual resources, and health and safety would be the same for the portion of the Proposed Action that the Option would replace. Therefore, these are not discussed here.

Soils and Vegetation

AFFECTED ENVIRONMENT

The Crooks Gap Option would cross the following soil groups: soils of the nearly level to gently sloping (0 to 5 percent slopes) floodplains, low terraces and alluvial fans; soils of the nearly level to sloping (0 to 9 percent slopes broad basins and valley floors; and soils of the

undulating to rolling (3 to 15 percent slopes) plains dissected by intermittent drainageways forming from mixed loamy and sandy materials. Table 60 shows the location and extent of the larger areas of unfavorable soils and terrain requiring more intensive reclamation and erosion control.

The Crooks Gap Option would cross mainly sagebrush grass vegetation type.

ENVIRONMENTAL CONSEQUENCES

The Crooks Gap Option would disturb 216 acres of which all would be reclaimed. Types of land disturbance would be the same as that portion it replaces.

Of the total 216 acres that would be disturbed by this option, 15.6 acres of sensitive soils and terrain would be

TABLE 60
AREAS REQUIRING MORE INTENSIVE RECLAMATION AND EROSION CONTROL
CROOKS GAP OPTION

Project Component	Location by Milepost	Extent Miles (Acres)		SENSITIVE AREA DESCRIPTION AND COMMENTS			Other Comments
				Slope 15% +	Unfavorable Soils	AAP (inches)	
Main Pipeline	111.4CG	0.1	1.2	X	X	9-12	Sideslope
	112.7-112.8CG						
	112.9-113.1CG	0.2	2.4		X		
	114.9-115.1CG	0.2	2.4		X		
	116.0CG					7-9	
	123.2-123.4CG	0.2	2.4	X	X		Sideslope
	124.8-125.1CG	0.3	3.6	X	X		
	125.5-125.6CG	0.1	1.2	X	X		
	127.2-127.3CG	0.1	1.2		X		Sideslope-drain-ageway
	128.8-128.9CG	0.1	1.2		X		
	129.0CG						
	TOTAL:	1.3	(15.6)				156 acre (AAP 7-9 inches)

Note: Table prepared from soils-terrain analysis and orthophotograph interpretations. Milepost locations are approximate, based on general, preliminary right-of-way information. See Appendix 7, Methodologies for source of inventory data and methodology.

AAP = Average annual precipitation.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

disturbed and 156 acres would be located in areas with less than 9 inches average annual precipitation. See Table 60 for the approximate locations and extent of sensitive soil and terrain areas.

The Crooks Gap Option would not significantly affect soils. See Proposed Action for discussion of erosion control and reclamation measures.

Impacts to vegetation would generally be insignificant. Understory vegetation would return to preconstruction within 5 years after construction, assuming the procedures outlined in Appendix 4 were followed.

Agriculture

AFFECTED ENVIRONMENT

The ranching operations, along this option are similar to those for the portion it replaces. The grazing capacity averages between 10 to 12 acres per AUM. No cropland occurs along this option.

ENVIRONMENTAL CONSEQUENCES

The land disturbance from this option would cause a short-term (2 to 5 year) loss of forage on about 216 acres. This would amount to about 20 AUMs.

Transportation Networks

AFFECTED ENVIRONMENT

The Crooks Gap Option would affect about 6 miles of U.S. Highway 287 and Wyoming State Highway 789, east of Jefferson City, and about 11 miles of Freeman County Road south of Jefferson City. Also primitive dirt roads connecting main roads to the construction sites.

ENVIRONMENTAL CONSEQUENCES

Traffic volumes along road segments of U.S. Highway 287, Wyoming State Highway 789, plus several primitive dirt roads would increase for the 18-day construction period. Traffic would require hauling 5,130 tons of pipe and material, involving 40 truck trips per day from the pipeline welding and storage yard at Casper, Wyoming. In addition, 52 vehicle trips (cars, buses, and pickups) would be needed to move the labor force. Impacts associated with accidents and road deterioration would be the same as described for the Proposed Action.

Water Resources

AFFECTED ENVIRONMENT

The Crooks Gap Option would pass through similar watershed conditions as the main pipeline but would cross only one perennial stream—Cottonwood Creek.

ENVIRONMENTAL CONSEQUENCES

The impacts to water resources would be insignificant and the same as described for the Proposed Action.

Wildlife

AFFECTED ENVIRONMENT

The various components of this option would be constructed on or across 18 miles of several kinds of wildlife habitats.

Terrestrial Wildlife. Vegetation (habitat) types crossed by the Option are identified and described in the Soils and Vegetation section. Pronghorn, mule deer, and elk are the principal big game animals found along this route. The route would not cross any crucial seasonal ranges for big game.

Sage grouse, an important upland game bird, are common along the entire length of this route. Lek and associated nesting habitat are crucial areas that are used for strutting, breeding, and nesting from about March 1 through June 30.

The project area is inhabited by large numbers and varieties of raptors. Nesting raptors that could occur near the pipeline include golden eagles, ferruginous hawks, red-tailed and Swainson's hawks, prairie falcons, harriers, American kestrels, great horned owls, and burrowing owls. The golden eagle, prairie falcon, ferruginous hawk, and burrowing owl are migratory birds of high federal interest and require special consideration. In addition, the ferruginous and Swainson's hawk are under review for possible listing as threatened or endangered species (*Federal Register* 1982).

Numerous small mammals (both small game and nongame) use the various habitats along the pipeline route. These species are highly cyclic and population numbers can vary greatly from year to year.

Few reptile or amphibian species are found along the route.

CROOKS GAP OPTION—LAND USE PLANS

Aquatic Wildlife. The Option would cross only one perennial stream, Cottonwood Creek, which is a Class IV stream. Populations of brook trout are good in this stream, but they are only of local importance. These fish spawn in the fall and early winter.

Threatened or Endangered Species. The only federally listed species that may occur along this route is the black-footed ferret. This rare animal may be found in prairie dog colonies that could be affected by the construction of the pipeline.

ENVIRONMENTAL CONSEQUENCES

Terrestrial Wildlife. Construction, operation, and abandonment of the pipeline along this route would disturb about 216 acres of wildlife habitat. The Crooks Gap option would not disturb any crucial big game winter ranges, calving or fawning areas, or migration routes in the area. Construction would disturb about 25 acres of sage grouse nesting habitat, but these impacts would be avoided by proper timing of construction (Appendix 4).

The entire 18-mile-long Option could be considered as raptor nesting habitat, ranging in quality from fair to good. One known prairie falcon nest occurs within 1/4 mile of the proposed route. Disturbance of this nest site could be avoided by proper timing of construction (Appendix 4). Other raptor species nesting near this route could also be disturbed by construction. Each raptor species has a different tolerance to disturbance during the nesting season; each would abandon its nests if that tolerance was exceeded. Proper timing of construction would avoid adverse impacts to these species.

Impacts to other terrestrial wildlife species and habitats would be similar to those discussed for the Proposed Action.

Aquatic Wildlife. If the companies adhered to their proposed construction schedule (Chapter 1), most of the direct impacts to fisheries would be avoided. If the pipeline were to be constructed across Cottonwood Creek (MP 127.3CG) during the fall, brook trout spawning could be reduced. Other impacts to this fishery would be similar to those discussed for the Proposed Action.

Threatened or Endangered Species. Construction of this Option would not disturb any known threatened or endangered species. One mapped prairie dog colony is located about 1/2 mile from the proposed route at about MP 127.5CG. No other colonies are known to occur along the route.

Direct impacts to the colony are not likely, but if direct impacts occurred, surveys for black-footed ferrets would be required before the colony was disturbed.

CUMULATIVE IMPACTS

Cumulative impacts to wildlife species from the construction, operation, and abandonment of this Option and other related projects are not expected to be significant because construction would disturb less than 1 percent of the total wildlife habitat in the area.

Cultural Resources

AFFECTED ENVIRONMENT

Three known sites occur between MP 111–129CG of the route. Two sites are small camps with lithic scatters and fire-cracked rock, the remnants of fire hearths. One site is historic. Eligibility status of the three sites is unknown pending further investigation. There is also a metal post indicating that the *Burent Ranch Stage Station* once existed near MP 116CG. Nothing else is known of this location.

The Crooks Gap Option would cross the Rawlins-Ft. Washakie Stage Road at various points between MP 113.1CG and 116.2CG. The eligibility status for individual segments of the road is unknown in this area.

Since no statistically valid surveys have been done in the area of the Crooks Gap Option, few sites are known to exist there.

ENVIRONMENTAL CONSEQUENCES

Impacts to the sites in the Crooks Gap Option would be similar to those discussed for the Proposed Action.

Paleontological Resources

AFFECTED ENVIRONMENT

The Crooks Gap Option would cross 6 miles of geology having low paleontological sensitivity and 12 miles having moderate paleontological sensitivity.

ENVIRONMENTAL CONSEQUENCES

The impacts would be similar to those from the Proposed Action, insignificant.

Land Use Plans, Controls and Constraints

No significant land use impacts would occur because of the Crooks Gap Option.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

NO-ACTION ALTERNATIVE

If the proposed project was not built, impacts to the environment from the proposal would not occur. Impacts occurring from ancillary facilities needed for CO₂ enhanced oil recovery would also be avoided. Resources that would be used directly for construction and operation of the proposed pipeline and ancillary facilities would not be used, thereby making them available for use in other economic areas.

If the proposed project was not built, the benefits of enhanced oil recovery would be lost. Enhanced oil recovery through CO₂ injection would not take place.

Consumers would be deprived of the benefits of additional oil production or more expensive sources of energy would have to be used.

The No-Action Alternative would save the cost of the proposal but would lose the benefits associated with it. Accordingly, the benefits of the No-Action Alternative are the avoidance of impacts and the cost of construction.

Because of the uncertainty surrounding the economics of enhanced oil recovery projects, the net benefits of the proposal cannot be estimated. The net benefits of the No-Action Alternative also cannot be determined.

Chapter 3

Benefits, Trade-Offs, and Commitment of Resources



CHAPTER 3 PHOTO:

**Reclaimed right-of-way of recently constructed
Williston gas pipeline near U.S. Highway 85**

CHAPTER 3

BENEFITS, TRADE-OFFS, AND COMMITMENT OF RESOURCES

The impact analysis in Chapter 2 assumes that the general measures listed in Appendix 4 would be applied. Since no more mitigation measures have been proposed or committed to, the unavoidable adverse impacts for each resource are as discussed in Chapter 2. This chapter focuses on the benefits, trade-offs, and commitment of resources from building and operating the Proposed Action or the U.S. Highway 85 Alternative. (The Single Bairoil Pipeline Alternative would generally be the same as the Proposed Action, except for magnitude. Also, the Crooks Gap Option would be similar to the portion of the Proposed Action route it would replace.)

BENEFITS

The major benefit from the Proposed Action or U.S. Highway 85 Alternative would be increased oil and gas production from the Wertz and Lost Soldier oil fields at Bairoil, from undetermined oil fields along Exxon's proposed Wyoming-Dakota pipeline, and probably from oil fields along Shell's Cedar Creek Anticline in Montana. Other benefits would be the reduced venting of CO₂ at Exxon's Shute Creek natural gas plant and increased profits from gas plant projects. In addition, emissions in the Bairoil fields would be reduced by replacing an older gas plant that emits 509 tons of SO₂ per year with a new plant that would release 45 tons per year. The additional oil and gas production from enhanced oil recovery would generate annual revenues from property taxes, severance taxes, and federal royalties. Either pipeline route would increase annual property taxes for the 18 affected counties.

Project construction would generate direct employment opportunities for a peak of 1,861 workers and generate \$63,970,000 in personal income.

TRADE-OFFS

The proposed project would not significantly or adversely affect social or economic conditions. Construction of the Proposed Action or alternatives would disturb some sensitive soils requiring extra rehabilitation efforts, would degrade a small amount of visual resources, and could destroy cultural resources. Construction would also cause a short-term loss of wildlife habitat but no significant loss of animals. In addition, traffic would increase, which could increase accidents and loss of life.

COMMITMENT OF RESOURCES

Construction and operation of the Proposed Action or U.S. Highway 85 Alternative could irreversibly or irretrievably commit certain environmental or energy resources. *Irreversible* is a term that describes the loss of future options for a resource. An irreversible impact applies primarily to the effects on the use of nonrenewable resources, such as minerals. *Irretrievable* applies to the loss of production, harvest, or use of natural resources.

Some resources may be adversely affected for the short term—during construction; others, for the long term. *Long term* is defined as the 30- to 35-year-life of these projects or longer. Neither the Proposed Action nor the U.S. Highway 85 Alternative would decrease the long-term productivity of the environment. Neither construction nor operation of the pipelines and gas separation plant would decrease long-term productivity. Operation of the enhanced oil recovery program at Bairoil would enable 5 to 15 percent more original oil in place to be recovered. Recovered oil would be consumed and lost for future use.

Table 61 summarizes the long-term and short-term effects of the Proposed Action or U.S. Highway 85 Alternative and states if a resource would be irreversibly or irretrievably affected.

BENEFITS, TRADE-OFFS, AND COMMITMENT OF RESOURCES

TABLE 61
SHORT-TERM AND LONG-TERM IMPACTS

Resource	Irreversible	Irretrievable	Short-Term	Long-Term
Socioeconomics			X	X
Soils and Vegetation			X ¹	
Agriculture			X ²	
Transportation Networks	X ³	X ⁴	X ⁵	
Water Resources			X	
Wildlife			X	
Cultural Resources	X	X	X	X
Air Quality		X	X	X ⁶
Minerals			X	
Paleontology	X	X	X	X
Visual Resources			X	X
Recreation			X	

¹ Accelerated erosion would occur during construction and continue until erosion control measures were implemented; understory vegetation is expected to return to near preconstruction conditions within 5 years.

² Forage production would be lost on disturbed land for 2 to 5 grazing seasons.

³ Increased traffic volume would increase traffic injury accidents, causing irreversible effects.

⁴ The traffic accidents could cause fatalities; loss of human life would be irreversible and irretrievable.

⁵ Project-related activities would cause some short-term, adverse impacts to transportation in the cities of Rock Springs, Rawlins, and Gillette, Wyoming; Baker, Montana; and Williston, North Dakota. Project-related rural roads and bridges would also be adversely affected.

⁶ Long-term emissions of SO₂ from the Bairoil plant would be less than now emitted from the existing Wertz plant.

Chapter 4

Comparative Analysis

CHAPTER 4 PHOTO

View of rolling hills in the distance from a field in the foreground. The field is divided into sections by a fence line. A small structure is visible in the distance.



CHAPTER 4 PHOTO:

**View of existing pipeline
right-of-way**

CHAPTER 4

COMPARATIVE ANALYSIS

Chapter 4 compares the environmental impacts of the Proposed Action, the U.S. Highway 85 Alternative, the Single Bairoil Pipeline Alternative, and the Crooks Gap Option. Table 62, developed from information in Chapter 2, compares most of the impacts, even if they would be insignificant or identical. Some impacts are not compared but are discussed in Chapter 2.

The State of Montana, Department of Natural Resources and Conservation (DNRC), has reviewed the need for the proposed project and the benefits and costs of the proposed alternatives. DNRC concluded that while great uncertainty surrounds the benefits and marketability of the project, if the project turns out to be marketable, the benefits are likely to greatly outweigh the costs. Furthermore, the project would not likely be built unless marketability was assured. See Appendix 3 for the economic analysis.

RESOURCE COMPARISON

Impacts of the Proposed Action and the U.S. Highway 85 Alternative would only differ slightly and would not differ for socioeconomic; transportation networks; water resources; visual resources; recreation; wilderness; land use plans, controls, and constraints; and parts of some of the remaining resource categories. The Single Bairoil Pipeline Alternative would cause impacts similar to the Proposed Action and the U.S. Highway 85 Alternative, but some resources would be less affected by the Single Bairoil Pipeline because of less disturbance caused along Spread 1.

The U.S. Highway 85 Alternative would be 4 miles longer than the Proposed Action, whereas the Single Bairoil Pipeline would be 23 miles shorter. The U.S. Highway 85 Alternative would disturb 48 more acres of soils and vegetation than would the Proposed Action, and the Single Bairoil Pipeline Alternative would disturb 669 fewer acres. The Proposed Action would disturb more acres of sensitive soils than either of the alternatives; 18 more acres than the U.S. Highway 85 Alternative and 93.1 more acres than the Single Bairoil Pipeline Alternative. The U.S. Highway 85 Alternative would cause a loss of 15 more animal unit months (AUMs) of forage than the Proposed Action, and the Single Bairoil Alternative would cause a loss of 63 fewer AUMs.

The U.S. Highway 85 Alternative would disturb 78 fewer acres of cropland than the Proposed Action, while the Single Bairoil Pipeline Alternative would disturb the same number of acres as the Proposed Action.

The Proposed Action would cross 18 perennial streams 26 times at 22 locations; the U.S. Highway 85 Alternative would require one more crossing than the Proposed Action, and the Single Bairoil Pipeline Alternative would require four less crossings. All three alternatives would require the same amount of long-term water use for the Bairoil plant and enhanced oil recovery program, and all would cross Lake Sakakawea at the same location.

The Proposed Action and the alternatives would disturb similar amounts of crucial wildlife habitat. Some differences do occur between the Proposed Action and the Single Bairoil Pipeline Alternative for several wildlife species habitat. Acres of crucial mule deer and pronghorn winter range, pronghorn fawning habitat, sage grouse winter and breeding/nesting habitat, raptor nesting habitat, feral horse range, and prairie dog colonies would all be less for the alternative. The smaller acreages reflect the deletion of the mileage along the segment paralleling the Rangely CO₂ pipeline and the narrower width of disturbance from MP 0.0 to MP 111.

Cultural resource site information is not uniformly known, but 224 known sites occur along the Proposed Action, 5 more sites than occur along the U.S. Highway 85 Alternative. The segment of the Proposed Action from MP 543 to 622 has 11 sites, mostly lithic scatters, and the segment of the U.S. Highway 85 Alternative that would bypass these miles is known to contain 16 sites within the 1-mile-wide corridor, also mostly lithic scatters. The Proposed Action and U.S. Highway 85 Alternative pipelines would cross the same historic roads and trails 27 times. The Single Bairoil Pipeline Alternative would make the same crossings as the Proposed Action except for four crossings of historic roads and trails along the Rangely segment. The Single Bairoil Pipeline Alternative would also not affect the five cultural resource sites within the mile-wide corridor along the Rangely segment of the Proposed Action.

The Proposed Action would create about 6,473 tons of fugitive dust, the U.S. Highway 85 Alternative would

COMPARATIVE ANALYSIS

TABLE 62
BAIROIL/DAKOTA CO₂ PROJECTS
COMPARATIVE ANALYSIS

Element	Proposed Action	U.S. Highway 85 Alternative		Single Bairoil Pipeline Alternative	
Pipeline length (miles)					
Main Pipeline	666.5	670.5	(+ 4)	643.5	(-23)
Bairoil Spur	20.0	20.0	(0)	20.0	(0)
Cedar Creek Distribution Pipeline	65.0	65.0	(0)	65.0	(0)
Total miles	751.5	755.5	(+ 4)	728.5	(-23)
Socioeconomics					
Population increase in Bairoil	60/22.2%	60/22.2%	(0)	50/18.5% (-10/-3.7%)	
Significant local government revenue increase—construction					
Montana					
Carter County	\$210,000—38.3%	\$210,000—38.3%	(0)	\$210,000—38.3%	(0)
Carter County schools	330,000—37.0%	330,000—37.0%	(0)	330,000—37.0%	(0)
North Dakota					
Golden Valley County schools	\$19,000—12.5%	\$19,000—12.5%	(0)	\$19,000—12.5%	(0)
Significant local government revenue increase—operation					
Wyoming					
Sweetwater County	\$2,300,000/37.1%	\$2,300,000/37.1%	(0)	\$2,300,000/37.1%	(0)
Montana					
Carter County schools	\$380,000/69.1%	\$380,000/69.1%	(0)	\$380,000/69.1%	(0)
	610,000/68.5%	610,000/68.5%	(0)	610,000/68.5%	(0)
Golden Valley County schools	\$30,000/19.7%	\$30,000/19.7%	(0)	\$30,000/19.7%	(0)
Soils and Vegetation					
Acres of soils & vegetation disturbed during construction (1 yr) and short-term vegetation impacts (2-5 years)	9,485.0	9,533.0	(+ 48)	8,799.0	(-669.0)
Acres of soils occupied by surface facilities	223.0	223.0	(0)	215.3	(-7.7)
Acres of sensitive soils and terrain affected	796.8	778.8	(-18)	703.7	(-93.1)
Acres of disturbance in areas with less than 9 inches average annual precipitation	2,718.0	2,718.0	(0)	2,534.0	(-184.0)
Agriculture					
Forage loss (AUMs/yr) short-term (2-5 years)	785	800	(+ 15)	722	(-63)
Forage loss (AUMs/yr) for project life (30 years)	20	20	(0)	20	(0)

COMPARATIVE ANALYSIS

TABLE 62
BAIROIL/DAKOTA CO₂ PROJECTS
COMPARATIVE ANALYSIS (Continued)

Element	Proposed Action	U.S. Highway 85 Alternative		Single Bairoil Pipeline Alternative	
Cropland disturbed for 1 year (acres)	1,897	1,819	(-78)	1,897	(0)
Cropland converted to other uses by project facilities	2	2	(0)	2	(0)
Transportation					
Segments of major roads significantly	U.S. Highway 287, Wyoming State Highways 789, 220; U.S. Highways 20, 26; Wyoming State Highways 191, 50, 220, 59; Montana State Highways 544, 59, 327, and 7; North Dakota Federal Aid Systems 1711, 1744, 1746, 0419, 0408, 200, and 1804; North Dakota State Highway 16; county and local roads.	Same as Proposed Action plus U.S. Highway 85, and North Dakota State Highways 73, 220		Same as Proposed Action	
Water Resources					
Water requirements (ac-ft/yr)	4,614	4,614	(0)	4,614	(0)
Perennial stream crossings*	26	27	(+ 1)	22	(-4)
Lake crossings	1	1	(0)	1	(0)
Wildlife					
Elk crucial winter range and calving area (acres)	12	12	(0)	12	(0)
Crucial mule deer winter range (acres)	186	186	(0)	40.5	(-145.5)
Mule deer winter concentration area (acres)	36	36	(0)	36	(0)
Crucial pronghorn winter range (acres)	828	828	(0)	501	(-327)
Pronghorn fawning habitat	144	144	(0)	0	(-144)
Crucial white-tailed deer winter range (acres)	36	36	(0)	36	(0)
Bighorn sheep lambing range (acres)	168	168	(0)	168	(0)
Sage grouse winter range (acres)	42	42	(0)	37.5	(-4.5)
Sage grouse breeding/nesting habitat (acres)	312	312	(0)	243	(-69)
Sharp-tailed grouse breeding/nesting habitat (acres)	24	24	(0)	24	(0)
Raptor nesting habitat (acres)	648	648	(0)	525	(-123)

COMPARATIVE ANALYSIS

TABLE 62
BAIROIL/DAKOTA CO₂ PROJECTS
COMPARATIVE ANALYSIS (Continued)

Element	Proposed Action	U.S. Highway 85 Alternative		Single Bairoil Pipeline Alternative	
Bald eagle winter habitat (acres)	156	156	(0)	156	(0)
Prairie dog colonies (acres)	501	501	(0)	394	(-107)
Feral horse range	1,452	1,452	(0)	1,131	(-321)
Cultural Resources					
Known sites	224	229	(+ 5)	219	(-5)
Crossing of historic trails and roads (some crossed more than once)	27	27	(0)	23	(-4)
Air Quality					
Fugitive dust from construction (tons produced)	6,473	6,505	(+ 32)	6,020	(-453)
Bairoil Plant emissions (tons per year SO ₂)	45	45	(0)	45	(0)
Minerals/Paleontological Resources					
Coal precluded from recovery during pipeline lifetime (millions of tons)	16	15	(-1)	16	(0)
Low paleontological sensitivity (miles)	245.0	255.0	(+ 10)	245.0	(0)
Moderate paleontological sensitivity (miles)	285.5	252.5	(-6)	258.5	(0)
High paleontological sensitivity (miles)	246.5	246.5	(0)	246.5	(0)
Visual Resources					
Number of areas with significant resources	11	11	(0)	9	(-2)
Acres significantly affected	550	550	(0)	424	(-126)
Recreation Resources	Urban-related recreation opportunities would receive impacts during construction phase in Bairoil, Wyoming	Same as Proposed Action		Same as Proposed Action	
Wilderness	No significant adverse impacts	No significant adverse impacts		No significant adverse impacts	
Land Use Plans, Controls, and Constraints	No conflict	Same as Proposed Action		Same as Proposed Action	

COMPARATIVE ANALYSIS

TABLE 62
BAIROIL/DAKOTA CO₂ PROJECTS
COMPARATIVE ANALYSIS (Concluded)

Element	Proposed Action MP 111-124	Crooks Gap Option MP 111-129 CG	
Pipeline length (miles)	13	18	(+ 5)
SOILS AND VEGETATION			
Areas of soils and vegetation disturbed during construction (1 yr) and short-term vegetation impacts (2-5 years)	156	216	(+ 60)
Acres of sensitive soils and terrains affected	74.4	15.6	(-58.8)
Acres of disturbance in areas with less than 9 inches average annual precipitation	0	156	(+ 156)
AGRICULTURE			
Forage loss (AUMs/yr) short-term (2-5 years)	17	20	(+ 3)
WATER RESOURCES			
Perennial stream crossings	3	1	(-2)
WILDLIFE			
Elk Crucial Winter Range and Calving Area (acres)	12	0	(-12)
Feral horse range (acres)	156	216	(+ 60)
Sage grouse nesting habitat (acres)	0	25	(+ 25)
Prairie dog colonies (acres)	24	0	(-24)
CULTURAL RESOURCES			
Known sites	19	3	(-16)
Historic trails and roads crossed	0	1	(+ 1)
PALEONTOLOGICAL RESOURCES			
Moderate sensitivity (miles)	8.9	12	(+ 3.1)
Low sensitivity (miles)	4.1	6	(+ 1.9)

Numbers in parentheses show the differences of the alternative compared with the Proposed Action.

* The Green River at MP 2.6 would be crossed twice at the same location, once by Exxon and once by Amoco, and Crooks Creek would be crossed twice at each of two locations, by Exxon and Amoco.

COMPARATIVE ANALYSIS

create 32 tons more, and the Single Bairoil Pipeline Alternative would create 453 tons less. Emissions from the plant would be the same under all three alternatives.

The Proposed Action and the Single Bairoil Pipeline Alternative would preclude development of 16 million tons of lignite in the Carlyle and Dickinson deposits during the life of the project. The U.S. Highway 85 Alternative would preclude development of 1 million fewer tons of lignite than the Proposed Action.

The U.S. Highway 85 Alternative would cross 6 fewer miles of lands with moderate paleontological sensitivity than the Proposed Action. The Single Bairoil Pipeline Alternative would cross the same miles and categories of paleontological sensitivity as the Proposed Action.

Areas and acres of significantly affected visual resources crossed by the Proposed Action and the U.S. Highway 85 Alternative would be the same, 11 areas and 549 acres. The Single Bairoil Pipeline Alternative would cross two fewer areas and 126 fewer acres because the areas along the Rangely segments would not be part of the alternative route. In addition construction of Spread 1 would require less disturbance and thus, affect fewer acres per mile.

The Crooks Gap Option was developed to bypass the Proposed Action from MP 111 to MP 124. The 18-mile-long route would bypass 13 miles of the Proposed Action route in this area. It would disturb 216 acres of soils and vegetation, 60 more than the Proposed Action segment.

About 60 acres more sensitive soils would be disturbed by the Crooks Gap Option than the segment of the Proposed Action. Three more AUMs would be lost by the Crooks Gap Option than along the segment of the Proposed Action it would replace. The Option would cross 156 acres of land receiving less than 9 inches of rainfall while the segment of the Proposed Action would cross more lands higher in elevation with more than 9 inches of rainfall. The Crooks Gap Option would cross two fewer streams than would the corresponding segment of the Proposed Action.

The Crooks Gap Option would not disturb any crucial elk winter range or calving areas, while the Proposed Action would disturb 12 acres. Both segments would disturb wild horse range, but the Option would disturb 60 acres more. The Crooks Gap Option would disturb 25 acres of sage grouse nesting habitat, while the Proposed Action segment would not disturb any.

The Proposed Action segment would cross 19 known cultural resource sites, 16 more than the Crooks Gap Option which, unlike the Proposed Action segment, would cross an historic trail.

The Crooks Gap Option would cross 3.1 more miles of formations containing moderately sensitive paleontological reserves and 1.9 miles more with low sensitivity than the Proposed Action.

COST BENEFIT COMPARISON OF THE PROPOSED ACTION AND NO-ACTION ALTERNATIVE

(Montana Department of Natural Resources and Conservation 1985)

The benefits and costs of the pipeline in relation to the No-Action Alternative cannot now be determined. Measuring the benefits of the project requires an estimate of the demand for CO₂ to be carried by the pipeline. This information will not be known until field tests and evaluations are completed by owners for oil fields targeted as CO₂ markets. Even then, much of the information may be regarded as privileged by field owners and Exxon. As discussed in Appendix 3, if the marketability of CO₂ and financial feasibility of the proposed pipeline can be demonstrated, it will indicate that the project would generate greater net benefits than the No-Action Alternative.

A demonstration to the applicants' satisfaction that the project is financially feasible means that the present value of revenues, given the applicants' required rate of return, is greater than the present value of costs. A different benefit-cost calculation would be required to show that the public would be better off with the proposed project than with the No-Action Alternative. The public calculation also would evaluate the private revenues and costs, but would use a lower discount rate, in part because the social risk is generally lower than the individual risk. This would result in a higher present value for the private revenue stream. In addition, environmental costs and certain consumer benefits would be counted and certain tax benefits would not. This project would have one environmental benefit—the reduction in SO₂ emissions at Bairoil—and no significant detrimental environmental impacts that could not be alleviated. Appendix 3 indicates that the project would generate net benefits. If CO₂ is marketable, it is likely that the project would be preferable to the No-Action Alternative.

AGENCY PREFERRED ALTERNATIVE

The Agency Preferred Alternative was selected by BLM and the cooperating agencies in the preparation of the EIS: the Forest Service and the Montana Department of Natural Resources and Conservation.

COMPARATIVE ANALYSIS

The Agency Preferred Alternative is the Single Bairoil Pipeline Alternative, which involves:

- granting rights-of-way for one CO₂ pipeline from MP 26 of the existing Rangely CO₂ pipeline near Rock Springs, Wyoming to Tioga, North Dakota; the 20-mile segment from the main CO₂ pipeline route over to Bairoil, Wyoming; and associated facilities. The agency has no preference on whether Exxon or Amoco would build the first 111 miles

of the main CO₂ pipeline and the 20 miles over to Bairoil;

- granting rights-of-way for all facilities on public land needed to permit construction and operation of the proposed Bairoil gas separation plant;
- granting rights-of-way for the CO₂ distribution pipeline near Baker, Montana and associated facilities.

APPENDICES PHOTO:

**View of pipeline right-of-way where
it crosses the Little Missouri River**

APPENDIX 1

PROJECT MAPS

Project maps identified for this appendix are located in the back inside pocket of this EIS.

APPENDIX 2

CONSULTATION AND COORDINATION

SUMMARY OF PROJECT SCOPING

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 is to determine the significant issues related to a proposed action which should be included in the EIS. The basic goal of scoping is to make EISs more concise and meaningful to persons in the federal government who must make decisions on the proposal, as well as for persons in state and local government and the people who may be affected by approval or disapproval of the proposal or alternatives.

Method of Scoping

The scoping process for the Bairoil/Williston Basin Carbon Dioxide projects consisted of agency meetings, mailouts to solicit written comments from the public, and informative conversations with interested parties within the affected area.

Three public scoping meetings were also held during the scoping period:

February 26, 1985 7:00 p.m.	Baker High School 1015 South 3rd West Baker, Montana
February 27, 1985 7:00 p.m.	Broadus High School 500 North Trautman Broadus, Montana
March 7, 1985 7:00 p.m.	Gate City Community Room 204 Sims Street Dickinson, ND 58602

With the assistance of federal and state agencies, local entities, and private individuals, the significant issues and concerns were identified for analysis in the EIS. Insignificant issues were also identified so that they could be eliminated from the scope of the EIS. Project information and information on the scoping process were published in the *Federal Register* on February 13, 1985.

The mailout questionnaire scoping packets were mailed to interested persons selected in part from the mailing

lists of the affected BLM districts and the State of Montana. Packets were also sent to anyone requesting them.

Results of Scoping

The results of the scoping process, along with further input from various federal and state agencies, identified the most significant issues associated with the project (BLM 1984b). The extent to which each resource is analyzed was partially determined by the concerns raised during scoping.

The most significant issues were determined to be within the following topics (listed in order of overall significance):

- Socioeconomics
- Soils and Reclamation
- Water Resources
- Wildlife

A report on the scoping responses can be obtained from the Bureau of Land Management, Division of EIS Services, 555 Zang Street, First Floor East, Denver, Colorado 80228.

PUBLIC INVOLVEMENT

While preparing this draft EIS, BLM consulted with many federal, state, and local agencies; elected representatives; environmental and citizens groups; industry; and individuals. Many of these participated in the scoping process. The following agencies, groups, and individuals will receive a copy of the draft EIS for formal review.

Federal Government Agencies

Advisory Council on Historic Preservation
Department of Agriculture
Forest Service
Soil Conservation Service
Department of the Army
Corps of Engineers

CONSULTATION AND COORDINATION

Department of Energy
Department of the Interior
Bureau of Indian Affairs
Bureau of Mines
Bureau of Reclamation
Fish and Wildlife Service
National Park Service
Geological Survey
Environmental Protection Agency
Federal Energy Regulatory Commission
Federal Highway Administration
Interstate Commerce Commission

State Government Agencies

Montana
State Clearinghouse
Department of Fish, Wildlife, and Parks
Department of Natural Resources and Conservation
Department of Highways
Department of State Lands
State Historic Preservation Officer
Department of Health and Environmental Sciences

North Dakota
State Clearinghouse
Department of Game and Fish
Public Service Commission
State Historic Preservation Officer

Wyoming
State Clearinghouse
Department of Economic Policy and Planning
Recreation Commission
Wyoming State Engineers Office
Wyoming Game and Fish Department
Wyoming State Historic Preservation Office

Local Government Agencies and Jurisdictions

Montana
Carter County
Custer County
Dawson County
Fallon County
Powder River County
Richland County

Northern Cheyenne Tribe
Crow Tribe
Assinboine/Sioux Tribe

North Dakota
Billings County
Dunn County
Golden Valley County
McKenzie County

Montrail County
Stark County
Williams County

Turtle Mountain Band of the Chippewas
Standing Rock Sioux Tribal Council
Mandan, Hidatsa, and Arikara Tribes
Devil's Lake Sioux Tribe

South Dakota
Butte County
Lawrence County
Pennington County

Ogalala Sioux Tribe

Wyoming
Campbell County
Carbon County
Converse County
Fremont County
Johnson County
Natrona County
Sheridan County
Sweetwater County

Arapaho/Shoshone Tribes

Environmental Groups

Dakota Resources Council
Green River Economic Development Association
National Resources Defense Council
Powder River Resources Council
Sierra Club
Wild Horse Organized Assistance
Wyoming Outdoor Council
Wyoming Wildlife Federation

Industries and Individuals

(Detailed list available upon request from Janis VanWyhe, Division of EIS Services, Denver, Colorado.)

State Legislators

Montana
North Dakota
Wyoming

U.S. Senators and Representatives

Montana
North Dakota
Wyoming

APPENDIX 2

Copies of the draft EIS may be obtained from:

Bureau of Land Management
Division of EIS Services
555 Zang Street
First Floor East
Denver, Colorado 80228

Limited numbers of copies of the draft EIS may also be obtained from the following BLM offices:

Montana

Montana State Office
Granite Tower
222 N. 32nd Street
P.O. Box 36800
Billings, Montana 59107

Miles City District Office
West of Miles City
P.O. Box 940
Miles City, Montana 59301

Dickinson District Office
P.O. Box 1229
Dickinson, North Dakota 58602

Wyoming

Wyoming State Office
2515 Warren Avenue
P.O. Box 1828
Cheyenne, Wyoming 82003

Rock Springs District Office
P.O. Box 1869
Rock Springs, Wyoming 82901-1869

Big Sandy/Salt Wells Resource Areas
Gateway Building
79 Winston Drive
P.O. Box 1170
Rock Springs, Wyoming 82902-1170

Rawlins District Office
1330 Third Street
P.O. Box 670
Rawlins, Wyoming 82301

Casper District Office
951 Rancho Road
Casper, Wyoming 82601

Buffalo Resource Area
300 Spruce Street
Buffalo, Wyoming 82834

The final EIS is planned to be released February 26, 1986. It will be available from the following BLM office:

Wyoming State Office
2515 Warren Avenue
P.O. Box 1828
Cheyenne, Wyoming 82003
(307) 772-2219

The first part of the report is devoted to a description of the
 general conditions of the country, and to a statement of the
 results of the various expeditions which have been made
 since the first discovery of the gold fields.

The second part of the report is devoted to a description of the
 various gold fields, and to a statement of the results of the
 various expeditions which have been made since the first
 discovery of the gold fields.

The third part of the report is devoted to a description of the
 various gold fields, and to a statement of the results of the
 various expeditions which have been made since the first
 discovery of the gold fields.

APPENDIX 3

MARKETABILITY, NET BENEFITS, AND UNCERTAINTY

(Prepared by the Montana Department of Natural Resources and Conservation)

INTRODUCTION

The National Environmental Policy Act (NEPA) and the Council on Environmental Quality regulations for NEPA require that an EIS address the need for a proposed project and that alternatives to the proposal, including the no-action alternative, be evaluated and compared. The evaluation of need is closely related to the evaluation of the relative merits of the proposed action and the no-action alternative. A project is *needed* if there is a demand for the services the project will provide and the demand is great enough to warrant the costs of the project. The relative merits of the no-action alternative and the proposed action are measured by the benefits of the project (which will be lost if the no-action alternative is chosen) minus the costs of the project (which will be avoided under the no-action alternative). A major portion of the benefits are direct benefits to consumers of the project. These benefits give rise to and are measured by the consumer demand. If the benefits of the project exceed its cost, then the no-action alternative is inferior to the proposed project.

The most widely accepted method for evaluating the desirability of a project and for comparing alternatives is to determine the present value of the net benefits (minus costs) of each alternative over the future life of the project. This is done by calculating the costs and benefits of the alternatives for each year. To account for the time value of money, it is important to express costs in dollars of equal value. This is done by discounting the future costs and benefits to arrive at their present value in 1985 dollars.

An important question in evaluating the desirability of an action or in comparing it with alternatives is the perspective from which costs and benefits are measured. A project developer is generally interested only in costs and benefits that directly affect him. The public at large is concerned with the full social benefits and costs, including those that do not affect the developer but are borne by society or the environment.

Exxon, which proposes to build the pipeline for delivering CO₂ to oilfields in Wyoming, Montana, and North Dakota, is concerned with the project's financial feasibility. The benefits to Exxon would be the revenues

earned from the sale of CO₂ from Exxon's Shute Creek field in Wyoming to oilfield owners. Exxon's costs would be the direct costs of building and operating the pipeline less the effect of tax credits and accelerated depreciation, as well as the costs of treating and compressing the CO₂. If Exxon is sufficiently assured of a market strong enough to yield a satisfactory return on its investment, it is likely to want to build the project.

The public is concerned with the overall costs and benefits to society, which include the costs and benefits to Exxon, and other costs and benefits to society and the environment. For example, any environmental impacts that cannot be avoided make the project look worse to the public than to Exxon. Tax effects that reduce the costs to Exxon but not to society also make the project look worse to the public. The benefit to all oil consumers from the effect on price of a small increase in oil supply makes the project more favorable to the public than to Exxon. On balance, analysis of these factors seems to indicate that for this project private feasibility is likely to also ensure positive net benefits to society.

Marketability of CO₂ from the pipeline is uncertain at present. However, it is not likely that the project will be constructed unless the applicant is convinced the product is marketable and the project financially feasible. Approval of permits at this stage appears, therefore, to be reasonable.

DEMAND FOR CO₂

The project is designed to provide CO₂ for enhanced oil recovery (EOR) at oil fields in Wyoming, Montana, North Dakota and possibly Alberta. Potential markets have been identified at the Amoco Bairoil project in Wyoming, where two fields are slated for possible tertiary recovery; at the Shell Cedar Creek fields near Baker, Montana; and at Amerada Hess oil fields near Tioga, North Dakota. The Bairoil market is thought to be capable of using 150-200 million SCFD. The Cedar Creek field and the Amerada Hess project at Tioga together may use around 110 million SCFD. Additional markets up to 100 MMCFD may develop in Wyoming,

MARKETABILITY, NET BENEFITS, UNCERTAINTY

Montana, North Dakota and Alberta. However, the demand for CO₂ from the pipeline is not fixed but depends on various factors that are uncertain, and to some extent, unpredictable.

Completion of the project will enable the owners of these fields to conduct EOR. However, EOR will only take place in these fields if the field owners considered it economically feasible. For CO₂ miscible EOR to be feasible a number of physical requirements must be met. These relate to the conditions which will allow the maintenance of high enough pressures for CO₂ to mix with oil, and which will allow the mixture to move through the pore structure of the rock comprising the reservoir. The owners of the fields the applicant has designated as markets are still conducting and evaluating the results of field tests to determine the physical feasibility and to estimate the productivity of using CO₂ for enhanced oil recovery. Until these tests have been completed and evaluated, the demand for CO₂ will be uncertain.

For miscible CO₂ enhanced recovery to be economically viable, the relationship of costs and revenues must be favorable. Important factors in this relationship are the cost of CO₂, the quantity and costs of field facilities required for the enhanced recovery project, and fixed and variable operating costs. The productivity of the process in terms of MCF of CO₂ injection per barrel of additional oil produced, and the price of crude, will determine the cash flow of the project, its attractiveness to the field owner and hence whether the EOR project is implemented. If the economics are favorable the enhanced recovery projects will likely be implemented. The more favorable the economics of enhanced recovery, the greater will be the demand for CO₂ from the pipeline.

BENEFITS AND COSTS OF THE PROPOSED PIPELINE

In making a decision to commit resources to the pipeline in the expectation of future returns, it is necessary to compare the anticipated benefits and costs of the project to determine if the project is worth doing.

The calculation of costs and benefits conducted by the developer of a project focuses on those costs and benefits that will affect project owners. One purpose of the process mandated by the National Environmental Policy Act (NEPA), under which this EIS is written, is to ensure that other costs and benefits which may result from the project but which may not affect project owners, are given due consideration in decision making.

A benefit cost analysis conducted from the perspective of society as a whole would proceed as follows. The benefits would consist of the present value of the incremental production of crude oil, gas and natural gas

liquids plus the consumer surplus, which is the benefit to oil consumers of a small decline in crude oil prices associated with the increase in oil supply from EOR, plus any quantified environmental benefits. From this would be subtracted the present value of the costs of construction and operation of the pipeline, EOR facilities, and gas processing facilities, and the value of any quantified environmental costs. The resulting net present value would be a measure of the net benefits accruing to society over the life of the pipeline.

MARKETABILITY AND UNCERTAINTY

Analysis of the economic feasibility and attractiveness of the EOR projects will be conducted by the field owners after the field tests have been analyzed. The willingness of field owners to commit to purchases of CO₂ from the pipeline will depend on the results of their economic analysis, and will be sensitive to projections of the future price of oil, the costs of building and operating injection facilities, and the price of CO₂ from the pipeline.

A recent study (NPC 1984) by the National Petroleum Council, an advisory group to the Secretary of Energy, indicates that CO₂-based enhanced oil recovery appears to be reasonably promising even assuming prices for delivered CO₂ in the range of \$1.25-\$2.50 per Mcf. If the field tests turn out to be favorable for the effective use of the CO₂ technology and the other assumptions used in the NPC study are reasonable, it is likely that the markets for the pipeline will develop.

The willingness of field owners to purchase CO₂ from the Exxon pipeline will also depend on the availability and costs of alternatives. Amerada Hess has proposed a pipeline to serve some or all of the same targeted markets with CO₂ from the American Natural Gas coal gasification plant in Beulah, North Dakota. If this pipeline can deliver CO₂ more cheaply than the proposed pipeline, which seems unlikely, oil field owners in Montana and North Dakota may well choose it as their CO₂ source. If physical conditions permit, the oil field owners may also choose to wait for rising oil prices to improve the profitability of enhanced oil recovery, and hence to defer the start of their purchases of CO₂ from the pipeline.

Further, the amount and timing of CO₂ purchases from the proposed pipeline will depend on the field owners' ability to recycle the CO₂ after the recovery operations have begun. Recycling might require building gas treatment and compressor facilities to separate CO₂ from the other components of the produced gas and prepare it for reinjection. Recycling would reduce purchases of CO₂ from the pipeline in the later stages of enhanced recovery.

Given these uncertainties facing the owners of the oil fields, none has yet been willing to sign a contract to purchase CO₂ from the proposed pipeline. Some of the uncertainties will be resolved as more information becomes available, and if there is sufficient willingness to contract for delivery of CO₂ the pipeline will likely be built. Until this happens, however, the marketability for CO₂ from the proposed pipeline will be uncertain. Since the need for the project is to provide CO₂ for enhanced oil recovery at the target oil fields, need depends upon the use of CO₂ for this purpose being attractive to the field owners. The uncertainty surrounding the marketability of CO₂ thus extends to the need for the project.

Uncertainty also extends to the evaluation of the benefits of the project and the comparison of benefits and costs. Until the field evaluations are made it is not possible to predict how much CO₂ will be carried by the pipeline and the amount and timing of additional oil production due to CO₂ based enhanced recovery. It is also not possible to predict the costs of field facilities for EOR without knowing the number and size of EOR projects likely to be deemed attractive by the field owners. As discussed in the previous section estimates of these items are essential to the calculation of the net benefits of the project.

COMPARATIVE ANALYSIS

It is not possible at present to estimate the net benefits of the proposed pipeline, given the uncertainty surrounding the question of marketability of CO₂ from the pipeline at the target oil fields, and the absence of information on the cost of necessary field facilities at the Cedar Creek and Tioga oil fields. However, the following differences in direct pipeline costs can be compared for alternatives and combinations that could serve most of the markets identified for the proposed pipeline. (The proposed pipeline would have a capacity to serve 100 MMCFD in additional unidentified markets.)

TABLE 1
CAPITAL COSTS FOR ALTERNATIVES

Proposed Pipeline	Amerada Hess plus Amoco (Pipeline only)
\$270 million	\$135 million

¹ Montana DNRC estimate for Amerada Hess of \$76 million (192.5 miles at \$400,000 per mile), plus Amoco estimate of \$59 million for pipeline only. (Note that Amerada Hess has announced a project cost of \$51 million.)

The lower capital costs of the Amoco plus Amerada Hess alternative are mainly due to the shorter mileage of pipeline construction (346.5 vs 660 for the proposed pipeline). This must be offset by the higher cost and lower quality of CO₂ from the ANG gasification plant. CO₂ at the Shute Creek source is expected to cost about 50 cents/MCF. CO₂ from the ANG plant may cost as much as \$2.00/MCF. (Ref: *Enhanced Oil Recovery*, National Petroleum Council, 1984, Appendix E; *A Study of the Effects of the Proposed 6% Severance Tax on CO₂*, RE Ewing et al, Enhanced Oil Recovery Institute, University of Wyoming, 1985, Ch. 6). Other disadvantages of the ANG plant as a source are the cost of CO₂ cleaning, a possible 200 MMCFD limit on availability and possible uncertainty of supply associated with unscheduled maintenance shutdowns at the plant. The recent decision by ANG owners to abandon the plant to the U.S. Government creates great additional uncertainty over the plant as a source of CO₂.

Table 2 presents estimates of the capital component of the delivered cost of CO₂, assuming that the full capacity of each pipeline is marketable. There is a clear transport cost advantage to the Amerada Hess alternative. It would cost about 16.5 cents per MCF to transport CO₂ from the ANG plant to Tioga. The delivery of CO₂ from the Shute Creek field to Tioga would cost about 50.7 cents (plus a small cost for the 26.5 mile segment from Shute Creek to MP 0 on the Bairoil pipeline). This is a differential of just over 34 cents per MCF. However, the higher cost and lower quality of CO₂ from the ANG plant appear likely to outweigh its transport cost advantage by a significant margin.

The Exxon proposal can deliver CO₂ to Bairoil for less than half the cost of delivery by the Amoco alternative, 5.8 cents per MCF versus 14.3 cents. This is due to the ability to carry 2.5 times the volume of CO₂ at only a slightly higher construction cost.

The uncertainty about markets affects the comparison of alternatives. Exxon's cost advantage to Bairoil disappears if no markets exist at Baker and Tioga. If Exxon carries only 200 MMCFD from MP 0 to Bairoil the transport cost rises to 14.5 cents per MCF. This slight differential over the 14.3 cent cost from the Amoco pipeline for the same segment is probably insignificant.

If no market materializes at Baker, the cost of delivery from MP 0 to Tioga via the proposed pipeline rises to 76.9 cents per MCF. With no market at Baker the transport cost from ANG via the Amerada Hess line rises from 16.5 cents to 20.4 cents, raising the cost differential to about 56 cents per MCF. This is still likely to be insufficient to offset the difference in acquisition cost and quality of CO₂ at the source.

MARKETABILITY, NET BENEFITS, UNCERTAINTY

TABLE 2
THE COST OF TRANSPORTING CO₂ FOR ALTERNATIVE PIPELINES AND VOLUMES¹

Segment	Estimated Construction Cost ² (Millions)	Annualized Cost ³ (Millions)	Volume (MMCFD)	Transport Cost (\$/MCF)	Cumulative Transport Cost (\$/MCF from MP 0)
Amoco MP 0-Bairoil	\$ 59	\$ 10.4	200	\$.143	\$.143
Exxon MP 0-Bairoil	60	10.6	500	.058	.058
Exxon Bairoil-Baker	147	26.0	300	.237	.295
Exxon Baker-Tioga	66	11.6	150	.212	.507
Amerada Hess ANG-Killdeer	16(11)	2.8(1.9)	200	.038(.026)	NA
Amerada Hess Killdeer-Tioga	26(18)	4.6(3.1)	100	.127(.086)	.165(.112)
Amerada Hess Killdeer-Baker	33(22)	5.9(4.0)	100	.161(.109)	.199(.135)

¹ Cost figures represent only the amortized construction of each alternative and do not include operating, maintenance and compression costs or costs of acquiring CO₂ at the source.

² Cost estimates derived from Exxon's estimate of \$210m for 531 miles of pipeline from Bairoil to Tioga, or \$400,000 per mile. Mileage for Amerada-Hess pipeline segments estimated by Montana DNRC. Cost estimates in parentheses derived from media reports of \$51m project costs for Amerada-Hess.

³ Assumes 10 year amortization period and 12% return on investment.

AGENCY DECISION-MAKING AND UNCERTAINTY

The agency action for which this EIS is being prepared is the granting or refusal of right-of-way across public land and associated permits, and the routing of right-of-way, for the proposed pipeline if it is approved. Much of the information that will be used in making the decision, particularly information on need and the net benefits of the proposed action and alternatives, is subject to considerable uncertainty. The likelihood of markets developing for the CO₂ to be carried by the pipeline depends on field tests and analysis currently underway or not yet begun, and on economic analysis that will be conducted by oil field owners after the completion of the field tests. The cost of delivered CO₂ from the pipeline will vary depending on the volume of gas carried, which depends on the amount that be marketed. Furthermore, the recycling of the CO₂ injected into the fields may reduce future purchases by field owners to an extent unknown at present.

This uncertainty is important to agency decision makers, to the public, and to the project applicant. If some of the proposed markets do not materialize, then it is possible that attempts to recover costs from the remaining markets may reduce the amount of CO₂ sold or eventually increase the price of CO₂ beyond what the remaining markets are willing or able to pay. It is likely that the applicant will want considerable assurance of marketability before proceeding to commit the costs of actual construction of the facility.

This same uncertainty applies to the public and to agency decision makers. The public cannot be ensured that the public benefits exceed the costs. Further, agency decision makers cannot at this time be certain that it is worth committing public resources, such as public lands, to the project.

At this stage uncertainty appears to dominate attempts at analysis. Uncertainty about marketability and net benefits may not be a controlling factor in the permitting decision, however. From the applicants' perspective, permitting of the pipeline at this time is desirable primarily to speed up construction when and if it decides to proceed with the project. The information necessary for the owners to proceed with the major construction expenditures is in this case very similar to that necessary to demonstrate positive net benefits for the project.

While there is no certainty that the financial attractiveness of the project to the applicant ensures that benefits are greater than costs to society, it appears very likely that for this project the two are closely related. The difference between these two calculations are predominantly the following:

- a) Environmental benefits and costs, which the applicant ignores in calculating its own costs and benefits;
- b) Benefits to consumers from the small decline in the price of oil due to the small increase in overall oil supply. Since this benefit cannot be captured by

APPENDIX 3

the owners of the fields using the CO₂, it does not affect their demand for CO₂;

- c) The effects of tax credits and accelerated depreciation, which may make projects more attractive to an applicant though not necessarily to society; and
- d) Corporate Investors' preference for a high return on investment. This is equivalent to using a high discount rate, which tends to make projects less attractive to investors than to society.

Environmental studies of this project indicate there would be one environmental benefit (the reduced SO₂ emissions at Bairoil), and no major environmental costs that could not be alleviated. It is not possible to estimate the balance of the other three items. It appears likely, but not certain, that the effect of external consumer benefits and the high discount rate would outweigh the effect of the taxes and subsidy. Therefore, the net benefits to society are likely to be greater than those to the applicant. If the product is marketable for the applicant, the society as a whole is likely to benefit.

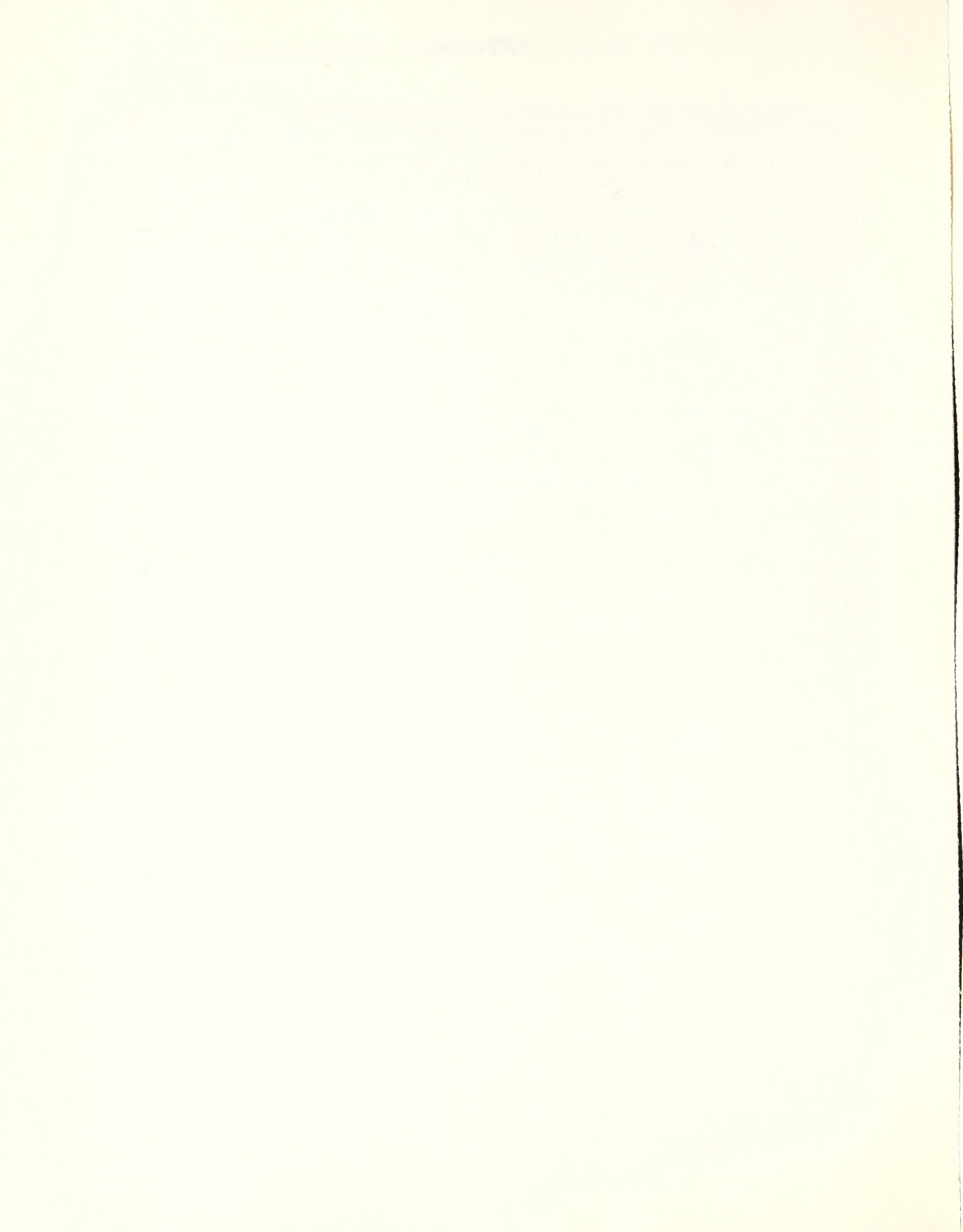
There remains some residual risk associated with approval, but it does not appear to be very great. Neither costs nor benefits can ever be known in advance with certainty; many unpredictable factors will affect them. Even a project which is expected to provide benefits greater than costs will carry with it some risk of loss, if

outcomes are unfavorable. The magnitude of this risk must be evaluated, along with the expected costs and benefits, in deciding whether to permit the project.

The sequential nature of the federal permitting process also provides assurance that public resources will not be committed unless the demand for CO₂ is sufficient for marketability. The decision to grant right-of-way across federal lands is conditional upon approval of construction plans and environmental mitigation, and no encumbrance on public land is granted until construction begins. If the project is abandoned, no legal rights to public lands will remain outstanding.

CONCLUSION

Approval of the application for granting the right-of-way across public land, given the uncertainty over need and net benefits of the project, involves a commitment of public resources and a risk that environmental damage may be incurred without an offsetting public benefit. However, it is unlikely that, even after permitting, the pipeline will actually be built unless there is reasonable assurance of marketability. Since the same information will determine whether the CO₂ is marketable and whether the project is likely to have positive net benefits, and since most of the environmental impacts are likely to be mitigated under the construction permit stipulations, approval at this time does not necessarily commit society to excessive risk.



APPENDIX 4

PROVISIONS AND MEASURES DESIGNED TO REDUCE ENVIRONMENTAL IMPACTS

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APPENDIX 4—PROVISIONS AND MEASURES

U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT

Required General Resource Measures

As a condition for granting rights-of-way and permits, the authorizing agencies require that certain terms and conditions be met. The general federal resource measures as presented here will be incorporated into the applicants' plans of operations. As project plans are completed and before they are authorized the authorizing agencies will add specific requirements.

1. SOILS AND VEGETATION

- a. Existing soils and geological data will be gathered by the company and used to achieve maximum revegetation and minimum soil erosion.
- b. Pipeline construction is subject to suspension during the wet season. Construction schedules will be approved by the authorized officer.
- c. Where practical, pipeline construction will avoid areas subject to mudflows, landslides, mudslides, avalanches, rock falls, and other types of mass movement. Where avoidance is not practical, the design, based upon detailed field investigations and analyses, will provide measures to prevent accelerated mass movement. A full-scale engineering diagram and staking must be completed in these locations. If a slide occurs, repair of damages will be the responsibility of the company, which will submit a plan for such restoration to the authorized officer for approval.
- d. Brush- and tree-covered areas will be precleared before dozer and maintenance blade work. In pre-clearing, brush and trees will be cut and removed to a designated area.
- e. Applicants will comply with regulations and procedures as required by BLM, states, and local weed and pest control districts.
- f. Topsoil will not be stripped from the general construction right-of-way but will be stripped from areas requiring excavation for level working surface such as sideslopes and creek crossings. All excavated topsoil will be protected to reduce potential mixing with subsoil.

2. AGRICULTURE

- a. To prevent interference with livestock trailing, construction will be coordinated between the company, livestock operators, and the authorized officer.

- b. Gaps (no less than 50 feet) will be left between adjacent lengths of pipe at suitable intervals and at well-defined trails to permit livestock and vehicles to pass during the time interval between stringing and other construction operations.

3. TRANSPORTATION NETWORKS

- a. The pipeline rights-of-way will be used as access roads only when needed during construction and only during emergencies after completion. Uses will be only as approved by the authorized officer. To avoid compaction, off-road, off-route travel through the vegetation will be controlled when the soil is wet.
- b. The company will control off-road vehicle use on the rights-of-way. Specified control could include physical barriers, replanting of trees, or other reasonable means.
- c. The company will not lock or close gates or cattle guards on established roads on public land unless the gates or cattle guards were originally locked or closed.
- d. The company will comply with existing federal, state, county, and private requirements developed for protecting all facilities. Load limit restrictions will vary from state to state, with each type of roadway and the time of the year. These restrictions could limit the hauling of heavy loads on specific roadways during specified times.

4. WATER RESOURCES

- a. When rivers, streams, and washes need to be crossed for access to project facilities, existing roads or bridges will be used unless an alternative is designated by the authorized officer. Culverts, bridges, or rock fords will be installed where new permanent access roads cross live streams to allow fish unobstructed passage. Where temporary roads cross drainages (ephemeral streams) or dirt fills, culverts or rock crossings will be installed during construction and removed upon completion of the project. Any construction in a perennial stream is prohibited unless specifically allowed by the authorized officer. All stream channels and washes will be returned to their natural states.
- b. Construction equipment will be refueled and maintained outside of stream channels, in areas designated by the authorized officer.

BLM REQUIRED MEASURES—WILDLIFE

- c. Water used for the hydrotest will be obtained and disposed of in accordance with applicable regulations. Permits for acquisition and disposal will be obtained from the agency or agencies of jurisdiction.

5. WILDLIFE

- a. Building of pipeline crossings through perennial streams that support naturally spawning gamefish will be timed to avoid in-stream construction during the spring and fall spawning and incubating periods. To protect rainbow trout, no in-stream construction will be allowed from April 1 to June 30. To protect brown and brook trout, no in-stream construction will be allowed from October 1 to December 31. Any exceptions must be approved by the authorized officer.
- b. The company will allocate enough funds and time before building any project element and related facilities to perform Fish and Wildlife Service approved inventories for any listed threatened or endangered species. If it is determined that listed species or their habitats may be present and could be affected by the proposal, appropriate consultation with the Fish and Wildlife Service will be conducted by the federal authorizing agency. No activities will be authorized until consultation is complete as specified by Section 7(c) of the Endangered Species Act. The biological opinion issued by the Fish and Wildlife Service as a result of the consultation will detail the mitigation measures to be carried out by the company.
- c. The company will comply with existing county, state, and federal laws to protect and preserve feral horses, feral burros, raptors, and game and nongame wildlife.
- d. To protect big game winter range and prevent wildlife harassment during the critical winter and calving/fawning periods, construction will be allowed only from April 1 to December 15 on winter ranges and from July 1 to May 1 on calving/fawning habitat. This limitation does not apply to right-of-way maintenance and operation. Any exceptions to the requirement must be obtained in writing from the authorized officer.
- e. No construction, disturbing activities, or the building of permanent facilities will be permitted within the prescribed distance or during the breeding/nesting period of the following:

Raptor	Distance	Dates
Bald Eagle	1.2 miles	March 1 - July 15
Golden Eagle	0.6 mile	March 1 - July 15
Red-Tailed Hawk	0.3 mile	April 1 - July 15
Swainson's Hawk	0.6 mile	April 1 - July 15
Ferruginous Hawk	1.2 miles	April 1 - July 15
Goshawk	0.6 mile	April 1 - July 15
Prairie Falcon	0.6 mile	April 1 - July 15
Cooper's Hawk	0.6 mile	April 1 - July 15
Merlin	0.6 mile	May 1 - August 15
Harrier	0.6 mile	April 1 - July 15
Burrowing Owl	0.6 mile	April 15 - July 15
Long-Eared Owl	0.5 mile	April 1 - July 1

Changes to any of these limitations may be approved in writing by the authorized officer in consultation with state fish and wildlife management agencies and the Fish and Wildlife Service.

- f. Active raptor nests near the pipeline will be located according to the techniques and timing detailed in *Nesting Habitats and Surveying Techniques for Common Western Raptors* (Call 1978).
- g. Pole type designs will be raptor safe according to *Suggested Practices for Raptor Protection on Powerlines for Power Transmission Lines* (Olendorff 1981).
- h. No occupancy or other surface disturbance will be allowed within 2 miles from the center of a sage grouse strutting ground (lek) from March 1 through June 30 unless permitted by the authorized officer.
- No occupancy or other surface disturbances will be allowed within 2 miles of the center of a sharp-tailed grouse dancing ground from March 15 through July 1 unless permitted by the authorized officer.
- i. Active grouse leks near the pipeline will be located according to techniques detailed in *BLM Manual* Section 6600, Wildlife (Specifically, Section 6601-3 Species Life History and Habitat Requirements—Sage Grouse).
- j. Prairie dog colonies on the proposed project route will be surveyed for the presence of black-footed ferrets, using Fish and Wildlife Service approved techniques before completing final engineering plans. If black-footed ferrets are present, the company will consult with the Fish and Wildlife Service; Wyoming Game and Fish Department; Montana Department of Fish, Wildlife, and Parks; North Dakota Game and Fish Department; and any BLM District as appropriate before proceeding.

APPENDIX 4—PROVISIONS AND MEASURES

- k. In the event of a CO₂ break and fish kill in a river, stream, or lake containing fish resources, the company will work with the state game and fish agency to determine the value of the fishes killed and to reimburse the agency for that amount.
- l. On certain streams, the following may be required by the Authorized Officer. In order to reduce impact on riparian vegetation, maintain structural diversity and speed recovery of overstory at stream crossings, mature shrubs encountered on the ROW in riparian zones should be removed with a backhoe or loader retaining as much of the root mass as possible. These should then be reset in similar sites adjacent to the ROW or replaced on the edge of the ROW in adequate excavations as soon as possible after removal. This would not apply to such shrubs as sagebrush, greasewood, snowberry, but would apply to willow (*Salix* spp.), waterbirch (*Betula occidentalis*), chokecherry (*Prunus* spp.), Hawthorne (*Vateagus* spp.), Rocky Mtn. Maple, *Acer tabrum*, Cottonwoods or Aspen (*Populus* spp.) less than 4 inches DBH and similar species encountered in riparian zones.

6. CULTURAL RESOURCES

As the lead agency for the project, the BLM is presently negotiating a Memorandum of Agreement (MOA) with the Advisory Council on Historic Preservation and State Historic Preservation Officers for Wyoming, Montana, and North Dakota (Appendix 8). This MOA will specify procedures required for the identification, evaluation, and treatment of significant cultural resources which may be affected by the projects. BLM and appropriate surface management agencies will ensure that stipulations specified in the MOA are implemented as conditions to the federal compliance with Sections 106 and 110 of the National Historic Preservation Act (16 U.S.C. 470) and its implementing regulations (36 CFR 800).

7. PALEONTOLOGY

- a. The company will provide a qualified, professional paleontologist subject to approval by the authorized officer. This paleontologist will intensively survey all sensitive formations found along the route by the authorized officer. Surveys will be completed on the identified areas before construction begins.
- a. The applicant will submit a report of paleontological investigation to the authorized officer detailing the results of the survey with recommendations for avoiding or mitigating significant paleontological deposits, which may be affected by the projects. The authorized officer will review the

report and make final decisions regarding treatment of paleontological resources. The applicant will implement the required mitigation measures before construction begins.

- c. The holder of this authorization shall immediately bring any paleontological resources or fossils discovered as a result of operations under this authorization to the attention of the authorized officer. The holder shall suspend all activities in the vicinity of such discovery until notified to proceed by the authorized officer. The authorized officer will evaluate, or will have evaluated, such discoveries not later than 5 working days after being notified, and will determine what action shall be taken with respect to such discoveries. The decision as to the appropriate measures to mitigate adverse effects to significant paleontological resources will be made by the authorized officer after consulting with the holder. The holder may be responsible for the cost of any investigations necessary for the evaluation, and for any mitigative measures.

8. AIR QUALITY

Where the pipeline crosses or parallels public highways, major access roads and the cleared pipeline right-of-way will be watered or other approved dust abatement procedures will be used to maintain air quality, to prevent severe wind erosion and for safety purposes

9. VISUAL RESOURCES

- a. All aboveground structures not subject to or otherwise conflicting with safety requirements will be painted by the company to blend with the natural landscape. The paint used will be a color or colors that simulate *standard environmental colors* designated by the Rocky Mountain Five-State Interagency Committee (Wyoming 1982). The color(s) selected for this project, including name and Munsell Soil Color Number, will be included in the Construction and Operation (CO) Plan.

10. LAND USES

- a. Construction and right-of-way maintenance will disturb to the least possible extent such improvements as fences, roads, and watering facilities. If improvements are damaged, the company will immediately act to restore them to at least their former condition. Functional use of these improvements must be maintained at all times.

REQUIRED RECLAMATION AND EROSION CONTROL

- b. If a natural barrier used for livestock control is broken during construction, the company will adequately fence the area to prevent livestock drift. In pronghorn ranges, the fence will be built to allow pronghorn to pass. Fence specifications will be determined on a case-by-case basis.
- c. All fencing built by the company will meet BLM requirements.

11. WASTE DISPOSAL

- a. Construction sites will be maintained in a sanitary condition at all times; waste at those sites will be disposed of promptly at an authorized site. *Waste* means all discarded matter, including human waste, trash, garbage, refuse, oil drums, petroleum products, construction materials, ashes, and equipment.
- b. A litter policing policy will be developed, approved by the authorized officer, and followed on all project roads and sites.
- c. Oil waste, toxic materials, and solid or liquid wastes will be dumped only in authorized waste disposal sites. No burying of debris or waste materials will be allowed, except as specified by the authorized officer.

12. MISCELLANEOUS

- a. An on-site prework conference will be held before any earth disturbance. This conference will be attended at a minimum, by an authorized representative of the company, the dirt contractor, and the authorized BLM officer. The company is responsible for scheduling and holding this meeting early enough to resolve any potential problems before construction.
- b. The company will notify BLM of the starting date for construction before any earth disturbance, preferably at the prework conference.
- c. The company will do everything reasonably within its power and will require its employees, contractors, and employees of contractors to do everything reasonably within their power, both independently and upon request of BLM, to prevent and suppress fires on or near the lands to be occupied under this permit.
- d. When all development and rehabilitation have been completed, a joint compliance check of the right-of-way will be made by the company and the authorized officer or designated representative to determine compliance with the terms and conditions of

the grant. The company will perform, at its own expense, any required changes or additional reclamation work to comply with the terms of the grant.

- e. The company will submit an *as built* survey map to the authorized officer within 60 days after construction is completed.
- f. Before beginning pipeline operations, the company will submit to the authorized officer a certification of construction, verifying that the pipeline system has been built and tested in accordance with the terms of the right-of-way grant and in compliance with the required plans and specifications and applicable federal and state laws and regulations.
- g. Whenever the authorized officer finds a weed-control problem, the company will be responsible for weed control on disturbed areas within the exterior limits of the grant. The company is responsible for consulting with local county weed and pest supervisors for the most appropriate weed control methods.
- h. The company will comply with the applicable federal and state laws and regulations concerning the use of pesticides (insecticides, herbicides, fungicides, rodenticides, or other similar substances) in all activities/operations under this grant. The company will obtain from the authorized officer approval of a written plan before the use of such substances. The plan must identify the type and amount of material to be used; the pest to be controlled; the method of application; the location for storage and disposal of containers; and other information that the authorized officer may require. The plan will be submitted no later than December 1 of the year before the year for which treatment is proposed (December 1, 1983 deadline for a 1984 treatment). If need for emergency use of pesticides is identified, the use must be approved by the authorized officer. Substances applied on or near the right-of-way will be used in accordance with the approved plan and only in accordance with its registered uses and any limitations imposed by the Secretary of the Interior. Pesticides will not be permanently stored on public lands authorized for use under this grant.

Required Reclamation and Erosion Control Procedures

The following procedures will be required for use on federal land. The company has stated it would follow or has agreed to follow these procedures on all federal, state, and private lands as appropriate and agreed to by the landowner. The procedures outlined in this appendix

APPENDIX 4—PROVISIONS AND MEASURES

will be incorporated as stipulations in any federal right-of-way grant that may be issued, and will be used by the company to develop their construction and operation (CO) plan. These procedures will be applied during all phases of the project (construction, operation, and abandonment).

1. The company will comply with the erosion control and reclamation programs it has developed and will follow through on its commitment to *comply with appropriate regulations and required plans and stipulations to protect and restore any land disturbed by project construction and operation to a stable, productive, and aesthetically acceptable condition.*
2. The company will develop a detailed, site-specific reclamation plan as part of its CO Plan. Because the proposed rights-of-way would cross many types of terrain, soils, vegetation, land uses, and climatic conditions, the detailed plan will include sets of techniques and measures tailored to each condition found. Local expertise and locally effective reclamation methods will be followed when the specific procedures for the detailed reclamation plan are developed. The erosion control, revegetation, and restoration guidelines and CO plan will be implemented under the direction of the authorized officer.
3. Details on applicable techniques of erosion control and reclamation to technically assist private landowners will be obtained as required by the private landowner from local Soil Conservation Service districts. Technical assistance and approval of written plans for federal lands will be obtained from BLM before any construction.
4. During project construction, the company will employ an on-site reclamation specialist to provide (a) liaison with private landowners, federal agency officials, and local governments; (b) expertise for directing restoration procedures when special conditions are found, without causing construction delays; and (c) favorable public relations.
5. General erosion control and restoration measures have been developed for the following areas:
 - Right-of-way and Site Clearing
 - Trenching and Preservation of Topsoil
 - Backfilling and Grading
 - Land Preparation for Seeding and Cultivation
 - Revegetation
 - Maintenance and Monitoring
 - Use of Biochemicals
6. On public land a standard 75-foot construction right-of-way will be granted. A wider right-of-way will be granted where needed and approved by the

authorized officer only after project plans are completed and on a case-by-case basis.

RIGHT-OF-WAY AND SITE CLEARING

Emphasis will be placed on protecting existing vegetation and minimizing disturbance of the existing environment.

- Land will be graded only on the area required for construction.
- Sidehill cuts that are approved in the CO plan will be kept to a minimum to ensure resource protection and a safe and stable plane for efficient equipment use. The authorizing agency will provide assistance as needed.
- Existing ground cover, such as grasses, leaves, roots, brush, and tree trimmings, will be cleared and piled only to the extent necessary. Slash will be piled and later shredded and chipped for use in restoration operations or disposed of at the discretion of the authorized officer.
- Trees and shrubs that are not to be cleared from the right-of-way will be protected from damage during construction.
- Where the right-of-way crosses streams and other water bodies, banks will be stabilized to prevent erosion. Construction techniques will be designed to minimize damage to shorelines, recreational areas, and fish and wildlife habitat.
- A buffer strip of terrestrial vegetation above the high water line will be left between work staging areas next to the stream and the stream itself.
- Care will be taken to avoid pollution in all areas including streams and other water bodies and in their immediate drainage areas. Spills will be cleaned up as required by the authorized officer or landowner.
- Design and construction of all temporary roads will be based on an approved transportation plan and will ensure proper drainage, minimize soil erosion, and preserve topsoil. After abandonment, these roads will be closed and the areas restored without unnecessary delay or maintained at the discretion of the landowners. Restoration, including redistribution of topsoil, will be to the satisfaction of the landowner, regulatory officials, or both.
- During wet and muddy conditions, as determined by the on-site reclamation specialist, the authorized officer will issue stop and start orders to prevent

REQUIRED RECLAMATION AND EROSION CONTROL

rutting or excessive tracking of soil and deterioration of vegetation in the right-of-way.

- During construction near streams or lakes, sedimentation (detention) basins, straw bale filters, or both will be built to prevent suspended sediments from reaching downstream watercourses or lakes, as required by the authorized officer.
- Construction will immediately follow clearing, especially where soils are highly susceptible to wind or water erosion and in other special areas.

TRENCHING AND PRESERVATION OF TOPSOIL

To facilitate complete project site reclamation, surface soil and favorable plant growth material will be removed from disturbed land within the project area as necessary (See Glossary for definitions.) Stockpiles will be mulched as necessary and seeded to reduce wind and water erosion. Trenching methods and techniques will ensure that

- Topsoil will be removed from the trench area by double-ditching or other company-proposed methods approved by the authorized officer. Topsoil needs to be windrowed separately, protected, and replaced last during backfilling.
- Remaining unearthed materials will be removed and stored to facilitate backfilling, will use the smallest possible right-of-way area, and will protect the excavated material from vehicle and equipment traffic.
- Cofferdams or other diversionary techniques will be used where needed to permit flow in one part of a stream while pipe is being laid in another part.
- A specific trenching and excavated material stockpiling procedure will be used on steep-sloping and rough, broken terrain to ensure the least disturbance as outlined in the CO plan. This procedure will be developed by both the authorized officer and the company.

BACKFILLING AND GRADING

- Backfill will be replaced in a sequence and density similar to the preconstruction soil condition.
- Areas will be backfilled in a manner that will reduce further vegetation disturbance.
- The ground contour will be restored to permit normal surface drainage.

- In steeply sloping and steep terrain, erosion control structures such as water bars, diversion channels, and terraces will be built to divert water from the pipeline trench and reduce soil erosion along the right-of-way and adjoining areas disturbed during construction. All water bars will extend at least 5 feet beyond the disturbed area.
- All structures such as terraces, levees, underground drainage systems, irrigation pipelines, and canals will be restored to preconstruction conditions so that they function as originally intended.
- The surface will be graded to conform to the existing surface of the adjoining areas except for a slight crown over the trench to compensate for natural subsidence. In cropland areas, especially border-and furrow-irrigated cropland, the soils (backfill) within the trench will be compacted and the crown smoothed to match the bordering area and allow surface irrigation.
- Topsoil will be uniformly replaced over the trench fill and other disturbed areas to restore productivity to preconstruction conditions.
- Materials unsuitable for backfilling or excess backfill material will be disposed of as arranged by the authorized officer.
- Temporary work space or staging areas used at stream and highway crossings and at other special sites will be restored to approximate preconstruction conditions and to the satisfaction of the authorized officer.
- The rights-of-way at stream crossings will be restored as nearly as possible to preconstruction states soon after completion of construction. The upland areas and banks will be revegetated to preconstruction conditions; where such revegetation is not possible, these areas will be mulched with rock that is larger in diameter than materials excavated from the trench. The streambed will be returned to its original contours with sediments similar to those excavated and as approved by the authorized officer. All drainages crossed by the pipeline will be kept free of vegetative debris, and channels will be reopened following construction.
- For rights-of-way through steep terrain or wet areas, land must be graded at two elevations (two-toning), or diversion dams built, or other company proposed methods used to facilitate construction, as approved by the authorized officer. The areas will be contoured upon completion of construction to resemble the original grade as nearly as possible and as agreed to by the authorizing officer in consultation with the company.

REQUIRED RECLAMATION AND EROSION CONTROL

LAND PREPARATION FOR SEEDING AND CULTIVATION

Construction, backfilling, and grading commonly cause compaction and later soil conditions that could affect soil productivity, seeding success, or both in the right-of-way. The following practices will be used to improve these soil conditions, protect soil from erosion, and provide a favorable seedbed:

- As required by the authorizing agency or landowner, subsoiling or chiseling will be used in cropland to ensure that soil compaction is reduced and preconstruction soil permeability restored.
- Chiseling will be used in rangeland to reduce compaction and improve soil permeability unless the landowner or authorizing agency objects. Pitting the contour furrowing as directed by the authorizing agency or landowner, will be done on disturbed areas with steeper slopes to increase infiltration and to reduce runoff and erosion.
- Suitable mulches and other soil stabilizing practices will be used on all regraded and topsoiled areas to protect unvegetated soil from wind and water erosion and to improve water absorption. Areas and types of mulches will be identified by the company in the CO plan and approved by the authorized officer.
- Special mulching practices or matting will be needed to protect seeding, seedlings after germination, and plantings in critical areas where wind and water are serious erosion hazards.
- Commercial fertilizers will be applied to soil areas with low inherent fertility and where woody materials are chipped and used as mulch, to maintain crop yields and establish grass seedings. Application rates will be commensurate with annual precipitation and available irrigation water. The company will identify areas needing commercial fertilizers in the CO plan.
- Seedbeds for areas seeded to grass will be prepared so that they will provide a suitable condition for establishing grass stands.
- Rock mulches may be used as determined in the CO plan in steep-sloping rock outcrop areas and low precipitation areas to reduce erosion and promote vegetation growth.
- Cultivation and land preparation operations will be conducted on the contour on steeply sloping areas to reduce erosion.
- Soil with rock fragments such as very coarse gravel, cobble, or stone scattered on the surface

will be restored to the original preconstruction surface condition to blend with the adjoining area, to avoid a smooth surface right-of-way, and to control accelerated erosion.

REVEGETATION (RESEEDING AND PLANTING)

As soon as possible after disturbance occurs, all disturbed areas will be reshaped and revegetated as nearly as possible to their original condition or to a condition agreed upon by both the company and the authorized officer. Revegetation efforts will continue until a satisfactory vegetation cover is established. The following practices and techniques will be used where reseeding is suitable, as determined by the authorizing agency:

- A firm seedbed will be prepared before seeding. This seedbed will include a mulch of plant residues or other suitable materials. A cover crop may be needed in larger disturbed areas.
- Seed will be planted by drilling, broadcasting, or hydroseeding. Wherever possible, seeds will be planted by drill. Drill seeding with a grass drill equipped with depth bands will be used where topography and soil conditions allow, to meet the seeding requirements of the species being planted. Broadcast seeding will be used in inaccessible or small areas when broadcasting the amount of seed used in drilling will be doubled. Seed will be covered by raking or harrowing. Critical areas will be hydroseeded as determined by the reclamation specialist or authorized officer.
- Only species and species varieties adaptable to local soil and climatic conditions, generally native species, will be used, but introduced species may be considered for specific conditions when approved by the landowner and regulatory authority. Seeding rates in critical areas will be increased by 100 percent or more over regular seeding rates to compensate for seed mortality from adverse growing conditions.
- Seeds will be tested to meet federal, state, and agency requirements.
- Areas will be seeded when seasonal or weather conditions are most favorable and as determined by the landowner or authorized officer.
- Grazing or mowing will be delayed at least one season after seeding, especially in highly erodible areas, to provide time for vegetation to become established unless otherwise agreed upon by the landowner or lessee and the authorized officer. Protective fencing may be needed in special areas as agreed upon and will be built, maintained, and removed according to authorizing agency or landowner specifications.

FOREST SERVICE MEASURES

- In areas of low annual precipitation (generally less than 8 to 10 inches), erosion control structures and measures will be applied on sloping areas to reduce accelerated erosion and to allow reestablishment of preconstruction surface soil conditions and natural revegetation.
- Trees and shrubs will be reestablished in areas as specified in the revegetation plan. Temporary or permanent structures or both will be installed by the company at specific locations along the right-of-way and at other disturbed sites to prevent off-road vehicle access.

MAINTENANCE AND MONITORING

The applicant and authorized officer will jointly inspect the reclaimed areas to monitor the success and maintenance of erosion control measures and revegetation programs on native grazing land for a period determined by the landowner on private land or the authorized officer on state or federal land. The monitoring program will identify problem areas and corrective measures to ensure

cover and erosion control. Successful revegetation and erosion control will be certified by the landowner or authorized officer.

USE OF BIOCHEMICALS

Biochemicals such as herbicides, fungicides, and fertilizers will be applied by ground rather than aerial methods, in compliance with state and federal laws, regulations, and policies regarding the use of poisonous, hazardous, or persistent substances. State and federal wildlife agencies will be contacted if any of these substances will be applied on or near sensitive wildlife areas. Before these substances are used on or near the permit or grant area, the company will obtain approval of a written plan for such use from the authorized officer, landowner, or appropriate wildlife agency. The plan will outline the kind of chemical, method of application, purpose of application, and other information as required, and will be considered as the authorized procedure for all applications until revoked by the authorized officer, landowner, or appropriate wildlife agency. This plan will become part of the CO plan.

U.S. DEPARTMENT OF AGRICULTURE, FOREST SERVICE, LITTLE MISSOURI NATIONAL GRASSLANDS

General Measures

The specifications are included as a basis for control of construction and rehabilitation, operation, and maintenance of the pipeline right-of-way. These controls are within the constraints of the Multiple Use Plan for the Badlands Planning Unit and Rolling Prairie Units, Custer National Forest.

1. Pipeline right-of-way for construction shall be limited to 75 feet. Center line location will be designated and approved by the District Ranger of the Forest Service at either Dickinson or Watford, North Dakota. Right-of-way width for operation and maintenance shall be limited to 20 feet.
2. An on-site prework conference shall be held prior to any earth-disturbing activities. This shall include, at a minimum, the permittee/operator or his authorized representative, the dirt contractor, and the authorized Forest Service officer. The permittee/operator is responsible for scheduling and holding this meeting in a timely manner sufficient for resolving any potential problems prior to actual construction.
3. The Forest Service District Ranger shall be notified of the starting date for construction prior to any

earth-disturbing activities. Preferably this should be determined at the prework conference.

4. All pipeline construction activities are subject to immediate suspension during periods of wet weather. The normal wet season in this area is from March 1 to June 1. No construction will be allowed between these dates without the District Ranger's approval.

During below-freezing weather, when the topsoil and subsoil are frozen solid, all pipeline construction activities will be suspended immediately unless approval to proceed has been granted by the District Ranger.

5. Non-ferrous pipe that is not encased must have an electrically conductive wire or other means of locating the pipe while it is underground.
6. Related facilities such as pumping stations, compressor stations, and compressor sites will be fenced to Forest Service standards.
7. Outdoor lighting fixtures will be allowed on facilities but may only be used when personnel are present on location.

APPENDIX 4—PROVISIONS AND MEASURES

8. Topsoil shall not be stripped from the general construction right-of-way. Topsoil shall be stripped from areas requiring excavation for level working surface such as side slopes and creek crossings. All excavated topsoil shall be protected to reduce potential mixing with subsoil material.
9. Depth of backfill from surface to the top of the pipe shall be no less than 4 feet. Backfill is to be compacted in 1-foot lifts.
10. Pass-throughs to allow cattle access to either side of right-of-way will be provided at a minimum as follows:

2 per mile near stock tanks or dams.

1 per mile in open range country.

11. Pesticides or herbicides may not be used to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, etc., without the prior written approval of the Forest Service District Ranger. A request for approval of planned uses of pesticides will be submitted annually by the permittee/operator on the due date established by the Forest Supervisor. The report will cover a 12-month period of planned use beginning 3 months after the reporting date. Information essential for review will be provided in the form specified. Exceptions to this schedule may be allowed, subject to emergency request and approval, only when unexpected outbreaks of pests require control measures which were not anticipated at the time an annual report was submitted.

Only those materials registered by the U.S. Environmental Protection Agency for the specific purpose planned will be considered for use on National Forest System lands. Label instructions will be strictly followed in the application of pesticides and disposal of excess materials and containers.

12. When construction or maintenance of pipelines or related facilities occurs within an existing road right-of-way, it is the permittee/operator's responsibility to obtain prior written permission from the holder of any easement, project work agreement, special use permit, or encroachment permit of the affected portion of the road. Following construction or maintenance activities, the permittee/operator shall return the roadway to its original condition, including compacting, seeding, and surfacing, if necessary. The permittee/operator is also responsible for any future road reconstruction or maintenance needs resulting from this activity, such as compaction necessitated by pipeline settling, unless released from this liability by the holder of the applicable easement, project work agreement, special use permit, or encroachment permit.

13. Cleanup of right-of-way shall consist of restoring entire length to as near original condition as possible. All slopes and contours will be shaped and smoothed near original contour.
14. Stockpiled topsoil will be replaced and evenly spread over exposed subsoil to the extent practicable.
15. Revegetation on all favorable sites or on areas where ground cover was destroyed during construction will consist of the following mixture:

MCKENZIE RANGER DISTRICT

Species	Pounds/Acre (Pure Live Seed)
Streambank wheatgrass	8
Pubescent wheatgrass	10
Standard crested wheatgrass	5
Oats or rye (cover crop)	20

MEDORA RANGER DISTRICT

Species	Pounds/Acre (Pure Live Seed)
Streambank wheatgrass	8.4
Pubescent wheatgrass	9.7
Standard crested wheatgrass (<i>Agropyron desertorum</i>)	5.0
Sheep fescue (<i>Festuca ovinsa</i>)	1.0
Sand dropseed (<i>Sporobolus cryptandrus</i>)	0.5

16. Seed mixture shall be certified. A certified copy shall be supplied to Forest Service prior to planting.
17. Seeding or planting will be done between the dates of April 1 to May 15 or October 1 to November 15 in a manner which the District Ranger considers to have the best chance of success and will be repeated annually until such areas are accepted in writing by the District Ranger as satisfactorily revegetated and stabilized. Shrubs and trees will be planted as early as possible in the spring.

Replaced topsoil should be evenly spread over the area to be seeded. The seed bed should be thoroughly worked, firm and free of clods. Drill row spacing should be 2 inches. Seeding depth should be 1/2 inch. Seeding deeper than 1 inch would result in a poor stand.

18. The permittee/operator shall be responsible for the prevention and control of soil erosion and gullyng on the area covered by this permit and lands adjacent thereto and shall provide preventive measures as required by the following specifications:

FOREST SERVICE MEASURES

- a. Normal cut and fill ratios for pipeline construction will be as follows:

Cuts 0-10 feet high	3:1
Cuts 10 feet and over	2:1

Abnormal situations such as hogback ridges, V-draws, etc., will take special considerations to be approved in writing by the District Ranger.

- b. Following refilling of the trench, care will be taken to eliminate all berms to prevent concentration of water on the disturbed area.
- c. After refilling the trench, waterbars will be constructed at approximately the following intervals:

Percent of Slope	Waterbar Intervals—Feet
0-5	150
5-10	110
10-20	90
20-30	80
30+	70

- d. When pipelines are laid vertically down a slope, adjacent waterbars should spill water to opposite sides of the disturbed area to avoid concentration of water.
- e. All waterbars should extend at least 5 feet beyond the disturbed area.
- f. Waterbars should not be constructed in locations that will cause water to drain on fill slopes.
- g. Mulching may be required on disturbed slopes. These sites will be mulched using clean straw or native grass hay.
19. The permittee/operator shall do everything reasonably within its power and shall require its employees, contractors, and employees of contractors to do everything reasonably within their power, both independently and upon request of the Forest Service, to prevent and suppress fires on or near the lands to be occupied under this permit.
20. All structures shall be painted to blend with the surrounding land features. Paint colors shall be approved by the District Ranger at Dickinson or Watford City, North Dakota.
21. All debris, such as wire, cans, pipe, cable, etc., shall be removed from the construction site and disposed of as approved by the District Ranger at Dickinson or Watford City, North Dakota. Garbage will be disposed of in an approved facility.

22. In the event of any loss of hydrocarbons from any facility, the District Ranger at Dickinson or Watford City, North Dakota shall immediately be notified.
23. Hydrocarbon cleanup operations will be approved by an authorized Forest Service representative prior to cleanup.
24. All pipelines, power lines, and telephone lines shall be installed 10 feet from existing lines unless otherwise authorized by the District Ranger at Dickinson or Watford City, North Dakota due to topographic or spacing constraints.

Fire Equipment and Requirements for Crews Working on the Little Missouri National Grasslands

1. Exhaust systems of vehicles shall have an acceptable muffler and shall be in proper working condition.
2. Fire extinguishers: Type ABC: One 2 lb. per pickup - or - One 5 lb. for drill rigs & trucks over 1 T. GW One 10 lb. per dozer, motor patrol, scraper, or other earthmoving equipment.
3. Each vehicle shall carry a shovel and axe and one of the following (per person):
 - a. Backpack water pump - 4 or 5 gal. (Indian or equiv.) - or -
 - b. Burlap bags in a 10 gal. or larger container of water - or -
 - c. Fire swatter/fire brooms
4. All smoking will be done inside of vehicles or in areas cleared of flammable material.
5. Each welding crew will have available a ground tanker of not less than 300 gal. capacity with a pump capable of pumping 20 gallons per minute at 100 psi and not less than 100 feet of hose.

A road grader or dozer will be kept in the immediate area when welding is being performed.
6. There will be no welding when winds over 20 mph occur.
7. Fire inspections will be held to check the above requirements.

APPENDIX 4—PROVISIONS AND MEASURES

Special Use Plat Requirements

Minimum requirements for pipeline, telephone, and underground cable plats on Forest Service land:

Maximum size of plat: 2' x 3' (Federal aid sheet size)

Title block with following:

Name of company applying
Size and type of line (gas, crude, etc.)
Material (steel, plastic with tracer wire, etc.)
Origin and destination
Depth of line
Right-of-way width
Name of company preparing plat:
Date
Scale (1" = 1000' minimum)
Drawn by (name)

Signed, sealed, and dated by licensed engineer or surveyor in the State of North Dakota.

Plat shall show:

Sections, township, range, north arrow, and 5th P.M.
Centerline of pipeline with stations at P.I.s
Property boundaries and land ownership, including adjoining
Crossing of existing utilities (identify both overhead and underground)
Roads, highways, and other existing improvements
Bearing of tangents
Length of line on Forest Service by subdivision
Land ties at subdivision boundaries identifying what is being tied to (set stones, brass cap, etc.)
Subdivision boundaries are defined as section lines.
Land ties also required at point of entry and exit of Forest Service lands.

U.S. DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS

The Army Corps of Engineers has prescribed management practices that should be followed, to the maximum extent practical, for discharges covered by the Nationwide 404 Permit (items 1 through 8). Additionally, certain conditions (33 CFR 323.4-3(b)) must be met under the Nationwide Permit authority (items 9 through 16). For further detail, please see the Army Corps of Engineers Permit Program, *A Guide for Applicants*, November 1, 1977.

1. Discharges of dredged or fill material into United States waters 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 block 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 main purpose of the fill is to impound water).
4. If any discharge creates an impoundment, adverse impacts on the aquatic system caused by the accelerated passage of water or the restriction of its flow should be minimized.
5. Discharges in wetlands should be avoided.
6. Heavy equipment used 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 entirely removed.
9. Preconstruction bottom contours cannot change. (Excess material must be removed to an upland disposal area.)
10. The discharge cannot occur in the proximity of a public water supply intake structure.
11. The discharge cannot destroy a threatened or endangered species as identified under the Endangered Species Act or endanger the critical habitat of such species.
12. The discharge cannot disrupt the movement of aquatic species indigenous to a water body.
13. The discharge must consist of suitable material that is free of toxic pollutants in other than trace amounts.
14. The fill created by a discharge must be properly maintained to prevent erosion and other nonpoint pollution sources.
15. 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.
16. No access roads, fills, dikes, or other structures can be built below the ordinary high water of the streams specified under the Nationwide Permit. These structures would require separate Section 404 permits.

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U.S. ENVIRONMENTAL PROTECTION AGENCY

Since construction of the pipeline will involve river crossings, a Nationwide Section 404 Permit will be required. Generally river crossings are covered under the permit, although specific permits (Individual 404 and Section 10 permits) will be needed for important crossings. An individual permit will be required if filling of any wetlands is involved. The U.S. Environmental Protection Agency reviews applications for 404 permits administered by the Army Corps of Engineers and provides recommendations for action on the permit, including mitigation measures. For this project, the U.S. Environmental Protection Agency will likely recommend the following measures for major river crossings:

- a. Dredged materials should be stored away from the flowing waters;

- b. Disturbed wetland or riverine areas should be revegetated with native trees, shrubs, and grasses where applicable;
- c. The permit should consider appropriate times for river disturbance that do not interrupt fish spawning cycles. This consideration may involve identifying the *gaps* or *windows* for construction between different spawning seasons.

More mitigation measures will be considered for the following areas after more details are received:

- d. Provisions for backfillings;
- e. Lengths of riprapping involved; perhaps some limitations to minimize use of riprap.

STATE OF MONTANA

When constructing or operating on Montana state land the following mitigation measures and stipulations will apply:

General Measures

1. The grantee shall schedule a preconstruction conference prior to commencing any construction of facilities. Grantee's field representative and the grantee's contractors involved in construction or maintenance of facilities shall attend the preconstruction conference. Contact the Office of the Commissioner, Montana Department of State Lands, 1625 Eleventh Avenue, Helena, Montana, at (406) 444-2074 for arranging a date and location for this meeting.

At this conference the grantee should indicate or submit a schedule of its construction activities. The grantee shall keep the Department of State Lands (DSL) inspector informed of changes in the schedule.

2. The Helena Office of Disaster and Emergency Service (406) 449-3034 shall be notified of all pipeline ruptures which may occur during operation of the pipeline system.
3. Except where Federal Aviation Administration (FAA), Occupational Safety and Health Administration regulations and others dictate otherwise, exteriors of structures shall be painted the same color as that used on federal lands.
4. The grantee shall survey and flag the exterior limits of the approved construction areas every 300 feet.

All activities associated with construction or maintenance of the pipeline facility must be conducted within the approved limits.

5. The grantee shall install right-of-way or line markers. The number, size, height, type and color of these markers will be the same as those used on federal lands.
6. Clearing should not proceed more than 10 miles ahead of the backfilling operations.
7. The preferable method of vegetation control during pipeline maintenance is by mechanical methods. However, if herbicides are needed, the grantee shall comply with the applicable federal and state laws and regulations concerning the use of pesticides (i.e., insecticides, herbicides, fungicides, rodenticides, and other similar substances) in all activities/operations under this grant. The grantee shall obtain from the DSL approval of a written plan prior to the use of such substances. The plan must provide the type and quantity of material to be used; the pest, insect, fungus, etc. to be controlled; the method of application; the location for storage and disposal of containers; and other information that the DSL may require. The plan to be submitted each year may be the same as that required by the federal government. Emergency use of pesticides may occur. The use of substances on or near the right-of-way shall be in accordance with the approved plan. A pesticide shall not be used if the Environmental Protection Agency has prohibited its use. A pesticide shall not be permanently stored on state lands authorized for use under this grant.

APPENDIX 4—PROVISIONS AND MEASURES

8. A pumper truck capable of holding 250 gallons of water shall accompany all welding operations. Similar fire control equipment shall be available on short notice for use on any portions of the right-of-way where equipment is operating or that is receiving traffic during the construction period.

The grantee's contractors shall, prior to right-of-way clearing: (a) contact local fire control officials and establish procedures to be used in the event of fires outside the right-of-way; (b) inform construction foremen of these procedures; (c) locate water sources close enough to construction sites to be effective in suppressing fires. In the absence of convenient water sources, tank trucks containing sufficient water to control fires will be available, especially during dry and windy conditions. Contractors equipment may be operated off the right-of-way on state lands for fire control. All equipment and vehicles operated on the right-of-way shall be equipped with at least a shovel, swatter and a 2-pound or larger ABC fire extinguisher. All vehicles on the ROW shall have spark arresters on exhaust systems.

9. The grantee's Erosion, Sedimentation Control and Restoration plan, and all other plans requiring approval by the Office of the Federal Inspector (OFI) shall be binding upon the grantee unless otherwise specified by DSL. Inspection and quality control procedures established by the grantee and the OFI will be followed, including DSL procedures as established by a Cooperative Agreement between the OFI and Montana.
10. Any modifications to these and specific stipulations must be approved in writing by the DSL.

Erosion, Sedimentation Control, and Restoration Stipulations

1.0 GENERAL

The DSL requires that the right-of-way (ROW) be restored as near as practical to pre-construction conditions. The goals of restoration are to control erosion, restore natural contours to the extent practicable, restore natural drainage patterns and hydrological conditions, and establish a plant cover adapted to the region similar to that which occurred originally. During and after construction, necessary structural and vegetative practices will be implemented as specified herein to control erosion and sedimentation.

Generally, the major long-term control of erosion and sedimentation will be by vegetative means. Temporary erosion control measures will be used where

required to minimize erosion and sedimentation during construction. Steep areas with unfavorable soils will require site specific controls as identified by the Company.

2.0 CLEARING AND SURFACE PREPARATION

The ROW will be cleared of obstruction and graded where necessary to permit construction equipment to operate safely. The extent of clearing and surface preparation shall be restricted to the minimum necessary for construction.

2.1 CLEARING OF VEGETATION

2.1.1 Shrubs, e.g., Sagebrush. A dozer or motor grader will be used to uproot shrubs from the trench line. The root systems of woody plants on spoil side of the ROW shall be preserved where possible. Where shrubs are large enough to interfere with construction equipment, additional clearing may be done, keeping surface disturbance to a minimum. Cleared vegetative material may be disposed of by chipping and spreading them over disturbed areas to serve as mulch.

2.2 DISPOSAL OF ROCK

Where rocks are brought to surface in cultivated lands which may interfere with cultivation, they shall be disposed of in a manner specified in Site Specific Stipulations. No rocks or boulders will be permitted over the backfilled trench or crown where none occurred before. Rocks or boulders that were removed during construction will be replaced according to the size, type, and density of those occurring in the adjacent undisturbed areas.

2.3 GRADING

On rough lands, shaping by cutting and filling may be required to permit construction activities where identified by the Company inspector. Grading shall tie in with federal land requirements.

2.3.1. Cuts and fills shall be limited to the minimum necessary for trenching operation.

2.3.2. Topsoil shall be stripped from cut areas and stockpiled separately for topsoil replacement during restoration as specified in the Site Specific Stipulations.

2.3.3. Sub-soil materials from cuts shall be stockpiled for recontouring upon completion of trenching operations. Excess material shall be placed in approved disposal areas specified in the Site Specific Stipulations where minimal erosion can be expected to occur. Excess material shall be shaped to blend

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with adjoining lands and to provide a land form suitable for revegetation.

2.4 ACCESS ROADS

2.4.1 Temporary Access Roads. Access to the ROW will normally be from existing public roads. Where existing public roads do not provide sufficient access to the ROW, temporary access roads may be required. All temporary access roads must be approved by DSL prior to construction. The Contractor shall be responsible for obtaining permission for utilizing private roads and trails, and on state lands, approval by the DSL. The upgrading of existing trails or construction of new temporary access roads shall be in accordance with the following guidelines:

2.4.1.1. Roads shall be located where possible to avoid erosion prone areas, drainages, areas of woody cover, wetlands or other sensitive areas and are subject to approval by the Company and the DSL. Topsoil will be salvaged and replaced after use.

2.4.1.2. The roads shall be designed with gutters and culverts properly located to minimize erosion and sedimentation as required.

2.4.1.3. Dust shall be controlled, where required, by surfacing with dust free materials or by a suitable water sprinkling or other dust abatement program.

2.4.1.4. Abandoned access roads shall be cleared of all materials, and returned as near as practicable to pre-construction contours and conditions. Revegetation shall be in accordance with Section 5.

2.4.2 Use of the Right-of-Way as a Road. Damages to the right-of-way caused by use of the right-of-way as a road will be kept to a minimum. Use of the right-of-way for workers commuting more than 5 miles to construction sites is prohibited; however, buses or vans may be used to transport workers. The grantee shall strip and stockpile topsoil from a traffic lane on state land parcels where the right-of-way is used as a road for access 5 miles beyond the parcel. Restoration of the portion of the right-of-way used as a road will proceed as in section 2.4.1 except as follows: (a) temporary structures, such as culverts placed on ephemeral drainages, will be removed except as approved by DSL; (b) the grantee will provide structures such as fences and gates to prevent the use of the right-of-way as a public road or trail after construction is completed; (c) the grantee shall reduce soil compaction in the traffic lane through the use of chisel or disc equipment after replacement of topsoil.

2.4.3 Permanent Access Roads. All permanent access roads must be approved by DSL.

2.5 FIREBREAKS

Fire barriers will be constructed along the edges of the construction ROW where the adjoining vegetation consists of very dry flammable grasses and mature small grains. These areas will be specified in the Site Specific Stipulations.

2.5.1. Plow, blade or otherwise expose mineral soil for width of 10 feet on each interior side of the ROW.

2.5.2. The firebreaks will be restored in conjunction with the final ROW restoration.

2.6 TRENCHING

Where soil conditions permit, the trench shall be excavated with a rotary wheel ditcher. Other areas will be excavated with backhoe or other appropriate equipment.

2.6.1 Double Trenching. This method refers to the excavation and placement of the surface soil in a separate windrow, normally opposite the working side of the ROW. Excavation may be with trencher or tractor and scraper. The remaining soil is then excavated by trencher or backhoe and placed in the zone between the surface soil windrow and trench. Double trenching will be used on all state lands. Six to ten inches of topsoil will be salvaged unless otherwise specified in the Site Specific Stipulations.

2.6.2 Noxious Weeds. Where the ROW is routed through noxious weed areas, the exit side will be flagged to indicate that the equipment shall be raised, inspected and cleaned of noxious weed fragments and seed. Where possible, the Company will provide the locations of noxious weed areas, such as leafy spurge, in advance.

2.6.3 Crossings. As requested by the DSL, machinery and cattle crossings will be provided at specified locations. These locations will be specified in the Site Specific Stipulations.

3.0 BACKFILLING, CLEAN-UP, AND FINISH GRADING

3.1 BACKFILLING

After the pipe has been lowered into the trench and its position inspected and approved, the backfilling operation will begin.

3.1.1 Standard Backfilling. Where there is no topsoil, the windrow of spoil will be returned to the

APPENDIX 4—PROVISIONS AND MEASURES

trench with a crown of soil sufficient to compensate for settlement, which will normally be 12 inches. Excess spoil shall be spread in a thin layer over the ROW. Unsuitable materials will be removed to approved disposal sites specified in Site Specific Stipulations.

3.1.2 Double Backfilling. Topsoil shall be segregated when present, and the windrow of sub-surface soil shall be returned to the trench, leaving sufficient space for the return of the surface soil windrow. After the surface soil has been placed and crowned, any remaining sub-surface soil shall be spread in a thin layer over the ROW. Unsuitable materials will be removed to approved disposal sites.

3.2 CUT SLOPES

Any cut slopes shall be finish graded to a stable slope, less than the angle of repose as directed by the Company inspector.

3.3 STREAMBANKS

Streambanks shall be finish graded as specified in Site Specific Stipulations.

4.0 EROSION AND SEDIMENTATION CONTROL STRUCTURES

Erosion and sedimentation control structures shall be constructed or installed where directed by the Company based upon field conditions during and immediately after completion of construction.

4.1.1 Mulching. Areas with sand to sandy loam soils or as required by DSL on a specific site are treated under Section 5, Revegetation.

4.1.2 Wind Barriers. Areas of loamy fine sand to sand facing the prevailing winds are susceptible to blow outs. In addition to mulching materials, these areas, on a case by case basis as specified in the Site Specific Stipulations, may require the installation of temporary snow or slat fences across wind exposed sites. The purpose of these fences is to reduce wind velocities to non-erosive levels at the soil surface. Snow fence rows shall be oriented at right angles to the prevailing wind and shall be spaced approximately two rods apart.

4.2 DIVERSION DITCHES

This practice is used to intercept runoff water from higher lying areas that could cause erosion on the ROW and to divert the drainage through protected outlets.

4.2.1 Cross Section. Shall be V-shaped with stable sideslopes and graded sufficiently to facilitate revegetation.

4.2.2 Grade and Velocity. Grade may be uniform or variable. Where required, ditch checks will be installed to reduce water velocity based upon field determinations.

4.2.3 Location. Shall be determined by outlet conditions, topography and ROW easement terms.

4.2.4 Outlets. May be grassed waterway, armored area, grade stabilization structure, stable watercourse or underground outlet. The outlet must convey runoff to a point where the outflow will not cause damage.

4.2.5 Restoration. Disturbed areas will be treated in accordance with Section 5, Revegetation.

4.3 TRANSVERSE BERMS, TERRACES, AND LEVEES

As directed by the Company inspector, a series of low dikes will be installed across the ROW in sloping areas and constructed at sufficient frequency to reduce slope length and thus prevent the concentration of runoff water originating primarily within the ROW. Stream banks will also be protected from erosion during construction where required, by constructing terraces or levees to prevent runoff and reduce sedimentation.

4.3.1 Spacing. Shall be determined by the Company inspector based upon soil erodibility, ground cover conditions, slope predicted runoff and capacity requirements.

4.3.2 Size. Shall be sufficient size to control the expected runoff originating between transverse berms on the ROW. Transverse berms shall normally be a minimum of three feet high, twelve feet wide, and shall drain at a maximum gradient of one foot per hundred feet. The design may be modified dependent upon landowner requirements.

4.3.3 Location. The location will be influenced by spacing requirements. Where possible, locations shall be adjusted to allow discharge onto grassed waterways, well vegetated areas, sites favorable for armoring or other structural controls, or access requirements of the landowner.

4.3.4 Maintenance. These diversion facilities will be repaired and maintained as required by DSL after passage of traffic or subsequent operations.

4.3.5 Restoration. Berms will be revegetated in accordance with Section 5, Revegetation.

4.4 GRADE STABILIZATION STRUCTURES

These are structures installed in permanent and intermittent watercourses and outlets from diversion

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ditches and transverse berms where concentration and flow velocity of runoff waters is such that they are needed to stabilize the grade in channels or to control gully erosion.

4.4.1 Types. Included are check dams, letdown structures (armored out falls), and stilling basins.

4.4.2 Location. Shall be determined by outlet conditions and topography.

4.4.3 Design. Shall be adequate to safely control the anticipated runoff to which the structures will be subjected.

4.4.4 Restoration. Disturbed soil will be shaped and revegetated in accordance with Section 5, Revegetation.

4.5 LINED WATERWAY OR OUTLET

A lined waterway or outlet is a waterway having a lining of rock or other erosion resistant material. Its purpose is to provide safe disposal of runoff from other erosion control structures or natural concentrations of flow where unlined or grassed waterways would be inadequate.

4.5.1 Application. The tract is applicable where:

4.5.1.1. Concentrated runoff is such that a lining is needed to control erosion.

4.5.1.2. Steep grades, wetness, prolonged base flow, seepage or piping could cause erosion.

4.5.1.3. Soils are highly erosive or other soil or climatic factors preclude using vegetation.

4.5.2 Design. Shall be adequate to carry the expected flows and velocity as determined by the Company inspector or DSL based upon field conditions.

4.5.3 Restoration. Disturbed soil shall be shaped and seeded in accordance with Section 5, Revegetation.

4.6 SEDIMENT BASINS

A basin will be constructed to trap and store waterborne sediment from trench dewatering operations, construction sites and other sediment yielding areas where identified by the Company inspector. This practice may be used where ROW conditions preclude the installation of erosion control measures to keep the soil in place.

4.6.1 Location. Shall be as close as possible to the sediment yielding area taking into consideration topography and ROW easement terms.

4.6.2 Capacity. Shall equal or exceed the volume of sediment expected to be trapped during the predicted sediment yield period.

4.6.3 Design. Embankment and spillway sizing shall be adequate to withstand the impact of run-in waters.

4.6.4 Restoration. Disturbed soil shall be shaped to facilitate restoration. Temporary basins shall be recontoured to blend with the existing topography. Seeding will be in accordance with Section 5, Revegetation.

4.7 SEDIMENT FILTERS

Bales of hay or straw may be placed along drainages to filter sediments resulting from a water discharge where directed by the Company inspector.

4.8 DITCH PLUGS AND SACK BREAKERS

4.8.1 Ditch Plugs (Sack Breakers). Ditch Plugs consisting of Trench Sack Breakers will be installed where required to impeded or prevent longitudinal water movement down the backfilled pipeline trench.

4.8.1.1 *Application.* Sack Breakers will be installed in potholes or other areas such as steep slopes and stream crossings where topography and permeable backfill materials may allow water to drain down the backfilled trench. Sack Breakers will be installed where it is determined by the Company that standard compaction procedures will not control the water movement.

4.8.1.2 *Design Criteria.* Sack Breakers will consist of one cubic foot sacks of earth or sand placed around the pipe from the trench bottom to within 12 inches of the surface for the full dimensions of the trench. The sack breakers will normally extend along the trench for a thickness of three sacks.

4.8.2 Temporary Ditch Plugs. At stream crossings and wetland areas specified by the Company inspector, a segment of unexcavated material shall be left along the trench line to minimize water diversion down the trench. These plugs will be excavated immediately prior to lowering in of the pipe section.

4.8.3 Wetland (Pothole) Sealing. In wetland areas identified by the Company where trenches may intersect and disrupt impervious layers which may

APPENDIX 4—PROVISIONS AND MEASURES

result in induced drainage, a bentonitic slurry will be used to seal the trench over the permeable zone.

5.0 REVEGETATION

The primary purpose of revegetation is for erosion control and to restore existing land-use and vegetation types. Revegetation work performed by the contractor will include primarily rangelands (native pasture), stream banks and grassed waterways, wetlands and other areas which are not under active crop production. Such areas will return to current use according to the practices of the landowner following clean-up, finish grading, and surface preparation which will be the responsibility of the contractor unless specified otherwise by DSL. Special restoration measures will also be required for field windbreaks and visual resources and wildlife habitat where specified by the Company who will provide site specific plans.

5.1 ROW SURFACE CONDITIONS AFTER CONSTRUCTION

5.1.1 Native Vegetation Areas.

5.1.1.1 Level to Sloping Lands. The actual trench will have no residual vegetative cover. The remainder of the ROW will have varying amounts of trample damage from vehicular traffic and some vegetative scalping from backfill operations and associated activities. Natural native seed, rhizomes and viable root materials will be present throughout the non-trenched area.

5.1.1.2 Sloping to Steep Lands. These lands will have had varying amounts of land grading activities to enable the operation of trenching and associated equipment. Graded and recontoured areas will have no residual vegetative cover except where the surface soil has been stockpiled and respread.

5.1.2 Cropland, Hayland, and Tame Pasture. These areas will have had partial to total loss of residual vegetative cover. The DSL and surface lessee will accomplish revegetation with compensation following clean-up, finish grading, and surface preparation by the contractor unless specified otherwise in the Site Specific Stipulations.

5.2 SEEDBED PREPARATION

This shall be specified where the ROW is planned to be restored to permanent vegetation. Areas of cropland, hayland and tame pasture will be revegetated by the DSL or the surface lessee unless directed otherwise in Site Specific Stipulations.

5.2.1 Fertilization. Fertilizer shall be broadcast, as a first step, over the entire ROW at the rate of 50 pounds per acre each of Nitrogen (N) and Phosphate (P₂O₅). Where directed by DSL, a strip 100 feet wide on each side of the ROW may also be fertilized. Fertilizer shall be labeled with the manufacturer's guaranteed analysis as governed by applicable fertilizer laws.

5.2.2 Compaction Relief. One or more passes with chisel or disc type equipment shall be made in travel areas that may have been compacted by heavy equipment passage. In areas of summer fallow land, the direction of the chiseling will match the tillage pattern in the undisturbed portion of the fields in order to minimize wind erosion and to allow snow to accumulate on the fallowed strips as opposed to drifting down the ROW.

5.2.3 Packing. An agricultural type packer shall be used to firm the chiseled areas to the degree that to the extent practical a person's footprint will leave no more than a 3/8 inch deep impression in the soil to be seeded.

5.3 TEMPORARY SEEDING

Where permanent seeding is delayed by construction schedules or other factors, a temporary cover crop shall be planted to control wind and water erosion in areas identified by the Company:

5.3.1 Spring thaw to June 15. Plant winter wheat at the rate of 60 pounds per acre.

5.3.2 After June 15. Plant sudangrass at the rate of 20 pounds per acre.

5.3.3 Mowing. As necessary, the cover crop shall be mowed prior to the planting of the permanent seed mixture, as provided in site-specific requirements.

5.4 PERMANENT SEEDING (RANGELANDS OR NATIVE PASTURE, STREAMBANKS, ETC.)

Based on the proximity of native seed sources outside of the ROW, some natural revegetation of the ROW is anticipated to occur. To complement natural regeneration, five basic seeding mixtures will be used.

5.4.1 Standard Mixture. An adapted grass mixture to be used on non-problem areas where slope, or soil conditions do not pose special considerations.

5.4.2 Sand Mixture. A sand tolerant grass mixture to be used where the soil materials range from sand to sandy loam.

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5.4.3 Saline Mixture. A saline/alkaline tolerant grass mixture to be used where the soil materials are strongly saline/alkaline.

5.4.4 Badland Mixture. A mixture of very hardy grass and shrub species capable of establishment on the badland type topography found in Montana and North Dakota.

5.4.5 Wetland Mixture. A mixture of grasses adapted to saturated soils and with a tolerance to a wide fluctuation in soil moisture conditions.

5.4.6 Plant Species and Rate. When the final location has been established a table will be made showing where seeding mixture will be used.

5.4.7 Seed Quality (Certification).

5.4.7.1 Weed and Seed Laws. All seed shall comply with and be labeled in accordance with applicable seed laws. Seed lots shall contain zero noxious weed seed as listed in the weed control laws of Montana.

5.4.7.2 Application. Seed quantities shall be based on Pure Live Seed (PLS) determinations. Each seed lot shall carry a label showing (1) purity analysis, and (2) the viability as determined by germination or tetrazolium test methods. The viability test shall have been made within 9 months of the actual seeding date.

5.5 TIME AND METHODS FOR PERMANENT SEEDING

Seeding shall be done after October 15 until freeze-up as a dormant planting to break the dormancy of native seed. Allowing the seed to overwinter in the soil increases the rate of germination the following spring.

5.5.1 Drilled Plantings. Where topography permits, seeding shall be accomplished with standard or grassland drills. Equipment shall be fitted with grass seed drill boxes, agitators and press wheels and shall be capable of adjustment to maintain a planting depth of 1/2 inch or less. Seeding rates shall be as specified for the seeding mixture being used. Planting depth shall be no more than 1/2 inch.

5.5.2 Problem Planting. Where drill planting is impractical, one of the following alternatives may be used.

5.5.2.1 Broadcast Planting. Hand equipment such as a cyclone seeder will be used to apply the seed mixture at a doubled rate and applied as a split application at approximate right angles.

Whenever possible, follow with a light harrowing and packing or hand raking.

5.5.2.2 Native Grass Mats. Mats shall be formulated according to the appropriate seeding mixture and rates. Mats shall be applied and anchored in accordance with the manufacturer's recommendations.

5.5.2.3 Hydroseeding. The hydroseeder will apply the appropriate mixture at rates in accordance with manufacturer's recommendations.

5.6 MULCHING

To prevent potential wind and water erosion, mulch shall be applied to all areas seeded with Sand or Badland seeding mixtures, areas subject to severe wind erosion, and on all slopes of 2:1 or steeper. Choice of vegetative or commercial mulches is optional on areas with slopes ranging from level to 2:1. Commercial mulches shall be used on slopes greater than 2:1.

5.6.1 Vegetative Mulch.

5.6.1.1 Materials. Wheat, oat or barley straw from which grain has been removed shall be used. At least 50% of the stems shall exceed 10 inches when mechanically anchored. When tacked with asphalt, resin or netting, 50% of the stems shall exceed 6 inches.

5.6.1.2 Application. The rate shall be 4,000 pounds per acre when anchored with mulch tiller equipment. When anchored with emulsion tack, netting or hand methods, the rate shall be 3,000 pounds per acre.

5.6.1.3 Anchoring. Shall be accomplished by one of the following methods:

5.6.1.3.1. A commercial mulch tiller or a weighted farm disc set straight may be used. Equipment shall be capable of tucking the straw to a depth of three inches without cutting. If straw is brittle and breaks during the anchoring process, it shall be lightly sprinkled to facilitate operations.

5.6.1.3.2. Emulsion tack shall be applied with approved spray equipment and in accordance with manufacturer's recommendations.

5.6.1.3.3. Netting shall be stapled to the soils surface in accordance with manufacturer's recommendations.

5.6.1.3.4. Peg and twine shall be staked and tied on a four foot grid.

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5.6.1.3.5. Hand mulching material shall be punched into the soil surface with a square pointed spade in rows 12 inches apart.

5.6.2 Commercial Mulch. Excelsior erosion control blankets, wood cellulose fiber mulches, asphalt, asphalt emulsion, and resin emulsion shall be applied in accordance with manufacturer's recommendations. Use of asphalt, asphalt emulsion, and resin emulsion must be approved by DSL.

5.7 MAINTENANCE

Young seedlings will be monitored for a minimum of two full growing seasons by the Company to ensure their survival and stand development.

5.7.1 Weed Control. Competitive weed growth shall be controlled as necessary by spraying and/or mowing as follows:

5.7.1.1. Approved post-emergent herbicides shall be applied after the seeded grasses are in the 3-leaf stage and before weeds reach a height of 4 to 6 inches. Repeat applications to control regrowth may be required by the Company. Application rates shall be in accordance with the manufacturer's recommendations.

5.7.1.2. Mowing may be used as an optional control or as a supplement to herbicide control as designated by the Company. Mowing shall be restricted to spring mowing the first year when the weeds are 8 to 12 inches high. Mowers shall be adjusted to cut above the average height of the new grass seedlings.

5.7.2 Grazing Control. Wherever necessary plantings will be protected from grazing for at least two growing seasons or until vegetation is established. By agreement with the landowner, the Company will attempt to make one or more of the following arrangements:

5.7.2.1. Provide temporary fencing where practical.

5.7.2.2. Arrange for year long deferred grazing.

5.7.2.3. Arrange for winter grazing only.

5.8 EVALUATION OF GRASS REVEGETATION

During the reestablishment period, stand counts shall indicate a density of 3 to 5 plants per square foot. Three plants of rhizomatous species shall be adequate. Five plants per square foot are necessary for bunch grasses. Where this criteria cannot be met, reseeding shall be scheduled.

5.9 REVEGETATION OF WETLANDS

Wetland areas will be seeded where identified by the Company based upon its Wetlands Study. Active revegetation will be limited to reseeding with the wetland seed mixture (Mixture No. 5) at rates that will provide complete vegetative coverage in shallow impoundments and peripheral coverage in deep basins. The seed mixture will be broadcast over exposed areas of the wetland impoundments. The deeper, wetter vegetational zones will not be revegetated but will return to normal via natural revegetation.

5.9.1 Fertilization. Fertilization will normally not be required where topsoil had been segregated. Where directed, fertilization rates will be in accordance with Section 5.2.1.

5.10 REVEGETATION OF WOODY PLANTS

Revegetation of woody plants will be performed as required in areas specified in the Site Specific Stipulations. These types of areas may consist of field windbreak plantings, visual resource restoration, and wildlife habitat restoration. In general revegetation of woody vegetation will be accomplished by minimizing surface disturbance to the extent necessary for construction and by preserving as much rootstock as possible during ROW and site preparation.

5.10.1 Field Windbreaks.

5.10.1.1 *Preservation of Existing Plants.* Field windbreaks will be crossed as near as practical at a direction normal to the alignment of the rows of trees or shrubs. Where possible the contractor will restrict the width of the construction ROW to preserve trees and shrubs.

5.10.1.2 *Transplanting Existing Stock.* Where specified in the Site Specific Stipulations, the contractor may be required to dig up and ball shrubs and stockpile them for transplanting following finish grading. Shrubs will be top-pruned prior to their being lifted and kept in a moist condition. The contractor will guy the shrubs as required after they are transplanted. The trees or shrubs will not be transplanted directly over the pipeline.

5.10.1.3 *Plantings of Seedlings.* Where specified in the Site Specific Stipulations, seedlings will be acquired from commercial sources and planted at intervals corresponding to the original plantings.

5.10.1.4 *Maintenance.* Survival will be monitored during operations and remedial plantings will be made as required.

STATE OF MONTANA MEASURES

5.10.2 Visual Resource Restoration. Where required, special visual resource plantings will be made in areas designated by the Company, and the Company will provide site-specific plans.

Visual restoration will involve screen plantings of wood species which occur in the adjacent area or establishing clumps of vegetation along the right-of-way to provide curvature. Well developed clumps of vegetation along the right-of-way or staging area will be preserved wherever possible to provide an irregular boundary and break up the linear appearance.

These plans will be based on site specific evaluations which will be conducted in conjunction with the confirmation surveys and marking of construction working limits and will include:

5.10.2.1. Schematic drawings of the site showing the survey boundaries, highway right-of-way or river channel, existing vegetation patterns, and the location and arrangement for the special plantings with respect to the position of the observer and his line of sight.

5.10.2.2. The species, size classes, and number of plants to be used (most of the plants will be seedling and shrub size at the time of planting).

5.10.2.3. Instructions for acquiring and handling the plant materials which will normally be accomplished by stockpiling plants during clearing, or transplanting them from approved locations adjacent to the disturbed area, or utilizing available commercial sources.

5.10.2.4. Planting instructions, including timing, hole-size, fertilization, top-pruning, guying and watering if required. Planting will normally be done in early spring prior to budbreak or during the fall dormant period.

5.10.2.5. Where designated by the Company, visual resource plantings will be fenced to control livestock grazing for a period identified by the Company, subject to approval by the surface lessee.

5.10.2.6. The implementation of the plans will be closely inspected by the Company. Survival and growth will be monitored until the criteria in Section 5.8 are met. Remedial work will be performed where required.

5.10.3 Wildlife Habitat Restoration. Plantings of woody seedling and shrubs will be made where required on sites which will be specified in the Site Specific Stipulations where woody cover existed

prior to construction. Woody plantings will be made according to site specific plans provided by the Company.

5.10.3.1 *Objectives.* The purpose of this revegetation will be to complement and hasten the reestablishment of woody cover. The goal will be to establish a cover of woody plants on portions of the construction ROW and staging areas comparable in density and composition to that which occurred originally.

5.10.3.2 *Procedures.* The procedures used will follow those described in Section 5.10.2, with the exception that commercially available seedling will normally be utilized.

5.10.3.3 *Grazing Control.* The Company will assess the sites in terms of livestock usage. Where it is determined grazing would likely result in vegetation failure, special plantings will be implemented subject to provisions for grazing control agreed upon with the DSL and the surface lease.

5.11 DROUGHT CONDITIONS

These stipulations will be modified as necessary to take into account drought conditions that may occur during construction and restoration. Modifications in Sections 5.0 through 5.10 may especially be necessary, including more frequent application of mulch to prevent soil loss due to wind erosion, and the use of mulch during construction. Grantee shall consult with DSL and the OFI as necessary if drought conditions continue.

6.0 PLATS

6.1 Survey Plats.

Survey plats shall conform to the federal requirements. Additionally, the center line shall be identified on each parcel of state land crossed, 40 acres or larger in size, with cadastral references to at least the greater quarter section.

Site-Specific Stipulations

In addition to the preceding stipulations, Site Specific Stipulations must be developed to minimize or mitigate potential impacts. Site Specific Stipulations will be developed after right-of-way grants across state lands have been issued. Site Specific Stipulations will be developed for inclusion in the final EIS or State of Montana Supplemental EIS, by an aerial and on-the-ground reconnaissance and by review of existing data, such as soils survey information collected by the grantee.

APPENDIX 4—PROVISIONS AND MEASURES

The Site Specific Stipulations will be developed by August 15, 1985.

Site Specific Stipulations to be developed will require that locations be identified for:

- Disposal sites for excess rock and overburden.
- Areas with high fire hazard where fire barriers or other techniques may be employed for minimizing the risk of fires from construction related activities.
- Areas with fine soils susceptible to blow outs where wind barriers or other techniques may be used for reduction of wind erosion.
- Areas where lined waterways or other erosion control techniques may be required.
- Areas where each of the five permanent seeding/mixtures should appropriately be employed. The five permanent seeding mixtures will be listed in the State of Montana Supplemental EIS and the final Bairoil/Dakota Carbon Dioxide Projects EIS as site-specific stipulations on Montana land properties. These mixtures are listed as: standard mixture, sand mixture, saline mixture, badlands mixture, and wetlands mixture.
- Areas where revegetation with woody plants should be used to maintain field windbreaks, visual resources, and wildlife habitat.
- Areas where topsoil should be stripped to specified depths and kept separate from the lower subsoils.
- Areas where topsoil from roads should be stockpiled to minimize wind and water erosion.
- Areas where fences should be constructed to minimize damage to revegetation efforts.
- Areas where special measures should be adopted to minimize disruption of important wildlife/livestock areas, such as breeding/calving areas, grouse leks, critical habitat, and raptor nests.
- Areas where toxic or excessively saline or alkaline subsoils will be buried in the pipeline trench and covered with sufficient topsoil of a quality sufficient to support revegetation.
- Areas where existing trees and/or shrubs will be salvaged for replacement on the right-of-way after construction.
- Areas where machinery and cattle crossings are required.
- Areas where streambanks shall be finish graded.
- Areas where sediment basins are required.
- Areas where extremely wet sites occur, exterior limits of the right-of-way shall be flagged.

UNCOMMITTED MITIGATION

Impacts to social and economic conditions of Bairoil, Wyoming could be lessened by (1) helping provide a community planning staff, (2) developing a work camp with temporary housing for construction and contract personnel, and (3) developing a monitoring system to determine direct project-related impacts to the community.

Disturbance to windbreaks or shelterbelts would be lessened by (1) limiting surface disturbance to the smallest area needed for construction, (2) preserving root stock as much as possible, and (3) transplanting.

APPENDIX 5

LAND OWNERSHIP AND MANAGEMENT

The following tables contain data relating to the ownership or management of lands that would be directly affected by the Bairoil/Dakota Carbon Dioxide Project.

TABLE A-1
OWNERSHIP OR MANAGEMENT OF ACRES DISTURBED,
REMOVED, AND RECLAIMED
PROPOSED ACTION

Components	Acres Disturbed	BLM	Private	Wyoming	Montana	North Dakota	Forest Service	Corps of Engineers	Unknown
Pipelines									
666.5 miles @ 12 acres per mile	7,998.0	2,467.2	5,054.4	151.2	116.4	51.6	121.2	36.0	
20.0 miles @ 15 acres per mile	300.0	211.5	79.5	9.0	—	—	—	—	
65.0 miles @ 6 acres per mile	390.0	147.6	226.2	—	16.2	—	—	—	
Facilities									
Origin Meter/ Junction	2 @ 1 acre each	2.0	2.0						
Bairoil Junction	1 @ 1 acre each	1.0	1.0						
Block Valves	35 @ 1/10 acre each*								
Scraper Traps with Block Valves	5 @ 1/2 acre each*								
Green River Staging Areas	6 @ 2 1/2 acres each	15.0	10.0	2.5	2.5				
Booster Stations	3 @ 3 acres each	9.0	9.0						
Staging Area South Side Lake Sakakawea		3.5						3.5	
Staging Area North Side Lake Sakakawea		17.5						17.5	
Staging Areas Other Creeks & Rivers	7 @ 5 acres each	35.0		35.0					
Tioga Meter (Terminal)		1.0		1.0					
Up-Grading Existing Roads		74.0							74.0
Temporary Access Roads		108.0		108.0					
Bairoil Meter		1.0	1.0						
Bairoil Gas Plant		100.0		100.0					
Bairoil Product Storage Tank Site		3.0	3.0						
Bairoil Field CO ₂ Dist. Sys.		300.0		300.0					
Cedar Creek Receipt Meters (2)/ Booster Station		5.0			5.0				
Cedar Creek Delivery Meters	8 @ 2 acres each	16.0	4.0	12.0					
Power Lines to Junctions, Block Valves, Scraper Traps, Booster Stations & Microwave Sites		132.0		132.0					
Microwave Sites	20 @ 1/4 acre each	5.0	1.75	3.0	0.25				
TOTAL:		9,516.0	2,858.05	6,053.6	162.95	137.6	51.6	121.2	57.0
								74.0	

*Acres and ownership included in pipelines.

APPENDIX 5

**TABLE A-2
LAND OWNERSHIP
PROPOSED ACTION**

Milepost	Miles	Ownership/ Management
Main Pipeline		
49.0 R - 48.1 R	0.9	BLM
48.1 R - 47.5 R	0.6	Private
47.5 R - 46.3 R	1.2	BLM
46.3 R - 41.7 R	4.6	Private
41.7 R - 40.7 R	1.0	BLM
40.7 R - 39.6 R	1.1	Private
39.6 R - 39.4 R	0.2	BLM
39.4 R - 38.4 R	1.0	Private
38.4 R - 38.1 R	0.3	Wyoming
38.1 R - 37.7 R	0.4	Private
37.7 R - 37.2 R	0.5	Wyoming
37.2 R - 36.2 R	1.0	Private
36.2 R - 35.1 R	1.1	BLM
35.1 R - 33.0 R	2.1	Private
33.0 R - 32.1 R	0.9	BLM
32.1 R - 31.7 R	0.4	Private
31.7 R - 30.5 R	1.2	BLM
30.5 R - 30.3 R	0.2	Private
30.3 R - 29.5 R	0.8	BLM
29.5 R - 28.3 R	1.2	Private
28.3 R - 28.2 R	0.1	BLM
28.2 R - 27.2 R	1.0	Private
27.2 R - 26.0 R	1.2	BLM
0.0 - 1.8	1.8	Private
1.8 - 4.1	2.3	BLM
4.1 - 6.3	2.2	Private
6.3 - 7.1	0.8	BLM
7.1 - 8.1	1.0	Private
8.1 - 8.7	0.6	BLM
8.7 - 9.6	0.9	Private
9.6 - 12.3	2.7	BLM
12.3 - 12.8	0.5	Private
12.8 - 13.5	0.7	BLM
13.5 - 14.3	0.8	Private
14.3 - 14.5	0.2	BLM
14.5 - 22.0	7.5	Private
22.0 - 35.8	13.8	BLM
35.8 - 36.8	1.0	Wyoming
36.8 - 39.8	3.0	BLM
39.8 - 40.9	1.1	Private
40.9 - 42.0	1.1	BLM
42.0 - 44.1	2.1	Private
44.1 - 44.9	0.8	BLM
44.9 - 45.8	0.9	Private
45.8 - 46.7	0.9	BLM
46.7 - 47.8	1.1	Private
47.8 - 48.4	0.6	BLM
48.4 - 49.2	0.8	Private
49.2 - 50.0	0.8	BLM

TABLE A-2 (Continued)

Milepost	Miles	Ownership/ Management
50.0 - 50.5	0.5	Private
50.5 - 51.5	1.0	BLM
51.5 - 52.4	0.9	Private
52.4 - 53.5	1.1	BLM
53.5 - 54.5	1.0	Private
54.5 - 54.9	0.4	BLM
54.9 - 55.5	0.6	Private
55.5 - 56.4	0.9	BLM
56.4 - 57.5	1.1	Private
57.5 - 87.5	30.0	BLM
87.5 - 88.4	0.9	Wyoming
88.4 - 95.8	7.4	BLM
95.8 - 96.4	0.6	Wyoming
96.4 - 109.6	13.2	BLM
109.6 - 110.0	0.4	Private
110.0 - 112.3	2.3	BLM
112.3 - 112.6	0.3	Wyoming
112.6 - 115.4	2.8	BLM
115.4 - 116.1	0.7	Private
116.1 - 116.7	0.6	BLM
116.7 - 116.9	0.2	Private
116.9 - 117.7	0.8	BLM
117.7 - 118.0	0.3	Private
118.0 - 119.6	1.6	BLM
119.6 - 119.8	0.2	Wyoming
119.8 - 120.1	0.3	BLM
120.1 - 120.7	0.6	Private
120.7 - 121.4	0.7	BLM
121.4 - 122.1	0.7	Private
122.1 - 122.9	0.8	BLM
122.9 - 123.4	0.5	Wyoming
123.4 - 128.4	5.0	BLM
128.4 - 129.4	1.0	Wyoming
129.4 - 133.0	3.6	BLM
133.0 - 134.0	1.0	Private
134.0 - 137.1	3.1	BLM
137.1 - 138.0	0.9	Wyoming
138.0 - 139.3	1.3	Private
139.3 - 139.7	0.4	BLM
139.7 - 140.6	0.9	Private
140.6 - 140.8	0.2	Wyoming
140.8 - 141.1	0.3	Private
141.1 - 141.3	0.2	BLM
141.3 - 142.1	0.8	Private
142.1 - 148.3	6.2	BLM
148.3 - 149.9	1.6	Private
149.9 - 158.7	8.8	BLM
158.7 - 159.3	0.6	Private
159.3 - 162.3	3.0	BLM
162.3 - 163.2	0.9	Private
163.2 - 165.5	2.3	BLM
165.5 - 166.6	1.1	Private
166.6 - 168.2	1.6	BLM
168.2 - 168.5	0.3	Private

LAND OWNERSHIP AND MANAGEMENT

TABLE A-2 (Continued)

Milepost	Miles	Ownership/ Management
168.5 - 169.2	0.7	BLM
169.2 - 170.2	1.0	Private
170.2 - 171.2	1.0	BLM
171.2 - 175.3	4.1	Private
175.3 - 178.0	2.7	BLM
178.0 - 180.1	2.1	Private
180.1 - 180.9	0.8	BLM
180.9 - 182.6	1.7	Private
182.6 - 183.0	0.4	Wyoming
183.0 - 186.0	3.0	Private
186.0 - 186.8	0.8	BLM
186.8 - 190.4	3.6	Private
190.4 - 191.1	0.7	BLM
191.1 - 191.5	0.4	Private
191.5 - 195.6	4.1	BLM
195.6 - 195.8	0.2	Private
195.8 - 196.4	0.6	BLM
196.4 - 198.3	1.9	Private
198.3 - 198.8	0.5	Wyoming
198.8 - 199.0	0.2	BLM
199.0 - 199.6	0.6	Private
199.6 - 200.3	0.7	BLM
200.3 - 201.0	0.7	Private
201.0 - 208.7	7.7	BLM
208.7 - 209.3	0.6	Wyoming
209.3 - 222.3	13.0	BLM
222.3 - 222.9	0.6	Wyoming
222.9 - 223.2	0.3	BLM
223.2 - 223.6	0.4	Private
223.6 - 223.8	0.2	BLM
223.8 - 224.0	0.2	Private
224.0 - 224.4	0.4	BLM
224.4 - 224.8	0.4	Private
224.8 - 225.6	0.8	BLM
225.6 - 227.3	1.7	Private
227.3 - 229.1	1.8	BLM
229.1 - 229.6	0.5	Private
229.6 - 232.1	2.5	BLM
232.1 - 234.8	2.7	Private
234.8 - 235.4	0.6	BLM
235.4 - 236.0	0.6	Private
236.0 - 236.4	0.4	BLM
236.4 - 237.1	0.7	Private
237.1 - 238.2	1.1	BLM
238.2 - 238.7	0.5	Private
238.7 - 239.2	0.5	BLM
239.2 - 240.2	1.0	Private
240.2 - 240.5	0.3	BLM
240.5 - 241.4	0.9	Private
241.4 - 241.5	0.1	BLM
241.5 - 247.2	5.7	Private
247.2 - 248.0	0.8	BLM
248.0 - 252.4	4.4	Private
252.4 - 253.8	1.4	BLM

TABLE A-2 (Continued)

Milepost	Miles	Ownership/ Management
253.8 - 254.6	0.8	Private
254.6 - 256.2	1.6	BLM
256.2 - 257.1	0.9	Private
257.1 - 257.6	0.5	BLM
257.6 - 258.5	0.9	Wyoming
258.5 - 260.6	2.1	Private
260.6 - 261.4	0.8	BLM
261.4 - 261.7	0.3	Private
261.7 - 262.9	1.2	Wyoming
262.9 - 263.7	0.8	Private
263.7 - 263.9	0.2	BLM
263.9 - 311.0	47.1	Private
311.0 - 312.1	1.1	Wyoming
312.1 - 325.8	13.7	Private
325.8 - 326.1	0.3	BLM
326.1 - 327.7	1.6	Private
327.7 - 328.0	0.3	BLM
328.0 - 328.3	0.3	Private
328.3 - 328.5	0.2	BLM
328.5 - 340.0	11.5	Private
340.0 - 340.4	0.4	BLM
340.4 - 340.6	0.2	Private
340.6 - 341.0	0.4	BLM
341.0 - 343.8	2.8	Private
343.8 - 344.0	0.2	BLM
344.0 - 346.9	2.9	Private
346.9 - 347.2	0.3	BLM
347.2 - 349.0	1.8	Private
349.0 - 349.6	0.6	BLM
349.6 - 350.4	0.8	Private
350.4 - 350.7	0.3	BLM
350.7 - 351.0	0.3	Private
351.0 - 351.1	0.1	BLM
351.1 - 351.3	0.2	Wyoming
351.3 - 351.4	0.1	Private
351.4 - 351.7	0.3	BLM
351.7 - 352.0	0.3	Private
352.0 - 352.7	0.7	Wyoming
352.7 - 367.7	15.0	Private
367.7 - 368.9	1.2	BLM
368.9 - 382.0	13.1	Private
382.0 - 382.6	0.6	BLM
382.6 - 382.8	0.2	Private
382.8 - 384.0	1.2	Montana
384.0 - 388.1	4.1	Private
388.1 - 388.7	0.6	Montana
388.7 - 389.3	0.6	Private
389.3 - 389.9	0.6	Montana
389.9 - 390.9	1.0	Private
390.0 - 391.2	0.3	Montana
391.2 - 391.7	0.5	Private
391.7 - 394.1	2.4	BLM
394.1 - 394.7	0.6	Private
394.7 - 395.2	0.5	BLM

APPENDIX 5

TABLE A-2 (Continued)

Milepost	Miles	Ownership/ Management
395.2 - 397.8	2.6	Private
397.8 - 399.4	1.6	BLM
399.4 - 401.1	1.7	Private
401.1 - 401.9	0.8	BLM
401.9 - 402.9	1.0	Private
402.9 - 407.7	4.8	BLM
407.7 - 408.5	0.8	Private
408.5 - 413.4	4.9	BLM
413.4 - 413.8	0.4	Private
413.8 - 414.1	0.3	BLM
414.1 - 414.6	0.5	Private
414.6 - 415.6	1.0	Montana
415.6 - 424.6	9.0	Private
424.6 - 425.1	0.5	BLM
425.1 - 442.5	17.4	Private
442.5 - 443.0	0.5	BLM
443.0 - 443.5	0.5	Private
443.5 - 443.8	0.3	BLM
443.8 - 447.2	3.4	Private
447.2 - 448.3	1.1	Montana
448.3 - 462.5	14.2	Private
462.5 - 463.0	0.5	BLM
463.0 - 463.5	0.5	Private
463.5 - 464.5	1.0	BLM
464.5 - 467.0	2.5	Private
467.0 - 467.1	0.1	Montana
467.1 - 471.1	4.0	Private
471.1 - 471.6	0.5	Montana
471.6 - 473.2	1.6	Private
473.2 - 474.3	1.1	Montana
474.3 - 477.1	2.8	Private
477.1 - 478.5	1.4	Montana
478.5 - 481.4	2.9	Private
481.4 - 482.7	1.3	Montana
482.7 - 486.2	3.5	Private
486.2 - 486.7	0.5	Montana
486.7 - 504.0	17.3	Private
504.0 - 505.6	1.6	Forest Service
505.6 - 506.6	1.0	Private
506.6 - 506.8	0.2	Forest Service
506.8 - 507.6	0.8	North Dakota
507.6 - 509.2	1.6	Forest Service
509.2 - 510.8	1.6	Private
510.8 - 511.1	0.3	Forest Service
511.1 - 512.2	1.1	Private
512.2 - 513.2	1.0	North Dakota
513.2 - 516.6	3.4	Forest Service
516.6 - 519.7	3.1	Private
519.7 - 520.1	0.4	Forest Service
520.1 - 520.9	0.8	Private
520.9 - 521.5	0.6	Forest Service
521.5 - 522.5	1.0	Private
522.5 - 522.7	0.2	Forest Service
522.7 - 563.2	40.5	Private

TABLE A-2 (Continued)

Milepost	Miles	Ownership/ Management
563.2 - 563.7	0.5	North Dakota
563.7 - 623.2	59.5	Private
623.2 - 625.0	1.8	Forest Service
625.0 - 625.3	0.3	Private
625.3 - 628.3	3.0	Corps of Engineers
628.3 - 629.3	1.0	North Dakota
629.3 - 640.3	11.0	Private
640.3 - 641.3	1.0	North Dakota
641.3 - 643.5	2.2	Private
SUBTOTALS:		
	205.6	BLM
	421.2	Private
	12.6	Wyoming
	9.7	Montana
	4.3	North Dakota
	10.1	Forest Service
	3.0	Corps of Engineers
	666.5	
Bairoil Spur Pipeline		
0.0 - 2.9	2.9	BLM
2.9 - 3.5	0.6	Wyoming
3.5 - 13.7	10.2	BLM
13.7 - 16.8	3.1	Private
16.8 - 17.8	1.0	BLM
17.8 - 20.0	2.2	Private
SUBTOTALS:		
	14.1	BLM
	5.3	Private
	0.6	Wyoming
	20.0	
Cedar Creek Distribution Pipeline		
0.0 - 0.3	0.3	Private
0.3 - 1.3	1.0	BLM
1.3 - 2.3	1.0	Private
2.3 - 3.4	1.1	BLM
3.4 - 3.8	0.4	Private
3.8 - 5.1	1.3	BLM
5.1 - 8.7	3.6	Private
8.7 - 9.6	0.9	BLM
9.6 - 11.8	2.2	Private
11.8 - 12.9	1.1	BLM
12.9 - 13.1	0.2	Private
13.1 - 14.0	0.9	BLM
14.0 - 15.1	1.1	Private
15.1 - 15.8	0.7	BLM
15.8 - 16.2	0.4	Private
16.2 - 16.5	0.3	BLM

LAND OWNERSHIP AND MANAGEMENT

TABLE A-2 (Concluded)

Milepost	Miles	Ownership/ Management
16.5 - 18.0	1.5	Private
18.0 - 18.5	0.5	BLM
18.5 - 24.9	6.4	Private
24.9 - 25.9	1.0	Montana
25.9 - 29.1	3.2	BLM
29.1 - 29.4	0.3	Private
29.4 - 30.3	0.9	BLM
30.3 - 30.9	0.6	Private
30.9 - 31.6	0.7	BLM
31.6 - 32.7	1.1	Private
32.7 - 33.3	0.6	Montana
33.3 - 34.0	0.7	Private
34.0 - 34.6	0.6	BLM
34.6 - 37.7	3.1	Private
37.7 - 38.3	0.6	BLM
38.3 - 46.4	8.1	Private
46.4 - 47.5	1.1	Montana
47.5 - 48.1	0.6	Private
48.1 - 48.8	0.7	BLM
48.8 - 49.7	0.9	Private
49.7 - 50.1	0.4	BLM
50.1 - 51.2	1.1	Private
51.2 - 52.1	0.9	BLM
52.1 - 52.3	0.2	Private
52.3 - 53.6	1.3	BLM
53.6 - 54.0	0.4	Private
54.0 - 54.7	0.7	BLM
54.7 - 55.8	1.1	Private
55.8 - 56.9	1.1	BLM
56.9 - 57.1	0.2	Private
57.1 - 58.0	0.9	BLM
58.0 - 59.0	1.0	Private
59.0 - 59.6	0.6	BLM
59.6 - 60.2	0.6	Private
60.2 - 62.7	2.5	BLM
62.7 - 63.3	0.6	Private
63.3 - 65.0	1.7	BLM
SUBTOTALS:		
	24.6	BLM
	37.7	Private
	2.7	Montana
	<u>65.0</u>	
SUBTOTALS:		
	244.3	BLM
	464.2	Private
	13.2	Wyoming
	12.4	Montana
	4.3	North Dakota
	10.1	Forest Service
	3.0	Corps of Engineers
	<u>751.5</u>	

TABLE A-3
LAND OWNERSHIP
U.S. HIGHWAY 85 ALTERNATIVE

Milepost	Miles	Ownership/ Management
Main Pipeline		
49.0 R - 48.1 R	0.9	BLM
48.1 R - 47.5 R	0.6	Private
47.5 R - 46.3 R	1.2	BLM
46.3 R - 41.7 R	4.6	Private
41.7 R - 40.7 R	1.0	BLM
40.7 R - 39.6 R	1.1	Private
39.6 R - 39.4 R	0.2	BLM
39.4 R - 38.4 R	1.0	Private
38.4 R - 38.1 R	0.3	Wyoming
38.1 R - 37.7 R	0.4	Private
37.7 R - 37.2 R	0.5	Wyoming
37.2 R - 36.2 R	1.0	Private
36.2 R - 35.1 R	1.1	BLM
35.1 R - 33.0 R	2.1	Private
33.0 R - 32.1 R	0.9	BLM
32.1 R - 31.7 R	0.4	Private
31.7 R - 30.5 R	1.2	BLM
30.5 R - 30.3 R	0.2	Private
30.3 R - 29.5 R	0.8	BLM
29.5 R - 28.3 R	1.2	Private
28.3 R - 28.2 R	0.1	BLM
28.2 R - 27.2 R	1.0	Private
27.2 R - 26.0 R	1.2	BLM
0.0 - 1.8	1.8	Private
1.8 - 4.1	2.3	BLM
4.1 - 6.3	2.2	Private
6.3 - 7.1	0.8	BLM
7.1 - 8.1	1.0	Private
8.1 - 8.7	0.6	BLM
8.7 - 9.6	0.9	Private
9.6 - 12.3	2.7	BLM
12.3 - 12.8	0.5	Private
12.8 - 13.5	0.7	BLM
13.5 - 14.3	0.8	Private
14.3 - 14.5	0.2	BLM
14.5 - 22.0	7.5	Private
22.0 - 35.8	13.8	BLM
35.8 - 36.8	1.0	Wyoming
36.8 - 39.8	3.0	BLM
39.8 - 40.9	1.1	Private
40.9 - 42.0	1.1	BLM
42.0 - 44.1	2.1	Private
44.1 - 44.9	0.8	BLM
44.9 - 45.8	0.9	Private
45.8 - 46.7	0.9	BLM
46.7 - 47.8	1.1	Private
47.8 - 48.4	0.6	BLM
48.4 - 49.2	0.8	Private
49.2 - 50.0	0.8	BLM

APPENDIX 5

TABLE A-3 (Continued)

Milepost	Miles	Ownership/ Management
50.0 - 50.5	0.5	Private
50.5 - 51.5	1.0	BLM
51.5 - 52.4	0.9	Private
52.4 - 53.5	1.1	BLM
53.5 - 54.5	1.0	Private
54.5 - 54.9	0.4	BLM
54.9 - 55.5	0.6	Private
55.5 - 56.4	0.9	BLM
56.4 - 57.5	1.1	Private
57.5 - 87.5	30.0	BLM
87.5 - 88.4	0.9	Wyoming
88.4 - 95.8	7.4	BLM
95.8 - 96.4	0.6	Wyoming
96.4 - 109.6	13.2	BLM
109.6 - 110.0	0.4	Private
110.0 - 112.3	2.3	BLM
112.3 - 112.6	0.3	Wyoming
112.6 - 115.4	2.8	BLM
115.4 - 116.1	0.7	Private
116.1 - 116.7	0.6	BLM
116.7 - 116.9	0.2	Private
116.9 - 117.7	0.8	BLM
117.7 - 118.0	0.3	Private
118.0 - 119.6	1.6	BLM
119.6 - 119.8	0.2	Wyoming
119.8 - 120.1	0.3	BLM
120.1 - 120.7	0.6	Private
120.7 - 121.4	0.7	BLM
121.4 - 122.1	0.7	Private
122.1 - 122.9	0.8	BLM
122.9 - 123.4	0.5	Wyoming
123.4 - 128.4	5.0	BLM
128.4 - 129.4	1.0	Wyoming
129.4 - 133.0	3.6	BLM
133.0 - 134.0	1.0	Private
134.0 - 137.1	3.1	BLM
137.1 - 138.0	0.9	Wyoming
138.0 - 139.3	1.3	Private
139.3 - 139.7	0.4	BLM
139.7 - 140.6	0.9	Private
140.6 - 140.8	0.2	Wyoming
140.8 - 141.1	0.3	Private
141.1 - 141.3	0.2	BLM
141.3 - 142.1	0.8	Private
142.1 - 148.3	6.2	BLM
148.3 - 149.9	1.6	Private
149.9 - 158.7	8.8	BLM
158.7 - 159.3	0.6	Private
159.3 - 162.3	3.0	BLM
162.3 - 163.2	0.9	Private
163.2 - 165.5	2.3	BLM
165.5 - 166.6	1.1	Private
166.6 - 168.2	1.6	BLM
168.2 - 168.5	0.3	Private

TABLE A-3 (Continued)

Milepost	Miles	Ownership/ Management
168.5 - 169.2	0.7	BLM
169.2 - 170.2	1.0	Private
170.2 - 171.2	1.0	BLM
171.2 - 175.3	4.1	Private
175.3 - 178.0	2.7	BLM
178.0 - 180.1	2.1	Private
180.1 - 180.9	0.8	BLM
180.9 - 182.6	1.7	Private
182.6 - 183.0	0.4	Wyoming
183.0 - 186.0	3.0	Private
186.0 - 186.8	0.8	BLM
186.8 - 190.4	3.6	Private
190.4 - 191.1	0.7	BLM
191.1 - 191.5	0.4	Private
191.5 - 195.6	4.1	BLM
195.6 - 195.8	0.2	Private
195.8 - 196.4	0.6	BLM
196.4 - 198.3	1.9	Private
198.3 - 198.8	0.5	Wyoming
198.8 - 199.0	0.2	BLM
199.0 - 199.6	0.6	Private
199.6 - 200.3	0.7	BLM
200.3 - 201.0	0.7	Private
201.0 - 208.7	7.7	BLM
208.7 - 209.3	0.6	Wyoming
209.3 - 222.3	13.0	BLM
222.3 - 222.9	0.6	Wyoming
222.9 - 223.2	0.3	BLM
223.2 - 223.6	0.4	Private
223.6 - 223.8	0.2	BLM
223.8 - 224.0	0.2	Private
224.0 - 224.4	0.4	BLM
224.4 - 224.8	0.4	Private
224.8 - 225.6	0.8	BLM
225.6 - 227.3	1.7	Private
227.3 - 229.1	1.8	BLM
229.1 - 229.6	0.5	Private
229.6 - 232.1	2.5	BLM
232.1 - 234.8	2.7	Private
234.8 - 235.4	0.6	BLM
235.4 - 236.0	0.6	Private
236.0 - 236.4	0.4	BLM
236.4 - 237.1	0.7	Private
237.1 - 238.2	1.1	BLM
238.2 - 238.7	0.5	Private
238.7 - 239.2	0.5	BLM
239.2 - 240.2	1.0	Private
240.2 - 240.5	0.3	BLM
240.5 - 241.4	0.9	Private
241.4 - 241.5	0.1	BLM
241.5 - 247.2	5.7	Private
247.2 - 248.0	0.8	BLM
248.0 - 252.4	4.4	Private
252.4 - 253.8	1.4	BLM

LAND OWNERSHIP AND MANAGEMENT

TABLE A-3 (Continued)

Milepost	Miles	Ownership/ Management
253.8 - 254.6	0.8	Private
254.6 - 256.2	1.6	BLM
256.2 - 257.1	0.9	Private
257.1 - 257.6	0.5	BLM
257.6 - 258.5	0.9	Wyoming
258.5 - 260.6	2.1	Private
260.6 - 261.4	0.8	BLM
261.4 - 261.7	0.3	Private
261.7 - 262.9	1.2	Wyoming
262.9 - 263.7	0.8	Private
263.7 - 263.9	0.2	BLM
263.9 - 311.0	47.1	Private
311.0 - 312.1	1.1	Wyoming
312.1 - 325.8	13.7	Private
325.8 - 326.1	0.3	BLM
326.1 - 327.7	1.6	Private
327.7 - 328.0	0.3	BLM
328.0 - 328.3	0.3	Private
328.3 - 328.5	0.2	BLM
328.5 - 340.0	11.5	Private
340.0 - 340.4	0.4	BLM
340.4 - 340.6	0.2	Private
340.6 - 341.0	0.4	BLM
341.0 - 343.8	2.8	Private
343.8 - 344.0	0.2	BLM
344.0 - 346.9	2.9	Private
346.9 - 347.2	0.3	BLM
347.2 - 349.0	1.8	Private
349.0 - 349.6	0.6	BLM
349.6 - 350.4	0.8	Private
350.4 - 350.7	0.3	BLM
350.7 - 351.0	0.3	Private
351.0 - 351.1	0.1	BLM
351.1 - 351.3	0.2	Wyoming
351.3 - 351.4	0.1	Private
351.4 - 351.7	0.3	BLM
351.7 - 352.0	0.3	Private
352.0 - 352.7	0.7	Wyoming
352.7 - 367.7	15.0	Private
367.7 - 368.9	1.2	BLM
368.9 - 382.0	13.1	Private
382.0 - 382.6	0.6	BLM
382.6 - 382.8	0.2	Private
382.8 - 384.0	1.2	Montana
384.0 - 388.1	4.1	Private
388.1 - 388.7	0.6	Montana
388.7 - 389.3	0.6	Private
389.3 - 389.9	0.6	Montana
389.9 - 390.9	1.0	Private
390.0 - 391.2	0.3	Montana
391.2 - 391.7	0.5	Private
391.7 - 394.1	2.4	BLM
394.1 - 394.7	0.6	Private
394.7 - 395.2	0.5	BLM

TABLE A-3 (Continued)

Milepost	Miles	Ownership/ Management
395.2 - 397.8	2.6	Private
397.8 - 399.4	1.6	BLM
399.4 - 401.1	1.7	Private
401.1 - 401.9	0.8	BLM
401.9 - 402.9	1.0	Private
402.9 - 407.7	4.8	BLM
407.7 - 408.5	0.8	Private
408.5 - 413.4	4.9	BLM
413.4 - 413.8	0.4	Private
413.8 - 414.1	0.3	BLM
414.1 - 414.6	0.5	Private
414.6 - 415.6	1.0	Montana
415.6 - 424.6	9.0	Private
424.6 - 425.1	0.5	BLM
425.1 - 442.5	17.4	Private
442.5 - 443.0	0.5	BLM
443.0 - 443.5	0.5	Private
443.5 - 443.8	0.3	BLM
443.8 - 447.2	3.4	Private
447.2 - 448.3	1.1	Montana
448.3 - 462.5	14.2	Private
462.5 - 463.0	0.5	BLM
463.0 - 463.5	0.5	Private
463.5 - 464.5	1.0	BLM
464.5 - 467.0	2.5	Private
467.0 - 467.1	0.1	Montana
467.1 - 471.1	4.0	Private
471.1 - 471.6	0.5	Montana
471.6 - 473.2	1.6	Private
473.2 - 474.3	1.1	Montana
474.3 - 477.1	2.8	Private
477.1 - 478.5	1.4	Montana
478.5 - 481.4	2.9	Private
481.4 - 482.7	1.3	Montana
482.7 - 486.2	3.5	Private
486.2 - 486.7	0.5	Montana
486.7 - 504.0	17.3	Private
504.0 - 505.6	1.6	Forest Service
505.6 - 506.6	1.0	Private
506.6 - 506.8	0.2	Forest Service
506.8 - 507.6	0.8	North Dakota
507.6 - 509.2	1.6	Forest Service
509.2 - 510.8	1.6	Private
510.8 - 511.1	0.3	Forest Service
511.1 - 512.2	1.1	Private
512.2 - 513.2	1.0	North Dakota
513.2 - 516.6	3.4	Forest Service
516.6 - 519.7	3.1	Private
519.7 - 520.1	0.4	Forest Service
520.1 - 520.9	0.8	Private
520.9 - 521.5	0.6	Forest Service
521.5 - 522.5	1.0	Private
522.5 - 522.7	0.2	Forest Service
522.7 - 550.2	27.5	Private

APPENDIX 5

TABLE A-3 (Continued)

Milepost	Miles	Ownership/ Management
550.2 - 550.8	0.6	Forest Service
550.8 - 551.2	0.4	Private
551.2 - 551.6	0.4	Forest Service
551.6 - 557.7	6.1	Private
557.7 - 558.7	1.0	Forest Service
558.7 - 559.7	1.0	Private
559.7 - 560.8	1.1	North Dakota
560.8 - 562.6	1.8	Private
562.6 - 566.9	4.3	Forest Service
566.9 - 578.3	11.4	Private
578.8 - 580.6	2.3	Forest Service
580.6 - 580.9	0.3	Private
580.9 - 582.9	2.0	Forest Service
582.9 - 627.2	44.3	Private
627.2 - 629.0	1.8	Forest Service
629.0 - 629.3	0.3	Private
629.3 - 632.3	3.0	Corps of Engineers
632.3 - 633.3	1.0	North Dakota
633.3 - 644.3	11.0	Private
644.3 - 645.3	1.0	North Dakota
645.3 - 647.5	2.2	Private
SUBTOTALS:		
	205.6	BLM
	414.6	Private
	12.6	Wyoming
	9.7	Montana
	4.9	North Dakota
	20.7	Forest Service
	3.0	Corps of Engineers
	<u>670.5</u>	
Bairoil Spur Pipeline		
0.0 - 2.9	2.9	BLM
2.9 - 3.5	0.6	Wyoming
3.5 - 13.7	10.2	BLM
13.7 - 16.8	3.1	Private
16.8 - 17.8	1.0	BLM
17.8 - 20.0	2.2	Private
SUBTOTALS:		
	14.1	BLM
	5.3	Private
	0.6	Wyoming
	<u>20.0</u>	
Cedar Creek Distribution Pipeline		
0.0 - 0.3	0.3	Private
0.3 - 1.3	1.0	BLM
1.3 - 2.3	1.0	Private
2.3 - 3.4	1.1	BLM
3.4 - 3.8	0.4	Private
3.8 - 5.1	1.3	BLM
5.1 - 8.7	3.6	Private

TABLE A-3 (Continued)

Milepost	Miles	Ownership/ Management
8.7 - 9.6	0.9	BLM
9.6 - 11.8	2.2	Private
11.8 - 12.9	1.1	BLM
12.9 - 13.1	0.2	Private
13.1 - 14.0	0.9	BLM
14.0 - 15.1	1.1	Private
15.1 - 15.8	0.7	BLM
15.8 - 16.2	0.4	Private
16.2 - 16.5	0.3	BLM
16.5 - 18.0	1.5	Private
18.0 - 18.5	0.5	BLM
18.5 - 24.9	6.4	Private
24.9 - 25.9	1.0	Montana
25.9 - 29.1	3.2	BLM
29.1 - 29.4	0.3	Private
29.4 - 30.3	0.9	BLM
30.3 - 30.9	0.6	Private
30.9 - 31.6	0.7	BLM
31.6 - 32.7	1.1	Private
32.7 - 33.3	0.6	Montana
33.3 - 34.0	0.7	Private
34.0 - 34.6	0.6	BLM
34.6 - 37.7	3.1	Private
37.7 - 38.3	0.6	BLM
38.3 - 46.4	8.1	Private
46.4 - 47.5	1.1	Montana
47.5 - 48.1	0.6	Private
48.1 - 48.8	0.7	BLM
48.8 - 49.7	0.9	Private
49.7 - 50.1	0.4	BLM
50.1 - 51.2	1.1	Private
51.2 - 52.1	0.9	BLM
52.1 - 52.3	0.2	Private
52.3 - 53.6	1.3	BLM
53.6 - 54.0	0.4	Private
54.0 - 54.7	0.7	BLM
54.7 - 55.8	1.1	Private
55.8 - 56.9	1.1	BLM
56.9 - 57.1	0.2	Private
57.1 - 58.0	0.9	BLM
58.0 - 59.0	1.0	Private
59.0 - 59.6	0.6	BLM
59.6 - 60.2	0.6	Private
60.2 - 62.7	2.5	BLM
62.7 - 63.3	0.6	Private
63.3 - 65.0	1.7	BLM
SUBTOTALS:		
	24.6	BLM
	37.7	Private
	2.7	Montana
	<u>65.0</u>	

LAND OWNERSHIP AND MANAGEMENT

TABLE A-3 (Continued)

TABLE A-3 (Concluded)

Milepost	Miles	Ownership/ Management	Milepost	Miles	Ownership/ Management
GRAND TOTAL: (All pipelines)					
	244.3	BLM		4.9	North Dakota
	457.0	Private		20.7	Forest Service
	13.2	Wyoming		3.0	Corps of Engineers
	12.4	Montana		<u>755.5</u>	

**TABLE A-4
OWNERSHIP OR MANAGEMENT OF ACRES DISTURBED,
REMOVED, AND RECLAIMED
U.S. HIGHWAY 85 ALTERNATIVE**

Components	Acres Disturbed	BLM	Private	Wyoming	Montana	North Dakota	Forest Service	Corps of Engineers	Unknown	
Pipelines										
670.5 miles @ 12 acres per mile	8,046.0	2,467.2	4,968.0	151.2	116.4	58.8	248.4	36.0		
20.0 miles @ 15 acres per mile	300.0	211.5	79.5	9.0	—	—	—	—		
65.0 miles @ 6 acres per mile	390.0	147.6	226.2	—	16.2	—	—	—		
Facilities										
Origin Meter/ Junction	2 @ 1 acre each	2.0	2.0							
Bairoil Junction	1 @ 1 acre each	1.0	1.0							
Block Valves	35 @ 1/10 acre each*									
Scraper Traps with Block Valves	5 @ 1/2 acre each*									
Green River Staging Areas	6 @ 2 1/2 acres each	15.0	10.0	2.5	2.5					
Booster Stations	3 @ 3 acres each	9.0	9.0							
Staging Area South Side Lake Sakakawea		3.5							3.5	
Staging Area North Side Lake Sakakawea		17.5							17.5	
Staging Areas Other Creeks & Rivers	7 @ 5 acres each	35.0		35.0						
Tioga Meter (Terminal)		1.0		1.0						
Up-Grading Existing Roads		74.0							74.0	
Temporary Access Roads		108.0		108.0						
Bairoil Meter		1.0	1.0							
Bairoil Gas Plant		100.0		100.0						
Bairoil Product Storage Tank Site		3.0	3.0							
Bairoil Field CO ₂ Dist. Sys.		300.0		300.0						
Cedar Creek Receipt Meters (2)/ Booster Station		5.0				5.0				
Cedar Creek Delivery Meters	8 @ 2 acres each	16.0	4.0	12.0						
Power Lines to Junctions, Block Valves, Scraper Traps, Booster Stations & Microwave Sites		132.0		132.0						
Microwave Sites	20 @ 1/4 acre each	5.0	1.75	3.0	0.25					
TOTAL:		9,564.0	2,858.05	5,967.2	162.95	137.6	58.8	248.4	57.0	74.0

*Acres and ownership included in pipelines.

APPENDIX 6

ENDANGERED SPECIES ACT COMPLIANCE

The Endangered Species Act of 1973 requires, under Section 7, that any federal agency carrying out any action that might affect an endangered species must consult with the U.S. Department of the Interior, Fish and

Wildlife Service, concerning the effects of the projects on threatened or endangered species.

The correspondence contained in this appendix is the Fish and Wildlife Service response to BLM's request for a Section 7 listing of listed species in the project area.



United States Department of the Interior
FISH AND WILDLIFE SERVICE

RECEIVED
APR 3 1985
EIS OFFICE

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228

IN REPLY REFER TO:

FA/SE/BLM
Informal (Species List)

MAR 29 1985

MEMORANDUM

To: Chief, Division of EIS Services, Denver Service Center
Bureau of Land Management, Denver, Colorado

From: ~~Acting~~ Regional Director, Region 6
U.S. Fish and Wildlife Service, Denver, Colorado

Subject: Bairoil/Williston Basin CO₂ Projects EIS--Request for Section 7
Species List

This responds to your March 1, 1985, request for a species list on the subject project. In accordance with Section 7(c) of the Endangered Species Act, as amended (ESA), we have determined that the following listed and proposed threatened and endangered (T/E) species may be present in the project area.

Listed Species

Expected Occurrence

Bald eagle (Haliaeetus leucocephalus)
Montana and North Dakota
Wyoming

Migration, winter resident
Resident

Whooping crane (Grus americana)
North Dakota
Wyoming (Sweetwater County only)

Migration
Migration, possibly summer resident

Peregrine falcon (Falco peregrinus)

Migration

Black-footed ferret (Mustela nigripes)

Possible resident of prairie dog
towns

Proposed Species

Expected Occurrence

Piping plover (Charadrius melodus)

Breeding, migration

Possible ferret sightings have been reported in North Dakota in Billings (T137N, R102W, Sec. 20, SW 1/4; T134N, R100W, Sec. 23; and T140N, R101W) and Dunn (T142N, R91W, Sec. 18, S 1/2, and Sec. 19, N 1/2) Counties since 1970. Breeding piping plovers have been documented in Williams County, North Dakota, and in this State the plover population is largely confined to the shores of saline wetlands and river sandbars.

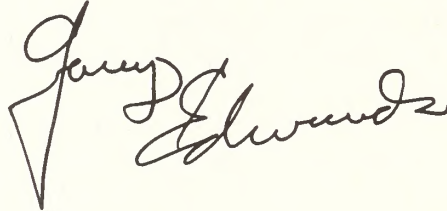
Section 7(c) of the ESA requires that you conduct and submit to the Fish and Wildlife Service (FWS) a biological assessment to determine the effects of the proposed project on listed and proposed species. If not initiated within 90 days, the list should be verified with the FWS prior to initiation of the assessment. The biological assessment should be completed within 180 days of initiation but can be extended by mutual agreement between your agency and the FWS. The assessment conducted pursuant to Section 7 may be undertaken as part of your agency's compliance with the requirements of Section 102 of NEPA and incorporated into the EIS. The biological assessment should include:

1. A description of the project;
2. The current status, habitat use, and behavior of T/E species in the project area;
3. Discussion of the methods used to determine the information in item 2;
4. Direct and indirect impacts of the project to T/E species;
5. Cumulative impacts from Federal, State, or private projects in the area;
6. Mitigation/coordination measures that will reduce or eliminate adverse impacts to T/E species;
7. The expected status of T/E species in the future (short- and long-term) during and after project completion;
8. Determination of "no affect"/"may affect" to listed species; and
9. Citation of literature and personal contacts used in assessment.

If you determine that the project will affect any of the above listed species, formal consultation should be initiated with FWS. Section 7(d) of the ESA requires that during consultation on listed species, the Federal agency and permit or license applicant shall not make any irreversible or irretrievable commitment of resources which would preclude the formulation of reasonable and prudent alternatives.

In addition, if you determine that the proposed action is likely to jeopardize the continued existence of a proposed species, BLM must confer with the FWS.

If we can be of further assistance, please advise us. You may contact Wayne Wathen (FTS 776-7398) in the Regional Office; Ron Crete (FTS 585-5225) for further information on Wyoming or Montana Species; or Wally Jobman (FTS 782-5226) for information on North Dakota.

A handwritten signature in cursive script that reads "Gary Edwards". The signature is written in black ink and is positioned above the printed name.

GARY EDWARDS

APPENDIX 7

METHODOLOGIES

SOCIOECONOMICS

This appendix describes the data sources and methods used to analyze the impacts. It is divided into the following sections:

- Employment
- Personal Income and Per Capita Personal Income
- Population
- Local Government Revenue
- Impacts Associated with Operation of the Pipeline

In each section the sources of baseline and impacts data and the analytical methods are described for that subject. Short-form references are given. Complete references can be found in *References Cited*.

Due to the relatively low significance of population impacts resulting from the proposed action, as well as their brief incidence, impacts to housing and infrastructure are not addressed in this document.

All estimates from all sources and/or methodologies are rounded except where actual, known data for an earlier year in a given locality is held constant.

Employment Impacts

BASELINE EMPLOYMENT

Carbon County: Report by Denver Research Group, Inc. February 14, 1985, page 2.

Sweetwater County: Exxon LaBarge Project Phase 2 Industrial Siting Application, Vol. 1, p. 5-60.

Fremont County: No projections available. The number presented is for 1983 and was derived by expanding 1983 total employment, published by the Wyoming Employment Security Commission, by the ratio of 1980 data published by the U.S. Bureau of Economic Analysis (1983) to 1980 data published by WESC.

Natrona, Converse, Johnson, Sheridan, and Campbell Counties: Derived by applying the ratio of 1980 BEA/WESC data to the number extrapolated between

1985 covered employment and 1987 covered employment as published in the *Powder River Coal DEIS (BLM 1984b)*.

Powder River, Carter, Fallon, Custer, Dawson, Richland, Butte, Lawrence, Meade, and Dennington Counties: Derived by employment/population ratio to projected population.

Golden Valley, Billings, Stark, Dunn, McKenzie, Mountrail, and Williams: 1980 BEA Data: No projections available. 1982 represented a peak before the slump.

EMPLOYMENT IMPACTS OF THE ALTERNATIVES

Peak Construction Employment—Proposed Action Single Bairoil Pipeline Alternative

- Based on a letter from Amoco dated February 25, 1985 (Amoco 1984-85), page 2, it is assumed that 30 percent of the construction crew for the oil field facilities would be hired locally.
- Based on Amoco and Exxon right-of-way application, it is assumed that 50 percent of the construction crew for the pipeline(s) and related facilities would be hired locally.
- Based on a telephone conversation with Exxon officials, it is assumed that 15 percent of the non-local pipeline construction crew would camp along the construction route.

SECONDARY EMPLOYMENT MULTIPLIERS

- 0.50 for construction of oil field facilities.
- 0.25 for construction of the pipeline(s) and related facilities.
- It is assumed that 100 percent of the secondary employment requirement would be filled locally through local housewives, students, and the families of primary employees.

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GRAVITY MODEL ALLOCATION (BASIC GRAVITY MODEL)

The population of each community was divided by travel times from site. The resulting quotients were summed. The percent of that total for each community was then calculated.

MODIFICATION FOR THIS ANALYSIS

Each pipeline spread was divided into three parts, giving reference points at 1/3 and 2/3 the distance of that spread. The model was run at each reference point and the results averaged for each spread and applicable facilities.

Separate model runs for each of these were summed to obtain the final results. Allocations of less than 5 percent were reallocated to the nearest community having an allocation of 5 percent or more. On a continually moving project, it is assumed that workers would favor larger communities within a reasonable commuting distance.

A separate gravity model was made for secondary employment, including only those communities to which primary employment was allocated.

EMPLOYMENT IMPACTS OF INTERRELATED PROJECTS (SOURCES/METHODOLOGY)

- Exxon Shute Creek development: Exxon Company, USA (1983)
- Chevron phosphate project: Western Research Corporation (1984)
- Jim Bridger power plant and Western Wyoming Community College: Western Research Corporation (Kimball 1984)

COAL DEVELOPMENT

Construction Period: 4.4 primary employees per 100,000 tons of production capacity - 0.55 secondary job per primary construction job.

Operational Period: 4 primary employees per 100,000 tons of production capacity - 1.35 secondary jobs per primary operational job.

Personal Income and Per Capita Personal Income

BASELINE PERSONAL INCOME (1984 DOLLARS) SOURCES

Sweetwater County: letter from Denver Research Group, Inc., dated February 14, 1985.

Carbon County: report by Denver Research Group, Inc., page 3.

All Others: U.S. Bureau of Economic Analysis (1983). Adjustments were made to update 1981 employment and income to 1986.

Impacts to CO₂ Pipeline and Interrelated Projects

Employment was multiplied by average earnings by sector, less social insurance contributions.

PER CAPITA PERSONAL INCOME

Total personal income was divided by county population.

Population

BASELINE POPULATION SOURCES

Sweetwater County, Green River, Rock Springs: 1986 Industrial Siting Application for the Exxon LaBarge Project, Phase 2, pages 5-92, 6-34, and 6-36 (Exxon 1983).

Bairoil: Report by the Denver Research Group, page 14.

Fremont County, Butte County, Lawrence County, Meade County, and Pennington County: Projections not available; 1982 estimate from U.S. Bureau of Economic Analysis, 1983, was used.

Carbon County and Rawlins: Report by the Denver Research Group, page 14.

Natrona County, Casper, Converse County, Johnson County, Buffalo, Sheridan County, Campbell County, and Gillette: 1986 is an interpolation between figures published for 1985 and 1987 in the Powder River Coal DEIS (BLM 1984b), 1984, pages 57 through 59; 1990 figures are the figures projected in that publication.

SOCIOECONOMIC METHODOLOGY

Powder River County, Carter County, Fallon County, Custer County, Dawson County, and Richland County: 1986 data is an interpolation between figures for 1980 and 1990 as presented in Montana County Profiles by the Montana Department of Administration, Research and Statistical Services Bureau, May 1983.

Baker, Miles City, and Belle Fourche: Based on 1980 ratio of city to county population.

Golden Valley County, Billings County, Stark County, Bellfield, Dickinson, Dunn County, Killdeer, McKenzie County, Watford City, Mountrail County, Williams County, Williston, and Tioga: Used 1980 census; projections were not usable, since 1982 reflected a peak before a slump.

IMPACTS OF CONSTRUCTION

Pipeline: Assumes 56 percent of primary employment would be single; 44 percent with a family, 3.4 persons per family.

Oilfield Facilities: Assumes 1.1 persons per additional primary employee at Bairoil. Source for Rawlins population impact is the Denver Research Group, page 14. All secondary workers were assumed to be from the local labor force.

Local Government Revenue

BASELINE REVENUE SOURCES

All Wyoming Counties, Communities, and Schools: 1984 revenues obtained through telephone conversation between Laurence E. Marks and officials of the specific local entities.

All Montana Counties and Schools: 1984 revenues from the report of the Montana State Department of Revenue for the period July 1, 1982 through June 30, 1984.

All North Dakota Counties and Schools: 1984 revenues obtained through telephone conversations between Dave Willard and officials of the specific local entities.

Baseline for Taxes During Operation: Taxes during construction baseline were increased in ratio to population.

IMPACTS OF CONSTRUCTION

Methods: Investment costs times assessment rate times mill levy.

Investment Costs (Amoco, Exxon): Investment costs divided among jurisdictions in proportion to mileage.

Assessment Rates (Wyoming Jurisdictions): Wyoming Department of Revenue and Taxation; Ad Valorem Tax Division; 10 percent pipeline value in-place.

Assessment Rates (Montana Jurisdictions): Montana Department of State Revenues; 15 percent pipeline value in-place.

Assessment Rates (North Dakota Jurisdictions): Office of the State Tax Commission; 5 percent pipeline value in-place.

MILL LEVIES SOURCES

Wyoming Jurisdictions: 1984 levies obtained through telephone conversations between Laurence E. Marks and officials of the specific local entities.

Montana Jurisdictions: 1984 levies from the Report of the Montana State Department of Revenue for the period July 1, 1982 through June 30, 1984.

North Dakota Jurisdictions: 1983 levies obtained through telephone conversations between David Willard and officials of the specific local entities.

IMPACTS ON INTERRELATED PROJECTS

Chevron Phosphate Project: Chevron Chemical Company (1982a), revised in accordance with Western Research Corporation (1984).

Exxon Shute Creek Development: Exxon Company, USA (1983).

No additional property taxes would be charged for the Jim Bridger power plant project (pollution control equipment is not taxed) or the Western Wyoming Community College expansion (because it is a state institution).

Campbell County Coal Mines: Based on relationships derived from Stinson's Coal Revenue Model.

Air Force Contracts: No tax on state or federal developments.

Impacts Associated with Operation of the Pipeline

BASELINE PRODUCTION SOURCES

Annual Oil and Gas Production (1981): 1982 Wyoming Mineral Yearbook; Wyoming Department of Economic Planning and Development.

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Employment for Sweetwater County (1990): Industrial Siting Application for the Exxon LaBarge Project, Phase 2, Vol. I, pages 5 through 60 (Exxon 1983).

Employment for Carbon County (1990): Report by the Denver Research Group, page 2.

Population of Sweetwater County (1990): Amendment supplement to Industrial Siting Application for the Chevron Phosphate Project, page 24.

Population of Carbon County, Rawlins (1990): Report by the Denver Research Group, page 14.

Personal Income in Sweetwater County (1990): Increased in ratio to baseline population.

Personal Income in Carbon County (1990): Report by the Denver Research Group (1985), page 3.

Local Government Revenues (1990): Wyoming and Montana Jurisdictions: Increased in ratio to baseline population and rounded.

Local Government Revenues (1990): North Dakota Jurisdictions: 1984 revenues held constant.

Other Government Revenues (1990): Baseline revenues consist of the summation of estimates of ad valorem, severance, and federal royalty revenues based on 1982 assessed valuation on oil and gas production as obtained from the Wyoming Mineral Yearbook published by WDEPAD in November 1982. CO₂ has not been previously collected or sold in Wyoming; therefore, it has not been taxed. Royalty Rates: 18.9 percent in Sweetwater County and 10 percent in Carbon County. These are weighted average royalty rates paid on oil and gas production in the Lost Soldier and Wertz fields as weighted by the percentage of federal lease holdings in those fields.

Ad Valorem and Severance Tax Rates (6 percent each): Wyoming Department of Revenue and Taxation (Bower 1985). Ad valorem and severance rates applied after royalty share of assessed valuation.

IMPACTS OF OPERATION

CO₂ Production: Based on Amoco's and Exxon's expressed intention to transport 200 MMcfd each to the Bairoil oil field facilities. It is assumed that 40 percent of the CO₂ production would occur in Lincoln County, based on the percentages of the total number of processing units that would be established in Lincoln County.

Oil and Gas Production: Additional production derived from tables 1-5 and 1-6. County production was based

on Amoco's estimate that 10 percent of total production would occur in Carbon County and 90 percent in Sweetwater County.

Employment: By place of employment. Values were interpolated from employment by place of residence from the report by the Denver Research Group (1985), pages 5 and 15.

Population (source): Report by the Denver Research Group, page 14.

Income (source): Report by the Denver Research Group, page 9.

IMPACTS TO LOCAL GOVERNMENT REVENUES DURING OPERATION OF THE PROPOSED ACTION

Methods and sources were generally the same as listed under the *Impacts of Construction*. Deviations are:

Wyoming: Minerals were assessed at 10 percent of 1982 assessed valuation; CO₂ was assessed at \$0.40 per mdf wellhead value.

Montana: Based on \$0.75 per mcf transported.

INTERRELATED PROJECTS

Derived from the same source as listed under the *Impacts of Construction*.

IMPACTS TO OTHER GOVERNMENT REVENUES

Same methodologies and sources as baseline, with mineral assessments and CO₂ value used in local government revenues above.

SOILS

General Methodology

Information from the following soil surveys was used to evaluate potential impacts and would be used by the applicants and authorizing agencies to determine applicable erosion control, reclamation, and revegetation measures: (1) Wyoming General Soil Map (University of Wyoming 1977); (2) General Soil Map, Sweetwater County, Natrona County and Campbell County, Wyoming (SCS 1984); (3) Frontier Pipeline Company EIS Soils Technical Report (BLM 1982b); (4) Soil Survey Campbell County, Wyoming (SCS 1946); (5) unpublished soil surveys of Fremont and Natrona Counties; (6) Soil

SOILS METHODOLOGY

Survey Powder River Area, Montana (SCS and BLM 1971); (7) General Soil Map Carter County, Montana and Fallon County, Montana (SCS 1985); (8) Soil Survey Report-County General Soil Maps North Dakota (Golden Valley, Billings, Dunn, McKenzie, and Williams counties) (North Dakota State University 1968); (9) Soil Survey Billings County, North Dakota (USDA 1944); and (10) Soil Survey McKenzie County, North Dakota (USDA 1942).

Soils occurring within the project area were combined into major generalized soil groups to evaluate potential impacts and to determine effective erosion control measures, reclamation, and revegetation potential. Combinations of soils were based on soil properties and slope characteristics. The generalized soil groups were then evaluated by climate conditions (average annual precipitation and frost-free season). The average annual precipitation zones identified were less than 9 inches, 9 to 12 inches, and 12 to 15 inches. Erosion control effectiveness and revegetation potential were based on these average annual precipitation zones.

Soil Groups

Soils were grouped as follows:

- Soils of the nearly level to gently sloping (0 to 5 percent slope) floodplains, low terraces, and alluvial fans

This group consists of deep, well-drained to somewhat poorly drained clay loam, loam, and sandy loam soils on nearly level to gently sloping flood plains and terraces. These soils formed in mixed alluvium derived mainly from sedimentary rocks. They are subject to a slight to moderate erosion hazard, and, in some areas, are moderately saline and alkaline. They are commonly the most productive soils of the area and are used for cropland and grazing. These soils occur in areas with an average annual precipitation of 7 to 15 inches.

- Soils of the nearly level to sloping (0 to 9 percent slopes) broad basins and valley floors

This group consists of deep, well-drained to moderately well-drained loam, clay loam, and clay soils on nearly level to gently sloping broad basin floors and valley bottoms. These soils formed in mixed alluvium derived mainly from sedimentary rocks. The soils are subject to a slight to moderate erosion hazard and in places are moderately to strongly alkaline. These soils occur in the 7- to 9-inch average annual precipitation area. These soils are used for livestock grazing and wildlife.

- Sandy soils of the undulating to hilly dune-like areas

This group consists of deep, well-drained sandy and loamy sand soils on undulating to hummocky and dunal areas. These soils formed in mixed aeolian material derived mainly from sedimentary rock. They are subject to a moderate to high wind erosion hazard. These soils are used for livestock grazing and wildlife.

- Soils of the undulating to rolling (1 to 7 percent slopes) plains and high terraces dissected by intermittent drainageways and underlain by siltstone, and shale

This group consists of moderately deep and deep, well-drained, mainly clay loam and loamy soils on gently sloping to rolling plains and high terraces dissected by intermittent drainageways and underlain by sandstone, siltstone, and shale. These soils are subject to a slight to moderate erosion hazard. They are used for grazing and nonirrigated cropland mainly in the area with 12- to 15-inch average annual precipitation.

- Soils of the undulating to rolling (3 to 15 percent slopes) plains dissected by intermittent drainageways forming from mixed loamy materials

This group consists of moderately deep and deep, well-drained, neutral to moderately alkaline clay loam and loam soils on sloping to strongly sloping and rolling plains dissected by intermittent drainageways. These soils are forming from mixed alluvial and aeolian and residual materials derived mainly from sandstone, siltstone, and shale. They are subject to a moderate to severe erosion hazard. These soils are used mainly for grazing and interspersed nonirrigated cropland in the 12-to 15-inch average annual precipitation areas.

- Soils of the strongly sloping to moderately steep (15 to 30 percent slopes) hillsides, including steep foothills

This group consists of shallow and moderately deep, well-drained, neutral to moderately alkaline clay loam and loam soils on strongly sloping to moderately steep side slopes of drainageways, buttes, plateaus, and foothills. These soils commonly contain varying amounts of coarse fragments (10 to 35 percent by volume). These soils formed in mixed alluvium, aeolian, and residual materials derived from sandstone, siltstone, and shale. Local butte-like areas of scoria beds are included. These soils are used for livestock grazing and wildlife.

- Soils of the undulating to rolling (3 to 9 percent slopes) glaciated tilled plains

This group consists of deep, well-drained, neutral to moderately alkaline loam and clay loam soils on the gently sloping to rolling glaciated till plains. These soils formed in glacial tills (containing varying amounts of

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coarse fragments, 10 to 35 percent by volume), mixed materials derived from sedimentary rocks, and aeolian materials (loess). These soils are subject to a moderate erosion hazard. They are used for non-irrigated cropland and livestock grazing.

- Soils of the strongly sloping steep and very steep (15 to 50 percent slopes) hills, sideslopes, and badlands

This group consists mainly of shallow and moderately deep, well-drained, neutral to moderately alkaline clay loam and sandy loam soils on strongly sloping and steep to very steep hills, fans, sideslopes, and escarpments bordering buttes and intermittent drainages, including badlands. Some deep soils occur in fan areas. These soils commonly contain varying amounts of coarse fragments (15 to 35 percent by volume). They are formed in mixed residual, alluvial, and aeolian materials derived from sedimentary rocks. These soils are usually sparsely vegetated and subject to high runoff and high erosion hazard (geologic erosion). They are used mainly for watershed protection, wildlife habitat, and very limited livestock grazing.

- Strongly saline and alkaline soils on floodplains, terraces, basins, and sideslopes

This group consists of deep, moderately well-drained to somewhat poorly drained, strongly saline and alkaline clay loam, clayey and loam soils on floodplains, terraces, basins, and toeslope positions of steep sideslopes. These soils formed mainly in mixed clayey alluvium derived from sedimentary rocks. They are subject to a slight to moderate erosion hazard, are strongly saline or alkaline, and have a low reclamation potential. They are used mainly for livestock grazing and wildlife.

Determination of Susceptibility to Impacts

Soils with the following properties would be most susceptible to impacts and require more intensive erosion control and reclamation measures: (1) shallow over bedrock (less than 20 inches); (2) underlain by hard bedrock; (3) sand, loamy sand, and clay-textured surface and subsoil layers; (4) containing more than 35 percent coarse fragments by volume, exceeding sizes of 3 inches in diameter; (5) permeability less than 0.6 inch per hour; (6) water table less than 72 inches; (7) soil reaction with pH value greater than 8.5, salinity more than 16 millimhos in the upper 40 inches; and (8) occupying slope steeper than 15 percent. Project areas located in the less-than-9-inch average annual precipitation zone were considered more susceptible to soil and vegetation impacts. Soil survey data, climatic data (average annual precipitation), in conjunction with orthophotograph

(scale 1:24,000) interpretations, and U.S. Geological Survey quadrangle maps (scale 1:24,000) were used to identify and locate sensitive soil and terrain areas.

VEGETATION

The vegetation inventory, forage availability revegetation potential, and threatened, endangered, and sensitive plant species information presented in this EIS was gathered from the following sources: (1) Frontier Pipeline Company EIS Vegetation Technical Report (BLM 1982c); (2) Frontier Pipeline Company EIS Grazing Technical Report (BLM 1982d); (3) Vegetation Inventory Bairoil CO₂ Flood Project (Amoco 1984a); (4) Draft Resource Management Plan/Environmental Impact Statement for the Platte River Resource Area, Casper, Wyoming (BLM 1984c); (5) Selmo Draft Resource area Management Plan and Draft Environmental Impact Statement for the Buffalo Resource Area, Casper District, Wyoming (BLM 1984d); (6) Climax Vegetation of Montana (SCS 1976); (7) North Dakota Grazing Environmental Impact Statement (BLM 1984e); (8) North Dakota Rangeland Resources (Shaver 1977); (9) North Dakota Natural Heritage Inventory Species of Concern (Eiken 1984), and (10) Montana Rare Plant Project (Lesica and others 1984). Orthophotographs (scale 1:24,000) and USGS Land Use and Cover Maps (scale 1:250,000) were used when available to supplement the vegetation inventory.

Vegetation communities and range sites were combined into 11 major vegetation types to evaluate impacts and determine revegetation potential. Grouping of vegetation communities into major vegetation types was based on the similarity of key species.

AGRICULTURE

Livestock Grazing

Inventory information for the grazing section was gathered along with the vegetation inventory. (See Vegetation section for sources.)

Impact analysis was based on three average carrying capacities described in the text. These carrying capacities were based on vegetation types and range sites, climatic zone (average annual precipitation), and terrain.

Cropland

Impact analysis for the cropland section was made from evaluations of field observations on portions of the pipeline route, orthophotograph interpretations, USGS Land Cover Maps (where available), Frontier Pipeline

EROSION CONTROL RECLAMATION METHODOLOGY

Company EIS Soil and Prime Farmlands Technical Report (BLM 1982b), Soil Survey reports, and North Dakota Important Farmlands (SCS 1984).

See the following section for the method used in evaluating impacts on cropland.

EROSION CONTROL, RECLAMATION, AND REVEGETATION ANALYSIS METHODOLOGY AND CRITERIA

The erosion control, reclamation, and revegetation guidelines (Appendix 3) were developed and evaluated using information collected in the soils and vegetation review of the project. The evaluation determined that if the procedures were followed and the appropriate monitoring occurred, the disturbed areas would be successfully revegetated upon completion of construction. The methodology used to complete the evaluation is discussed below. (See resource sections for assumptions.)

Soils, vegetation, and climatic information collected for the surface areas that could be disturbed by the Proposed Action or alternatives were evaluated. Soil surveys were reviewed to identify soil types and terrain strongly affecting construction activities, erosion control, and reclamation potential.

The soils data was analyzed and evaluated to identify:

- areas with soil properties that strongly affect restoration of cropland and revegetation of native rangeland;
- areas subject to slides, rockfall, and mass movement;
- areas that are susceptible to high wind and water erosion hazards;
- effective measures to minimize the effect of soil disturbances caused by construction activities and to control accelerated erosion; and
- areas where erosion and resultant sediment yield would affect water quality.

Soil erosion losses were estimated using the universal soil loss equation (USLE) and the wind erosion equation as applied to construction sites for selected soil areas representing various conditions occurring throughout the proposed project area. Recent developments in the USLE make it a potentially valuable tool for selecting and evaluating conservation practices on areas disturbed by construction activities. The information gained by application of the USLE to selected soil sites was used

as a basis for determining appropriate erosion control and revegetation measures and to evaluate the effectiveness of those measures to ensure successful erosion control, revegetation, and restoration. USLE calculations are available for review at the BLM Division of EIS Services.

Selected soils representing significant conditions in the project areas were analyzed. Additional information, consisting of major rangeland management concerns and recommended conservation practices, was obtained from published detailed soil survey reports and rangeland resource reports.

Vegetation data was analyzed and evaluated to identify:

- areas of critical vegetation types;
- regeneration potential; and
- effective revegetation measures.

The reclamation and erosion control guidelines were developed from the procedures outlined above to cover the range of soil and vegetation types, terrain, land uses, and climatic conditions. A detailed construction and erosion control plan will be developed prior to construction, including locally recommended techniques and measures tailored to the conditions encountered. Proper implementation of the outlined erosion control and revegetation measures should assure successful restoration of land disturbed by project construction activities.

The maintenance and monitoring program (Appendix 3) would also identify problem areas caused by adverse weather conditions during restoration periods or occurring in small localized areas with adverse soils properties and would provide corrective measures to ensure erosion control.

AIR QUALITY

Air Resource analyses for the new Wertz gas plant were performed by Amoco using the EPA guideline dispersion models Industrial Source Complex (ISC) and Complex I. Both models were applied to the project using meteorology data collected at Rawlins, Wyoming. These data most closely resemble the types of conditions at the Wertz plant and are generally representative of the area. The receptors chosen for this modeling, especially those for the Complex I modeling, reflected areas where highest concentrations and thus, highest impacts to air quality would result. For example, higher elevation receptor points were chosen in the Sweetwater Rocks Wilderness Study Area to allow the model to estimate concentrations that may result from elevated plume impaction to terrain. The low emission rates proposed for the Wertz plant (a reduction from the existing

APPENDIX 7

plant) do not appear to have any potential of causing unacceptable impacts to air resources or the ecology of the area near or removed from the plant site.

Impacts from the compressor station would be insignificant along the pipeline route because the stations would be electric-powered, causing almost no air pollution. Well field impacts, as far as can be determined, would be similar to those well fields operating with no CO₂ enhanced oil recovery, so no additional air resource impacts are expected. Increased H₂S production in the well field from secondary water flooding in the field was investigated. Although some increase in H₂S concentrations are to be expected, these increases would not cause increased impacts to the air resource. The new gas plant would lessen or eliminate all releases of H₂S to the atmosphere under normal well field safety operations.

The most significant cause of air pollution from the Proposed Action or alternatives would be from fugitive dusts. Dust would be generated from many sources during construction of surface facilities. Wind erosion on areas cleared of vegetation is a major fugitive dust source. Vehicle travel over areas which are unpaved is another major contributor. Dusts generated in these and some other more minor ways, are calculated and judged as ambient total suspended particulate (TSP) concentrations against ambient air quality standards. The more stringent prevention of significant deterioration (PSD) increments are applied to large stationary sources. Ambient air quality standards address relatively high pollutant concentrations for various times. By definition, ambient standards protect the health and welfare of the general public and not violating these standards

helps ensure that the best interests of the public are served. Generally standards are difficult to violate off the construction site, especially for projects involving only small areas of disturbance during a limited period.

Fugitive dust emissions during construction and operation of pipelines do not generally result in regional TSP air quality problems. To ensure that this would be the case for the Proposed Action, estimates of the amount of expected fugitive dust were made using emission factors taken from the Riley Ridge Natural Gas Project Air Resources Technical Report (Environmental Research and Technology, Inc. 1983). These factors were chosen because the study is recent and technically sound. Also this project is similar to some of the Riley Ridge activities and natural settings, and ERT based its emission factors on EPA studies and published research. Other studies have presented emission factors which are more or less conservative. For example, the Northern Border Pipeline: Climate, Air Quality, and the Ambient Sound Environment (Montana Department of Natural Resources and Conservation, 1980), presents emission factors that are more conservative than those of ERT. Application of the older, more conservative factors to the Northern Border Pipeline by the State of Montana did not, however, reveal that ambient air quality standards would be potentially violated.

STATE WATER QUALITY STANDARDS

State water quality standards are presented in Table A-5.

TABLE A-5
STATE WATER QUALITY STANDARDS

State	pH	Turbidity	Temperature Drop
Wyoming			
Class II	Maintain 6.5-9.0	No more than 10 NTU increase	No more than 2°F change
Class III	Maintain 6.5-9.0	No more than 15 NTU increase	No more than 2°F change
Class IV	Maintain 6.5-9.0	No specific standard	No more than 2°F change
Montana			
Class C-3	No more than 0.5 change and natural pH above 7.0 must be maintained above 7.0	No more than 10 NTU increase	For water greater than 55°F, maximum decrease of 2°F per hour. For water 32°F-55°F, maximum decrease of 2°F.
North Dakota			
Class I	Maintain 7.0-8.5	No specific standard	No specific standard
Class II	Maintain 6.0-9.0	No specific standard	No specific standard

NTU = Nephelometric Turbidity Unit

CO₂ CALCULATION METHODOLOGY

VISUAL RESOURCES

The procedure adopted by BLM for visual resource analysis is used as the primary reference for analysis. The BLM procedure, entitled the Visual Resource Management (VRM) system, provides a standardized method for inventorying and classifying the visual resource within the project area. The VRM classification is based on evaluations of existing landscape in terms of scenic quality (outstanding features), visual sensitivity, and viewing distances. There are five possible VRM classes—I through V (see Glossary for definitions of each class). Class I represents the highest priority areas for preserving the natural character, and Classes II through IV represent, in descending order, natural landscapes that have either been modified or lack distinguishable features. Class V indicates the character has been severely modified to the extent of needing rehabilitation. Visual Quality Objectives (VQOs) on National Forest lands correspond to VRM classes (see Glossary for the comparison). The VRM classes and VQOs are used as a guide in determining the degree of compatibility between the landscape and proposed development (BLM 1978).

Areas with no established visual resource management objectives were classified by analyzing available information. The informal classifications were used only to anticipate any impacts that may be caused by project components. Where the Little Missouri National Grasslands would be crossed, VQOs are correlated with VRM classes as closely as possible.

The BLM Visual Resources Management System was used to determine consequences by analyzing the degree of landscape contrast that would result from project construction. Adverse visual consequences would occur where project components significantly contrast with existing landscape features (line, form, color, and texture).

Visual management classes and VQOs delineating scenic quality, viewer sensitivity and viewing distance for landscapes in the project area were used to assess visual contrast. Revegetation, construction, and restoration methods were considered, as well as access to the view,

angle of observation, and duration of the view. The analyses focused on the residual effects from construction, such as surface scars or addition of structures.

METHODOLOGY FOR CALCULATING CO₂ CONCENTRATIONS FROM A LEAK OR RUPTURE

Solubility

Saturation of CO₂ in 100 cubic centimeter (cc) of water

$$0.348 \text{ @ } 0^{\circ}\text{C g/100 cc H}_2\text{O}$$

$$0.145 \text{ @ } 25^{\circ}\text{C g/100 cc H}_2\text{O}$$

There are 1000 milligrams in 1 gram (g). One thousand cubic centimeters are in 1 liter (l). Therefore:

$$\frac{10 \times 100 \text{ cc}}{1} \times \frac{1,000 \text{ mg}}{\text{g}} \times \frac{0.348 \text{ g}}{100 \text{ cc}}$$

This is true using Henry's Law if CO₂ is under one atmosphere. Under two atmospheres, two times as much would be possible, which could occur next to the pipe under 50 feet of water.

However, as the gas rises it would rapidly decrease.

Under normal conditions, one atmosphere and only the average percent of CO₂ in the air, the amount of CO₂ soluble in water drops to a small figure.

$$\text{CO}_2 \text{ in Air } 0.033\% = 0.00033$$

$$3,480 \times 0.00033 = 1.15 \text{ mg/l @ } 0^{\circ}\text{C}$$

$$1,450 \times 0.00033 = 0.48 \text{ mg/l @ } 25^{\circ}\text{C}$$

$$\text{at } 20^{\circ}\text{C} = 0.55 \text{ mg/l}$$

APPENDIX 8

DRAFT MEMORANDUM OF AGREEMENT BAIROIL/DAKOTA CARBON DIOXIDE PROJECTS

WHEREAS, the Bureau of Land Management (BLM), Forest Service (FS), and Army Corps of Engineers (COE) have determined that issuance of rights-of-way for the Bairoil/Dakota Carbon Dioxide Project will have an effect on cultural properties included in, eligible for, or potentially eligible for inclusion in the National Register of Historic Places and have requested the comments of the Advisory Council on Historic Preservation (Council) pursuant to Section 106 of the National Historic Preservation Act (16 U.S.C. 470) and its implementing regulations (36 CFR Part 800); and,

WHEREAS, the Wyoming State Office (Casper District Office), BLM, will act as lead agency for the other federal agencies involved in the Project,

Now, therefore, BLM, FS, COE, the Wyoming, Montana, and North Dakota State Historic Preservation Officers (SHPOs), and the Council agree that the undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on cultural properties.

STIPULATIONS

BLM shall ensure that the following stipulations are implemented as conditions to all use authorizations granted or issued for the Bairoil/Dakota Carbon Dioxide Projects as defined in BLM's Preliminary Draft Environmental Impact Statement of June 1985.

1. Procedures and Roles

All work set forth in this Agreement will be carried out in accordance with procedures and roles defined by the BLM and/or SMA (Surface Management Agency) and appropriate SHPO(s). The roles and procedures for the Project segment for which Exxon Pipeline Company is the Applicant are appended as Attachments A and B, respectively. When other Applicants decide to implement their Project plans, the roles (Attachment A) and procedures (Attachment B) established for the Exxon segment of the Project may be used or different procedures

and roles may be tailored to a Project segment in consultation among the appropriate BLM and/or SMA and SHPO. Changes in procedures must conform to the provisions in the body of the Agreement.

2. Identification and Recording of Cultural Properties

- a. All areas, regardless of surface ownership, which may potentially be affected by the undertaking will be inventoried to identify cultural properties listed in, eligible for, or potentially eligible for the National Register of Historic Places. Survey at BLM Class III standards will be conducted on all lands not previously inventoried at that level.

The size of corridors and other areas to be surveyed at the Class III level will be determined by the BLM and/or SMA and SHPO at the prework conference (see Attachment B). At a minimum, the area of maximum surface disturbance will be surveyed.

- b. Methods and levels of recording cultural properties will be determined at the prework conference (see Attachment B).

3. Testing and Evaluation of Cultural Properties

- a. Preliminary cultural property evaluations will be completed during survey and recording. Evaluations of potential eligibility under National Register criterion for depositional properties will be based on an examination of soil development through shovel testing or formal testing. Properties demonstrated to have significant cultural deposits or to have a depositional environment amenable to the preservation of buried cultural deposits will be considered potentially eligible for the National Register. Adverse effects to potentially eligible properties will be avoided by project relocation where feasible and prudent (see Attachment B.2).

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- b. At the pre-testing conference (see Attachment B), the appropriate BLM District and/or SMA and SHPO will review the preliminary cultural property evaluations and reach a final determination of potential eligibility when the data is adequate. Strategies for further testing of potentially eligible properties, or properties for which insufficient data was available to make a determination of potential eligibility, on which effect cannot be avoided, will be determined.
- c. Testing strategies developed per stipulation 2.b. will be implemented.
- d. At the post-testing conference (see Attachment B), the appropriate BLM District and/or SMA and SHPO will review the results of site testing and final evaluations of cultural properties. For purposes of the Agreement, cultural properties will be considered eligible when the BLM and/or SMA and appropriate SHPO agree that National Register eligibility criteria are met. If the federal agencies and SHPO disagree on site eligibility, BLM or the appropriate SMA will seek a formal determination of eligibility from the Keeper of the National Register of Historic Places following 36 CFR 63. If the Keeper recommends that the site is eligible, it will be considered eligible for purposes of this agreement.

4. Treatment of Cultural Properties

- a. The preferred treatment alternative is avoidance of effect by project relocation.
- b. Where it is not feasible and prudent to avoid eligible properties, treatment plans will be developed to mitigate the adverse effect on eligible properties, in conformance with the principles in Part I and recommendations in Part III of the Council's *Treatment of Archaeological Properties, a Handbook* and the *Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation*, (*Federal Register*, Vol. 48, No. 190, September 29, 1983, pp. 44716-44742), and those plans shall be implemented in accordance with this Agreement.
- c. At the post-testing conference (see Attachment B), the appropriate BLM District and/or SMA, SHPO and Council representative will finalize the treatment plans. The plans will (1) specify which cultural properties or portions of cultural properties will be affected by the Project and the nature of the effect; (2) specify which cultural properties or portions of cultural properties will be affected by the Project without any further treatment; (3) specify which cultural properties or portions of cultural properties will be subjected to data

recovery or other treatment; (4) specify what treatment or mitigation will be given cultural properties or portions of cultural properties eligible under National Register criteria other than D; (5) specify what research questions will be addressed by the data recovery efforts planned on sites eligible under National Register Criterion D and the data and methods needed to address the research questions; and (6) specify what consideration will be given the concerns of Native American people, if such concerns exist.

Acceptable treatment options may include sampling of sites which contain repetitive data, and/or concentrating data recovery on properties or portions of properties where it may yield the most significant information about history or prehistory.

- d. If the BLM and/or SMA, SHPO, and the Council representative disagree on a treatment plan or on the projects' potential effect on a cultural property or portion of a cultural property which is eligible for the National Register, BLM or other appropriate SMA will seek to resolve the dispute per Stipulation 12 of the Agreement.

5. Monitoring of Construction Work

- a. Monitoring of blading and/or trenching operations will be conducted in those areas determined at the post-testing conference by the appropriate BLM District and/or SMA and SHPO. Monitored areas will be those likely to yield significant buried cultural deposits (e.g. deep soils next to major drainages, etc.).
- b. Construction activities will be stopped in the area of potential effect surrounding a cultural property discovered during monitoring until the property's eligibility for the National Register has been determined and, if the property is found eligible, until a course of treatment has been determined and implemented.
- c. Cultural properties discovered during monitoring will be recorded to a level sufficient to allow determinations of eligibility for the National Register to be made. At an emergency meeting convened within five working days of the cultural property's discovery, the appropriate BLM District and/or SMA and SHPO will determine if the cultural property is eligible for the National Register and, if the property is determined eligible, decide a course of treatment.
- d. The course of treatment for eligible cultural properties discovered during monitoring will be implemented in such a way as to avoid delay in the pipeline construction, to the extent possible.

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6. Open-Trench Inspection

- a. Inspection of the open-trench for evidence of buried cultural properties will be conducted in some areas between completion of trenching and pipe-laying. Areas to be inspected will be determined at the post-testing conference by the appropriate BLM District and/or SMA and SHPO. Inspected areas will be those likely to yield significant buried cultural deposits.
- b. Cultural properties discovered during the open trench inspection will be recorded and/or treated in a manner to be determined at the post-testing conference by the appropriate BLM District and/or SMA and SHPO.

7. Reporting

- a. Reports will generally conform to the guidelines in the Council's *Treatment of Archaeological Properties, a Handbook*. Specific content and format will be approved by the appropriate District and/or SMA and SHPO at the post-testing conference. BLM Districts will consolidate report review comments and send them to SHPOs with requests for review.
- b. All aspects of survey, testing, and evaluation of cultural resources will be contained in a single formal report on a state-by-state basis or in several formal reports for segments of the pipeline on a state-by-state basis. This report will be submitted to the BLM and SMAs according to a schedule developed by the appropriate BLM, SMA, and SHPO at the post-testing conference (see Attachment B.9.).
- c. Results of treatment will be reported on a state-by-state basis. A formal report will be prepared on each cultural resource or group of resources for which a treatment plan(s) was developed. These reports will be submitted to the BLM and SMAs according to a schedule developed by the appropriate BLM District, SMAs, and SHPO after completion of all data recovery relevant to treatment plans (see Attachment B.9.).
- d. Results of monitoring and/or open-trench inspection will be reported on a state-by-state basis. This report will be submitted to the BLM and SMAs according to a schedule developed by the appropriate BLM District, SMAs, and SHPO after completion of monitoring and open trench inspection and data recovery resulting from monitoring and open trench inspection in a given state (see Attachment B.9.).

- e. Scheduling of reports will take into account the amount of data recorded or recovered, complexity of analyses required, and other factors relating to the reporting effort. The scheduling goal is to achieve timely, high quality reporting.

8. Formal Determinations of Eligibility

Cultural properties, which have been found eligible for the National Register of Historic Places for purposes of the Agreement and which retain the qualities which make them eligible after mitigation is completed, will be formally determined eligible.

9. Policy on Landowner Denial of Access for Cultural Resource Work

Significant cultural properties will be treated in such a way that adverse effects are either avoided or mitigated through effective treatment programs regardless of surface ownership. Should access be denied to any non-federal lands to carry out the requirements of the MOA, the applicant will take all reasonable steps to obtain such access. Should further efforts fail to obtain access the appropriate BLM District and/or SMA will consult with the appropriate SHPO and the Council per 36 CFR 800.4 to determine what further steps, if any, must be taken to satisfy the intent of this Agreement. Until such consultation is complete, neither the Applicant nor the BLM/SMA will take or sanction any actions that would have an adverse effect on a significant cultural resource which may be located on the property to which access has been denied.

10. Curation

- a. Collected cultural materials will be stabilized, labeled, and cataloged. Materials from FS lands in North Dakota will be curated by the FS under existing policies. Materials from Montana and other North Dakota lands will be placed in BLM's Montana Curation Center. Materials from Wyoming will be stored according to existing curation agreements.
- b. The disposition of cultural materials from private lands will be determined by the landowner. If the landowner wishes the materials to remain in government possession, they will be tested per Stipulation 9.a. of this Agreement.

11. Human Remains

Treatment of human remains will be in accordance with state laws and policies. Where no policy exists, one will be agreed upon by the BLM, SMA, and SHPO at the prework conference. The BLM District or SMA will consult with appropriate Native American peoples regarding the treatment of Indian remains.

12. Dispute Resolution

Should there be disagreement among the consulting parties regarding implementation of the Agreement, the disagreeing parties will consult with the Council. Sufficient information describing the disagreement will be forwarded to the Council and the Council will make its recommendations within 15 working days from receipt of the documentation. The BLM/SMA and Applicant will adhere to the Council's recommendation or notify the Council's Executive Director as to why the recommendations cannot be followed and request he ask the Chairman to schedule the issue for consideration at a Council meeting. Until the Chairman has responded and/or the Council has provided its comments, the BLM/SMA and Applicant will not take any action regarding the disputed issue that may affect cultural properties eligible or potentially eligible for the National Register. Other aspects of the Agreement about which there is no dispute may be implemented during the period of dispute resolution.

13. Failure to Carry Out the Terms of the Agreement

Failure to carry out the terms of this Agreement requires that the BLM or appropriate SMA again request the Council's comments in accordance with 36 CFR 800. If the BLM or appropriate SMA cannot carry out the terms of this Agreement, it shall not take or sanction any action or make any irreversible commitment that would result in an adverse effect with respect to cultural properties which may be eligible for the National Register 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.

14. Amendment of the Agreement

If any of the signatories to this Agreement determines 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.

15. Reporting Fulfillment of the Agreement

Within 90 days after carrying out the terms of the Agreement, BLM will provide a written report to all signatories to the Agreement on actions taken to fulfill the terms of the Agreement.

Execution of this Memorandum of Agreement evidences that BLM, FS, and COE have afforded the Council a reasonable opportunity to comment on the Bairoil/Dakota Carbon Dioxide Projects and its effects on historic properties and that the BLM, FS, and COE have taken into account the effects of the undertaking on cultural properties.

Montana SHPO (Date)

North Dakota SHPO (Date)

Wyoming SHPO (Date)

Casper District Manager, BLM (Date)

Executive Director, Council (Date)

Chairman, ACHP (Date)

I concur:

Exxon Pipeline Company (Date)

**ROLES AND RESPONSIBILITIES OF PARTICIPANTS
MEMORANDUM OF AGREEMENT
BAIROIL/DAKOTA CARBON DIOXIDE PROJECT**

1. In conformance with roles defined for other aspects of federal involvement in the Bairoil/Dakota Carbon Dioxide Project, BLM will coordinate actions required under the Memorandum of Agreement.
2. Casper District Office (CDO), BLM lead, will be the overall coordinator of activities under the Agreement.
 - a. CDO will monitor the progress of all cultural resource work to ensure that its scheduling tracks with other aspects of the undertaking. Potential problems in the progress or phasing of cultural resource work will be communicated to the participants in MOA activities in the state concerned (see Attachment B).
 - b. CDO will be the federal contact with the Council on matters related to the Agreement.
 - c. CDO will keep a consolidated record of transactions among the participants in MOA activities for all states. Copies of correspondence, telephone confirmation, and meeting notes will be forwarded to CDO by the consulting parties.
 - d. CDO will coordinate the prework conference for the participants in MOA activities in Wyoming and keep minutes of the meeting.
3. BLM Districts and other SMAs will be responsible for coordinating consultation and compliance activities in conformance with the Agreement in their area of jurisdiction.
 - a. Districts/SMAs will make agency decisions and provide agency input for Agreement activities in their area of jurisdiction.
 - b. Districts/SMAs will coordinate the pre-testing and post-testing conferences and keep minutes of those meetings.
 - c. Districts/SMAs will monitor the Applicant's consultant regarding progress and performance on formal site testing strategies and mitigation.
 - d. Districts/SMAs will be responsible for ensuring that surface disturbance from construction activities is stopped in the area surrounding a cultural property discovered during monitoring and that the provisions of Stipulation 5 of the Agreement are carried out.
 - e. Districts will consolidate SMA reviews of draft reports and forward them to the appropriate SHPO with a request for SHPO comments.
4. Miles City District Office (MCDO) will coordinate the prework conferences for the participants in MOA activities in Montana and North Dakota and keep minutes of those meetings.
5. SHPOs will perform review and compliance activities per the MOA in their respective states.
6. State agencies which are not SMAs may become a concurring party to the Agreement in conformance with existing agreements.
7. The applicants will be active participants in the Agreement and consultation process and may be a concurring party to the Agreement.
 - a. The Applicant will hire qualified consultants to perform surveys, testing, preliminary evaluation, mitigation, monitoring, and reporting as required to comply with the Agreement.
 - b. The primary consultant to the Applicant will be in general charge of all Agreement activities involving the consultants. The primary consultant represents the Applicant in the participation process unless the Applicant designates another representative (see Attachment B). The primary consultant will attend all conferences designated in the Agreement.

**SUMMARY OF MOA PROCEDURES
BAIROIL/DAKOTA CARBON DIOXIDE PROJECT**

These procedures are incorporated into the Agreement through Stipulation 1 of the Agreement. They are intended to detail more specifically the nature and timing of various actions which are necessary to ensure that the requirements of the Agreement are met. The procedures also identify more specifically who is responsible for completing the actions.

While these procedures were developed for the Exxon segment of the project to expedite the review process in the Council's regulations (36 CFR 800), different procedures may be developed for other portions of the Project which are still in the planning stage, as appropriate. If alternate procedures are needed, they may be

developed among the appropriate BLM and/or SMA and SHPO(s). Alternate procedures must conform to Stipulations in the body of the Agreement.

As used in this Summary of Procedures, the *consulting parties* include the BLM and/or SMA(s), SHPO(s), and the Council (if present). Other parties involved in the procedures are referenced to collectively as *participants*.

Item 2 of these procedures concerning inventory and initial evaluation offers alternatives (A and B) either of which may be used within a given state as approved among the appropriate BLM District(s), SMA(s), and SHPO.

MOA PROCEDURE	PARTICIPANTS/CONSULTING PARTIES/RESPONSIBLE PARTIES
1. State Prework Conference	Consulting Parties
A meeting held before field work commences to review activities related to the Agreement and to reach decisions on unresolved issues. Consulting parties should concur on the following:	CDO-Wyoming lead MCDO-ND & MT lead SMAs SHPO Participants
a. Inventory strategies for facilities not specifically addressed in Item 2 of the Summary of MOA Procedures (ie., gas processing plants, distribution pipelines, field facilities, booster stations, etc.)	BLM Districts Applicant's Consultants Interested State Agencies (optional)
b. Inventory strategy for historic structures <i>vis a vis</i> visual impact assessment.	
c. Methods and levels of site recording	
d. Strategies for preliminary site evaluation	
e. Collection policy	
f. Assignment of site numbers	
g. Treatment of human remains	
h. Other issues which may arise	

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MOA PROCEDURE

PARTICIPANTS/CONSULTING PARTIES/RESPONSIBLE PARTIES

2. Inventory and Initial Evaluation

a. Alternative A Procedure

- | | |
|--|---|
| (1) Complete Class III survey and preliminary site evaluations based on shovel testing. Minimum areas to be surveyed include 100 feet on both sides of the pipeline right-of-way centerline (total 200 feet), 50 feet on both sides of access road centerlines (total 100 feet), and 10 acres surrounding communications towers. | Responsible party
Applicants Consultant |
| (2) Complete site record forms and document the results of preliminary testing. | Same as above |
| (3) Recommend avoidance of potentially eligible properties and implement avoidance where necessary to facilitate project scheduling. | Applicants Consultant and applicant |
| (4) For potentially eligible properties which cannot be avoided, document why project relocation is not feasible and prudent. | Applicant's Consultant |
| (5) Recommend a program of further testing for potentially eligible properties on which adverse effects may not be avoidable. | Same as above |
| (6) Send documentation to the appropriate BLM/SMA/SHPO offices as much in advance of the pre-testing conference as possible. | Same as above |
| (7) Conduct the pre-testing conference. The pre-testing conference is a meeting or meetings to review the results of survey and initial testing and to decide on further testing needs and strategies. | Consulting parties:
Appropriate BLM District
Appropriate SHPO Participants:
Applicant's Consultants
Interested State Agencies |
| (a) Review site forms, preliminary evaluations and recommendations for further testing. | Same as above |
| (b) Review the rationale behind preliminary decisions that effects to certain potentially eligible properties are unavoidable. | Same as above |
| (c) Determine which potentially eligible, unavoidable properties need further testing and evaluation and define the strategies for formal testing of those properties. | Consulting parties above |
| (d) Concur on other matters as necessary to proceed to the next phase of the procedures. | Consulting parties above |

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MOA PROCEDURE	PARTICIPANTS/CONSULTING PARTIES/RESPONSIBLE PARTIES
B. Alternative B Procedure	
(1) Initiate Class III survey. Minimum areas to be surveyed include 100 feet on both sides of the pipeline right-of-way centerline (total 200 feet), 50 feet on both sides of access road centerlines (total 100 feet), and 10 acres surrounding communications towers.	Responsible party: Applicant's Consultant
(2) Complete site record forms and document the results of testing. Do enough testing on potentially eligible sites to confirm or deny eligibility.	
(3) Recommend avoidance of potentially eligible properties.	Same as above
(4) For potentially eligible properties which cannot be avoided, document why project relocation is not feasible and prudent.	
(5) Send documentation to the BLM and SHPO as much in advance of the on-site evaluation conference as possible.	Same as above
(6) Conduct on-site evaluation conferences as needed. The evaluation conference is to be held when one or more properties have been tested and eligibility determinations must be made before rerouting or further testing may begin. Consulting parties concur on eligibility, avoidance, and perhaps on further testing strategies for unavoidable eligible properties. Decisions on further testing may be deferred until the pre-testing conference.	Consulting parties: Appropriate BLM District/ SMA/Appropriate SHPO Participants: Applicant's Consultants Interested State Agencies
(7) Conduct the State pre-testing conference. The pre-testing conference is a meeting to review the results of survey, preliminary testing, and evaluation not discussed or resolved at the on-site evaluation conference. Consulting parties concur on formal testing strategies for unavoidable eligible properties. Other business may be conducted such as determining the potential effect to properties with standing structures and strategies for further evaluation of structures. This conference may be omitted if the consulting parties concur that all decisions necessary at this stage of the process have been made at on-site evaluation conferences. Documentation needed for review at the pre-testing conference will be sent to the BLM and SHPO as much in advance of the conference as possible.	Same as above
3. Formal Testing	
Formal testing is the systematic excavation of test pits to better understand the nature, density, and distribution of cultural materials in archaeological properties. It is intended to provide the data necessary to make final evaluations of National Register eligibility and/or to devise treatment plans.	
a. Implement formal testing program	Applicant's Consultants
b. Monitor progress and compliance with testing strategies	Appropriate BLM District or SMA

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MOA PROCEDURE

PARTICIPANTS/CONSULTING PARTIES/RESPONSIBLE PARTIES

4. Preliminary Treatment Planning

Treatment plans are prepared for individual properties or groups of properties by state or project segment within a state. Documentation is submitted to the appropriate consulting parties as much in advance of the post-testing conference as possible.

Responsible Party:
Applicant's Consultants

5. State Post-Testing Conference

A meeting or meetings held in each state to review the results of site testing and treatment planning.

Consulting Parties:

Appropriate BLM District
Appropriate SHPO
The Council

Participants:
Applicant's Consultants
Interested State Agencies

- a. Review testing results and make final judgments about property eligibility.
- b. Review treatment plans for eligible properties and modify them as needed.
- c. Determine strategies for monitoring construction work and areas to be monitored.
- d. Determine strategies for open-trench inspection and areas to be inspected.
- e. Decide other matters as needed at this phase of the MOA procedure.

Consulting Parties

Same as above

Same as above

Same as above

Same as above

6. Treatment/Data Recovery

- a. Treatment plans implemented.

Responsible Party:

Applicant's Consultants

Note: There will be no commitment made to begin data recovery until after the post-testing conference.

- b. Progress and compliance with treatment strategies monitored.

Appropriate BLM District/SMA

7. Monitoring/Stop-Work/Treatment of Sites Found After Construction Begins

- a. Monitoring of blading and/or trenching operators in defined areas.
- b. Construction work stopped when cultural properties are discovered during monitoring.
- c. Discovered properties recorded to a level sufficient to evaluate them for National Register eligibility.

Responsible Party:
Applicant's Consultants

Same as above

Same as above

APPENDIX 8

MOA PROCEDURE	PARTICIPANTS/CONSULTING PARTIES/RESPONSIBLE PARTIES
<p>d. Discovered properties evaluated and effect determined by the consulting parties. Mitigation plan determined by the consulting parties.</p>	<p>Consulting Parties: Appropriate BLM District or SMA Appropriate SHPO Council Representative</p> <p>Participants: Applicant's Consultants Other State Representative</p>
8. Open-Trench Inspection	
<p>a. Inspection of the open pipeline trench in defined areas.</p>	<p>Responsible Party: Applicant's Consultants</p>
<p>b. Discovered properties recorded and/or treated in a manner determined by the consulting parties.</p>	<p>Consulting Parties: Appropriate BLM District SMA Appropriate SHPO</p>
9. Reporting/Review	
<p>a. Reporting will be completed on a state-by-state basis.</p>	
<p>b. Draft report of survey, testing, and evaluation prepared and submitted for review to BLM Districts/SMAs according to the schedule developed by the consulting parties at the post-testing conference.</p>	<p>Responsible Party: Applicant's Consultants BLM Districts SMAs</p>
<p>c. Reviews of draft report consolidated by BLM Districts and forwarded to SHPO with agency request for review.</p>	<p>BLM Districts</p>
<p>d. SHPO reviews draft survey, testing, and evaluation report and sends comments to BLM Districts. Districts forward all review comments to Applicant's Consultants.</p>	<p>Appropriate SHPO</p>
<p>e. Final report of survey, testing, and evaluation prepared, taking into account review comments. Completed final submitted to BLM Districts, SMAs within 60 days of completed draft review in a given state.</p>	<p>Applicant's Consultants</p>
<p>f. Final review of the survey, testing, and evaluation report by consulting parties.</p>	<p>Consulting Parties: Appropriate SHPO Appropriate BLM District/SMA</p>
<p>g. Draft Mitigation reports prepared and submitted for review to BLM Districts/SMAs per a schedule established by the consulting parties after all data recovery field work is completed.</p>	<p>Responsible Party: Applicant's Consultants</p>
<p>h. Review and revision of the draft and final mitigation reports per Item 9.C.f. above.</p>	

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MOA PROCEDURE

**PARTICIPANTS/CONSULTING
PARTIES/RESPONSIBLE
PARTIES**

- | | |
|---|-------------------------------------|
| <ul style="list-style-type: none"> i. Draft monitoring and open trench inspection report prepared and submitted for review to BLM Districts/SMAs within 60 days of completion of field work related to monitoring and/or open trench inspection in a given state. j. Review and revision of the draft and final monitoring and open trench inspection report per Item 9.c. through 9.f., above. k. A final synthetic report compiled for the entire pipeline and submitted to the BLM lead District. | <p>Applicant's Consultants</p> |
| <p>10. Documentation of Curation and a Record of the Disposition of Privately Owned Cultural Materials submitted to Appropriate BLM Districts</p> | <p>Applicant's Consultants</p> |
| <p>11. National Register Forms Completed for Eligible Properties Retaining the Qualities which made them Eligible.</p> | <p>Applicant's Consultants</p> |
| <p>12. Formal Determinations of Eligibility Sought From the Keeper.</p> | <p>Appropriate BLM District/SMA</p> |
| <p>13. Reporting Fulfillment of the Agreement</p> <p>A summary report of all actions taken to fulfill the terms of the agreement submitted to all signatories within 90 days of completion of all terms of the agreement.</p> | <p>CDO, BLM</p> |

SUMMARY OF CHANGES MADE TO PRODUCE THE THIRD DRAFT OF THE MOA FOR THE BAIROIL/DAKOTA CARBON DIOXIDE PROJECTS.

MOA Opening

The opening paragraphs (*WHEREASes*) of the second draft were changed primarily in response to Council comment. A second *WHEREAS* clause was added to clarify that BLM will ensure that the MOA measures are carried out. This provision eliminates the necessity for all participating federal agencies to sign the MOA. Only BLM's Casper District Manager must sign.

BLM certainly does not object to other agencies as signatories but it may expedite completion of the MOA to keep the signatories to a minimum.

Stipulations Opening

The opening sentence to the stipulation was changed in response to our understanding that not all aspects of the Bairoil/Dakota Projects may be authorized and that only Exxon is thus far an active participant in the MOA process. The change is intended to provide the flexibility needed to allow agencies to use the MOA for other aspects of the Project (Amoco, Shell) as decisions are made to authorize them. Presumably, the body of the MOA would not need to be changed for these aspects of the Project. Later, provision is made in the MOA to allow changes in procedures (Attachment B) as required.

STIPULATION 1

Stipulation 1 in the third draft is new in response to comments from the Council and Montana SHPO. Both reviewers suggested strongly that the specific roles and procedures (Attachments A and B) be formally incorporated into the MOA. This was done, but because flexibility is needed to change the roles and procedures for

later aspects of the Project, if necessary, the stipulation is rather complex.

STIPULATION 2

Stipulation 2 in the third draft is a version of Stipulation 1 in the second draft.

2.a. The beginning of 2.a. was changed in response to a Custer National Forest comment suggesting that inventory be conducted to *identify cultural properties listed in, eligible for, or potentially eligible for the National Register of Historic Places*.

Again, in an attempt to make the body of the MOA general enough to be used for all aspects of the Project, specific areas to be surveyed in the Exxon part of the Project were removed from 2.a. and placed in the Procedures (Attachment B). A Council concern that the requirement to discuss specific survey strategies for ancillary facilities at the prework conference be broadened was changed and moved to Procedure 1.a. in Attachment B.

STIPULATION 3

Stipulation 3 is a much changed Stipulation 2 from the second draft.

3.a. Second sentence: the words *under National Register criterion d* was added to clarify that 3.a. pertains to archaeological properties with information content. The words *formal testing* were added to the end of the sentence as a change suggested by the Montana SHPO which will allow the flexibility to define alternative inventory and evaluation procedures as was done in Attachment B2.a. and b.

3.a. Third sentence: the words *to have significant cultural deposits* were also added to allow the development of the alternative inventory and evaluation procedures in Attachment B.

3.a. Fourth sentence: the words *feasible and prudent* replace *if possible* as suggested by the Exxon review.

3.b. This stipulation combines elements of 2 a. and b. from the second draft. It attempts to clarify the purpose of the pre-testing conference as requested by BLM's Rawlins District and the Custer National Forest.

3.d. Some changes in wording were made for clarity as suggested by the Custer National Forest.

STIPULATION 4

Stipulation 4 reflects several changes of the previous Stipulation 3 on treatment.

4.b. The words *feasible and prudent* were again added at the request of Exxon. The *Secretary of Interior's Standards and Guidelines for Archaeology and Historic Preservation* was added as a guide to treatment planning as suggested in the Council review.

4.c. Changes were made regarding finalization of treatment plans at the post-testing conference at the behest of the Council. The most fundamental being the addition of a Council representative to the post-testing conference.

Several reviewers noted that treatment plans must be in the hands of participants prior to the post-testing conference to facilitate review. This concern was handled under Item 4 of the Procedures (Attachment B) using language agreed upon at the Montana pre-work conference, ie. *Documentation is submitted to the appropriate consulting parties as much in advance of the post-testing conference as possible*.

3.d. from second draft was incorporated into the new Stipulation 4.C.

4.d. A few wording changes were made in the second draft, Stipulation 3.e., to correspond with the wording in third draft 4.C.

STIPULATION 5

Formerly Stipulation 4 on the monitoring of construction work.

5.a. The example of areas which may be determined to need monitoring was changed slightly in response to the Rawlins District review.

5.b. Several reviewers had problems with second draft stipulation 4.b. The content of the stipulation now appears as Stipulations 5.b. and 5.c. We hope 5.b. is now more clearly expressed to take into account the Council's concern that it was unintelligible. It also states that construction will be stopped *in the area of potential effect surrounding a cultural property discovered during monitoring* to deal with an Exxon request that it be made clear that construction in areas outside of any potential area of effect may proceed.

5.c. The specification regarding the level of recording required for properties discovered during monitoring was changed as the result of an Exxon review comment.

DRAFT MEMORANDUM OF AGREEMENT

5.d. Some word changes were made from those used in second draft Stipulation 4.c. Exxon's suggestions were incorporated.

STIPULATION 6

The wording of Stipulation 6 (formerly 5) reflects changes to read more like Stipulation 5 of the new draft.

STIPULATION 7

Some wording changes were made on reporting in an attempt at clarification. A stipulation was added (7.d.) requiring a report of monitoring and open-trench inspection activities as suggested by Exxon and Rawlins District.

STIPULATION 8

This Stipulation is new containing elements of second draft Stipulation 2.e. As suggested by the Montana SHPO, agencies will seek formal determinations of eligibility rather than nominations to the National Register.

STIPULATION 9

The Applicant is removed as a party to *consult* per 36 CFR 800.4, as recommended by the Wyoming SHPO.

STIPULATION 10

The stipulation regarding curation was changed in response to comments from the Custer National Forest, North Dakota SHPO, and Rawlins District. Custer Forest materials will be curated per their existing agreements. Stipulation 10.b. was added to clarify that the landowner will specify the disposition of materials from private property. Documentation of curation and a record of the disposition of privately owned materials is now required under Procedure 10, Attachment B.

STIPULATION 11

Changes in the MOA regarding human remains reflect concerns expressed by BLM's Wyoming State Office and the Council.

STIPULATIONS 12, 13, 14 and 15

No change.

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In order to help the reader locate copies of these references, symbols are used to indicate the following:

- a- Can be inspected at the Bureau of Land Management (BLM), EIS Office, 555 Zang Street, First Floor East, Denver, Colorado 80228
- b- Can be inspected at the BLM District Office, Casper, Wyoming
- c- Can be inspected at the BLM State Office, Cheyenne, Wyoming
- d- Can be inspected at the BLM Miles City District Office
- e- Available for loan from any public library

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ABBREVIATIONS AND ACRONYMS

AAMT —average annual monthly traffic	min —minimum
AAP —average annual precipitation	MLLA —Mineral Lands Leasing Act
AQRV —air quality related value	MLRA —major land resource area
AUM —animal unit month	MOA —Memorandum of Agreement
BLM —U.S. Department of the Interior, Bureau of Land Management	MP —milepost
bpd —barrels per day	NAAQS —National Ambient Air Quality Standards
Btu's —British thermal units	NADP/NTN —National Atmospheric Deposition Program/National Trends Network
cc —cubic centimeter	NDSHD —North Dakota State Highway Department
CDO —Casper District Office	NGL —natural gas liquid
cfs —cubic feet per second	NO₂ —nitrogen dioxide
CO₂ —carbon dioxide	NO_x —nitrogen oxides
COE —U.S. Department of the Army, Corps of Engineers	NTU —Nephelometric Turbidity Unit
DNRC —Montana Department of Natural Resources and Conservation	ORV —off-road vehicle
EPA —U.S. Environmental Protection Agency	OSHA —Occupational Safety and Health Administration
ERS —U.S. Department of Agriculture, Economic Research Service	PSD —prevention of significant deterioration
FCC —Federal Communication Commission	ROD —Record of Decision
FS —U.S. Department of Agriculture, Forest Service	SCS —U.S. Department of Agriculture, Soil Conservation Service
FWS —U.S. Department of the Interior, Fish and Wildlife Service	SHPO —State Historic Preservation Office
gpm —gallons per minute	SMA —Surface Management Agency
GPO —U.S. Government Printing Office	SO₂ —sulfur dioxide
HCRS —U.S. Department of the Interior, Heritage Conservation and Recreation Service	SO_x —sulfur oxides
hp —horsepower	su —standard units
H₂S —hydrogen sulfide	TDS —total dissolved solids
ISA —State of Wyoming, Office of Industrial Siting Administration	TSP —total suspended particulates
ISC —industrial source complex (model)	μg/m³ —micrograms per cubic meter
LACT —lease automatic custody transfer	USDA —U.S. Department of Agriculture
M —thousand	USGS —U.S. Department of the Interior, Geological Survey
max —maximum	USLE —Universal Soil Loss Equation
MCDO —BLM, Miles City District Office	UTM —Universal Transverse Mercator
MDOH —Montana Department of Highways	VHF —very high frequency
mg/l —milligrams per liter	VRM —Visual Resource Management
	WDOH —Wyoming Department of Highways
	WSA —Wilderness Study Area

GLOSSARY

ACCELERATED EROSION—Soil loss more rapid than normal, natural, or geologic erosion, mainly as a result of the influence of human activities or in some cases of animals or natural catastrophes that expose bare surfaces.

AIR QUALITY CLASS I, II, AND III AREAS—Regions in attainment areas where maintenance of existing good air quality is of high priority. In Class I areas, maintaining air quality has the highest priority with respect to other classes: in Class III areas, air quality has lower priority than it does in the other areas. Initially, all attainment areas except mandatory Class I areas were designated Class II.

AIR QUALITY MODEL—A mathematical representation of the behavior of air pollutants or their effects on air quality-related values.

AIR QUALITY STANDARDS—The concentrations of pollution and lengths of exposure at which specified adverse effects to health and welfare occur.

ALKALINITY—The capacity of a water body to neutralize acid, usually expressed as the concentration of bicarbonate and carbonate present.

ALLOTMENT—An area where one or more operators graze their livestock. An allotment generally consists of public lands but may include parcels of private and state-owned lands. BLM stipulates the number of livestock and season of use for each allotment on BLM-managed land, which may consist of one or several pastures.

ALLUVIAL FAN—A sloping, fan-shaped mass of sediment deposited by a stream or drainageway where it emerges onto a plain.

ALLUVIUM—Clay, silt, sand, gravel, or other loose stream-deposited material.

AMBIENT AIR QUALITY—Concentration levels in the surrounding air for a specified pollutant and a specified averaging time period within a geographic region.

ANIMAL UNIT MONTH (AUM)—The amount of forage a cow and a calf (6 months of age and under) consume in 1 month. This unit is used to calculate livestock carrying capacities and serves as a basis for grazing fees.

ANNUAL AVERAGE DAILY TRAFFIC—The average number of vehicles passing a specified point during a 365-day period.

ANTICLINE—An up-arched fold in bedrock layers similar to the roof of a house.

ARCH—An up-arched curve in bedrock layers similar to the head of an arched doorway.

ASPECT—The direction that a slope faces.

AUTHORIZED OFFICER—A designated federal regulatory agency employee responsible for activities involving the use of public lands or delegated to exercise authority over grants for use of these lands.

BARREL—A liquid measure of oil, usually crude oil, equal to 42 gallons or about 306 pounds.

BASELINE—Conditions existing or projected to exist in the area of influence, excluding applicant and inter-related projects. Baseline conditions include normal growth expected to occur in the area of influence, but not major new developments.

BLOCK VALVE—A valve that can be closed to isolate one section of pipe from an adjacent section.

CAPACITY—In transportation studies, the greatest number of vehicles having a reasonable opportunity to pass over a given section of a roadway within a given time under prevailing roadway and traffic conditions.

CATHODIC PROTECTION—An anti-corrosion technique for metal installations—pipelines, tanks, buildings—in which weak electrical currents are set up to offset the current associated with metal corrosion.

CLAYEY SOIL—A fine-grained soil that has high plasticity and contains more than 35 percent clay by weight. Clayey soil includes mainly clay loams, clays, sandy clay loams, and sandy clays.

CLIMATE—The average cause or condition of the weather at a place over a period of years.

COFFERDAM—A temporary dam-like structure built around an excavation to exclude water.

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GLOSSARY

CONSOLIDATED—Sediments which have been converted into rocks by compaction deposition of cement in pore spaces or by physical or chemical changes in the sediment itself.

CONTINENTAL CLIMATE—The climate of the interior of a land mass of continental size that is marked by large annual, daily, and day-to-day temperature ranges: low relative humidity; and (generally) moderate or small and irregular rainfall. The annual extremes of temperature occur soon after the solstices. In its extreme form, a continental climate gives rise to deserts.

CONTRAST—The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.

CORRIDOR—For purposes of this environmental impact statement, a wide strip of land within which a proposed linear facility could be located.

COW-CALF LIVESTOCK OPERATION—A livestock operation in which a base breeding herd of mother cows and bulls is maintained. The cows produce a calf crop each year, and the operation keeps some heifer calves from each calf crop for breeding herd replacements. The operation sells the rest of the calf crop between the ages of 6 and 12 months along with old or nonproductive cows and bulls.

COW-CALF-YEARLING LIVESTOCK OPERATION—A cow-calf operation that, instead of selling its calves between the ages of 6 to 12 months, sells them after they are 12 months old.

CRETACEOUS—Of, relating to, or being the last period of the Mesozoic era (from 136 to 65 million years ago) or the corresponding system of rocks.

CRUCIAL HABITAT—An area that is essential to the survival of any wildlife species sometime during its life cycle.

CULTURAL RESOURCE INVENTORY CLASSES:

Class I—Existing data inventory: an inventory study of a defined area designed (1) to provide a narrative overview (cultural resource overview) derived from existing cultural resource information and (2) to provide a compilation of existing cultural resource site record data on which to base the development of the BLM's site record system.

Class II—A sample-oriented field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a portion of a defined area to allow an objective estimate of the nature and distribution of cultural resources in the entire defined area.

The Class II inventory is a tool for use in management and planning as an accurate predictor of cultural resources in the area of consideration. The primary area of consideration for implementing a Class II inventory is a planning unit. The secondary area is a specific project in which an intensive field inventory (Class III) is neither practical nor necessary.

Class III—An intensive field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a specified area.

After Class III inventories are completed in an area, no further cultural resource inventory work is normally needed. A Class III inventory is appropriate on small project areas, all areas to be disturbed, and primary cultural resource areas.

CUMULATIVE IMPACTS—Impacts that would occur as a result of the proposed location(s) plus interrelated projects whose impacts would occur in the same time or space.

DEMONSTRATED RESERVES—Areas where coal has been shown to be economically minable by field data measurements.

DENDRITIC DRAINAGE (PATTERN)—A drainage pattern with tributaries branching like a tree's boughs.

EMISSION—Effluent discharge into the atmosphere, usually specified by mass per unit time.

ENDANGERED SPECIES—Any animal or plant species in danger of extinction throughout all or a significant portion of its range.

ENHANCED OIL RECOVERY—Sophisticated recovery methods for crude oil and gas which go beyond the more conventional secondary recovery techniques of pressure maintenance and waterflooding. Enhanced recovery methods now being used include micellar-surfactant (q.v.), steam drive, polymer, miscible hydrocarbon, CO₂, and steam soak. Enhanced oil recovery methods are not restricted to secondary or even tertiary projects. Some fields require the application of one of the above methods even for initial recovery of crude oil.

EPHEMERAL STREAM—A stream that flows only in direct response to precipitation.

FAULT—A bedrock fracture or fracture zone along which there has been displacement of the two sides relative to one another.

FEDERAL AID HIGHWAY—A highway whose construction or maintenance is funded in some part by the Federal Government.

GLOSSARY

FLOODPLAIN—The flat ground along a stream which is covered by water when the stream overflows its banks at flood stages.

FLUVIAL—Of or relating to rivers: growing or living in streams or ponds, as a fluvial plain.

FORAGE—All browse and herbaceous foods available to grazing animals, which may be grazed or harvested for feeding.

FORB—A low-growing, herbaceous plant that is not a grass, sedge, or rush.

FOREGROUND-MIDDLEGROUND—The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles.

FOSSIL—Any remains, trace, or imprint of a plant or animal that has been preserved by natural processes in the Earth's crust since some past geologic time.

FUGITIVE DUST—Airborne particles emitted from any source other than through a stack.

GUYED—Supported by a tension member (a solid wire or stranded wire) to withstand an otherwise unbalanced force.

HABITAT—A specific set of physical conditions that surround the single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

HIGH DEVELOPMENT COAL—Coal areas that have a minimum coal thickness of 5 feet with overburden less than 150 feet and an overburden to strippable coal ratio of 10 or less.

HYDROCARBONS—Organic chemical compounds of hydrogen and carbon atoms that form the basis of all petroleum products.

HYPOTHETICAL RESOURCE—Areas where coal is determined to be present based on general geologic knowledge of the area and very limited field data.

IMPACT—The change from an existing condition (baseline) caused by an action (such as construction or operation of a pipeline or facilities).

INCREMENTS—Maximum allowable increases over baseline concentrations of pollutants covered by the Prevention of Significant Deterioration (PSD) provisions in Class I, II, and III areas.

INTERMITTENT STREAM—A stream which flows part of the time, as after a rainstorm, during wet weather periods, or during part of the year.

INTERRELATED PROJECTS—Reasonable, foreseeable, projects proposed or planned for development, within or adjacent to the area that would be affected by an applicant(s) proposed project and during the same time period as the applicant(s) proposed project. The impacts of these projects with the applicant(s) projects would be related: they would overlap in time and space, and when considered together with the impact of the proposed applicant(s) project could be more significant than when considered in isolation.

INVERTEBRATE—Plants or animals that do not possess a bone structure.

LAND USE PLAN—A plan that identifies and establishes land uses and restrictions for a given geographic area.

LEK—An area where grouse gather for ritualistic display and breeding: also, a sage grouse strutting ground.

LEVEL-OF-SERVICE—In transportation studies, a qualitative measure of traffic flow along a given road in consideration of a variety of factors, including speed and travel time, traffic interruptions, and freedom to maneuver. Levels-of-service are designated A through F—A being a free-flow condition with low volumes and high speeds and F being a congested condition of low speeds and stop-and-go traffic. Intermediate levels describe conditions between these extremes. A level-of-service below C involves unstable to forced traffic flow in which a driver's freedom to select a speed is restricted and in which traffic stoppages cause congestion.

LITHIC SCATTER—A scatter of chipped stone materials which may include fragments, flakes, or stone tools.

LIVESTOCK CARRYING CAPACITY—The most livestock that can graze an area without damaging vegetation or related resources. The carrying capacity can vary from year to year depending on the range's forage production.

MISCIBILITY—The tendency or capacity of two or more liquids to form a uniform blend, that is, to dissolve in each other.

MITIGATION—The abatement or reduction of a construction or operation impact to the environment by (1) avoiding a certain action or parts of an action, (2) employing certain construction measures to limit the degree of impact, (3) restoring an area to preconstruction conditions, (4) preserving or maintaining an area throughout the life of a project, (5) replacing or providing substitute resources to the environment: or (6) gathering archaeological and paleontological data before disturbance.

GLOSSARY

MODERATE DEVELOPMENT COAL—Coal areas that have a minimum coal thickness of 5 feet, with overburden less than 200 feet and an overburden to stripable coal ratio of 20 or less, which do not meet the criteria for high development coal.

MULCH—A natural or artificial layer of suitable materials (crop residue, wood chips, or netting) that aids in soil stabilization and soil moisture conservation, thus providing microclimatic conditions suitable for germination and growth.

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)—The allowable concentrations of air pollutants in the air specified by the Federal Government in Title 40, Code of Federal Regulations, Part 50. The air quality standards are divided into primary standards (based on the air quality criteria and allowing an adequate margin of safety, and requisite to protect the public health) and secondary standards (based on the air quality criteria and allowing an adequate margin of safety and requisite to protect the public welfare from any unknown or expected adverse effects of air pollutants). Welfare includes effects on soils, water, crops, vegetation, manufactured materials, animals, wildlife, weather, visibility and climate: damage to and deterioration of property: and hazards to transportation. Also included are effects on economic values and on personal comfort and well being.

NEPHELOMETRIC TURBIDITY UNIT (NTU)—The standard unit used to measure the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through water, as measured by a nephelometer.

NOXIOUS PLANT—A plant that is undesirable because it conflicts with or restricts management objectives, or otherwise causes problems.

OFF-ROAD VEHICLE (ORV)—A vehicle (including four-wheel drive, trail bikes, and snowmobiles but excluding helicopters, fixed-wing aircraft, and boats) capable of traveling offroad over land, water, ice, snow, sand, marshes, and other terrain.

OVERSTORY VEGETATION—The upper canopy or canopies of plants, usually consisting of trees, tall shrubs, and vines.

PALEONTOLOGY—A science dealing with the life of past geological periods as known from fossil remains.

PARTICULATE—A particle of solid or liquid matter—soot, dust, aerosols, fumes, and mist.

PEDIMENT—A broad, gently sloping bedrock surface at the base of a steeper slope that is usually thinly covered with alluvial gravel and sand.

PERENNIAL STREAM—A stream receiving water from both surface and underground sources that flows throughout the entire year.

pH—A numeric value that gives the relative acidity or alkalinity of a substance on a 0 to 14 scale with the neutral point at 7. Values lower than 7 show the presence of acids, and values greater than 7 show the presence of alkalis.

PHYSIOGRAPHIC PROVINCE—An extensive portion of the landscape normally encompassing hundreds of square miles, portrayed by similar qualities of soil, rock, slope, vegetation, and climate of the same geomorphic origin.

PLAN OF OPERATIONS—A mandatory plan, developed by an applicant, of a mining operation or construction project, that specifies the techniques and measures to be used during construction and operation of all project facilities on public land. The plan is submitted for approval to the appropriate federal agency before any construction begins.

POLLUTANT—Any substance discharged into the ambient air that tends to create a harmful effect upon humans, property, convenience, or happiness or that causes contamination in ambient air to exceed legal limits.

PRECAMBRIAN—The earliest geologic era, which ended 600 million years ago.

PREVAILING WIND—The most frequent compass direction from which the wind blows.

PREVENTION OF SIGNIFICANT DETERIORATION (PSD)—A regulatory program based not on the absolute levels of pollution allowable in the atmosphere but on the amount by which present air quality will be allowed to deteriorate in a given area. Under this program, geographic areas are divided into three classes, each allowing different increases in increments of total suspended particulates and sulfur dioxide concentrations.

Class I—minimal additional deterioration in air quality (certain national wilderness areas).

Class II—moderate additional deterioration in air quality (most lands).

Class III—greater deterioration for planned maximum growth (industrial areas).

PRIME AGRICULTURAL LAND (PRIME FARMLAND)—Land that is best suited for producing food, feed, forage, fiber, and oilseed crops. The inventory of prime agricultural land is maintained by the U.S. Department of Agriculture, Soil Conservation Service.

GLOSSARY

PROJECT LIFE—The estimated time a project would be operating.

RANGE CONDITION—The present state of rangeland based on the potential vegetation it is capable of producing.

RECENT—The latest geologic time period, beginning about the time of glaciation and continuing to the present.

RECLAMATION—The process of converting disturbed land to its former use or other productive uses.

RIPARIAN LAND—Land along the edge of a stream or other body of water.

ROCK CAIRN—A small mound of rocks made by prehistoric or historic Indians and used for landmarking areas or concealment during hunting.

SCENIC QUALITY CLASS—The value (A, B, or C) assigned a scenic quality rating unit by applying the scenic quality evaluation key factors which indicate the relative visual importance of the unit to the other units within the physiographic region in which it is located.

Class A—Areas that combine the most outstanding characteristics of each rating factor.

Class B—Areas in which there is a combination of some outstanding features and some that are fairly common to the physiographic region.

Class C—Areas in which the features are fairly common to the physiographic region

SCRAPER TRAPS—A device for the insertion or recovery of pigs or scrapers used to clean the inside surfaces of pipelines.

SEEN AREA—That portion of the landscape which can be viewed from one or more observer positions. The extent or area that can be viewed is normally limited by land form, vegetation, or distance.

SENSITIVE PLANT SPECIES—Plants whose populations are consistently small and widely dispersed or whose ranges are restricted to a few localities, such that any appreciable reduction in numbers, habitat availability, or habitat condition might lead toward extinction. Sensitive plants also include species rare in one locality but abundant elsewhere. See Endangered Species and Threatened Species.

SOIL PRODUCTIVITY—The capacity of a soil to produce a plant or sequence of plants under a system of management.

SOIL PROFILE—A vertical section of soil that shows all horizons and parent material.

SPOIL—Earth and rocks excavated or dredged.

STONE CIRCLES OR RINGS (TIPI RINGS)—Stone circle configurations of varying diameters. Their exact function is unknown; however, some archaeologists believe they were used as the defining edge for Indian tipis.

SULFUR OXIDES—Pungent, colorless gases formed mainly by the combustion of fossil fuels. Considered major air pollutants, sulfur oxides may harm the human respiratory tract as well as damage vegetation. They are often considered a major causative agent in the acidification of the environment.

SURFACE SOIL—The soil ordinarily moved in tillage or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches. Frequently designated as the *plow layer*, or *Ap*'horizon.

SUSPENDED SEDIMENT—Soil and rock particles that are carried along a suspension by stream flow.

SWEETENING—Improvement of a petroleum product color and order by converting sulfur compounds disulfides with sodium plumbite (doctor treating), or by removing them by contacting the petroleum stream with alkalies or other sweetening agents.

TERTIARY—A time period in geologic history between 2 million and 65 million years ago.

TERTIARY OIL RECOVERY—The third major phase of crude oil recovery. The primary phase is flowing and finally pumping down the reservoir until it is *depleted* or no longer economical to operate. Secondary recovery usually involves repressuring or simple waterflooding. The third or tertiary phase employs more sophisticated techniques. This is accomplished by flooding the oil formation with certain chemicals that *free* the oil adhering to the porous rock so it may be taken into solution and pumped to the surface.

THREATENED SPECIES—Any plant or animal species likely to become endangered within the foreseeable future throughout all or a part of its range.

TOPSOIL—The original or present darker-colored upper soil that ranges from a mere fraction of an inch or two to 2 or 3 feet thick on different kinds of soils. Applied to soils in the field, the term has no precise meaning unless defined as to depth or productivity in relation to a specific kind of soil.

GLOSSARY

TOTAL DISSOLVED SOLIDS (TDS)—An aggregate of carbonates, bicarbonates, chlorides, sulfates, phosphates, and nitrates of calcium, magnesium, manganese, sodium, potassium, and other cations that form salts. High TDS solutions can change the chemical nature of water, exert varying degrees of osmotic pressures, and often become lethal to life in an aquatic environment.

TOTAL SUSPENDED PARTICULATE (TSP) MASS—A pollutant measured as the mass of all particles in the atmosphere without regard to size or chemical composition.

TRAFFIC—The flow of vehicles along a roadway.

TRONA—A hydrated mixture of sodium carbonate and sodium bicarbonate. Trona is a source of soda ash.

UNDERSTORY VEGETATION—Plants growing beneath the canopy of other plants, usually grasses, forbs, and low shrubs.

UNIVERSAL TRANSVERSE MERCATOR/GRID (UTM)—A mapping grid system consisting of identical transverse Mercator projections around the world in the intermediate latitudes, each covering 6 degrees of longitude. This system is used by the U.S. military mapping system and in Geological Survey topographic maps.

UPLIFT—The elevation of any extensive part of the earth's surface relative to some other part such as occurs during the formation of mountains.

VEGETATION TYPE—A plant community with distinguishable characteristics described by the dominant vegetation present.

VERTEBRATE—Animals which possess bone structures.

VISIBILITY—A measurement of the maximum distance from which large objects may be viewed. Fixed reference objects such as mountains, hills, towers, or buildings are normally used to estimate visibility.

VISUAL QUALITY OBJECTIVE (VQO)—National Forest Visual Management System designed to develop measurable standards or objectives for the visual management of all National Forest lands. The objectives are based upon the previously determined variety classes and sensitivity levels. They are represented by five terms which can be defined as visual resource management goals.

Preservation—Allows for ecological changes only. Management activities, except for very low visual impact recreation facilities, are prohibited.

Retention—Activities may only repeat form, line, color, and texture that are frequently found in the characteristic landscape.

Partial Retention—Management activities must remain visually subordinate to the characteristic landscape. Activities may repeat or introduce form, line, color, or texture common to the characteristic landscape, but changes in their size, amount, intensity, direction, pattern, etc., must remain visually subordinate to the characteristic landscape.

Modification—Activities may visually dominate the original characteristic landscape. However, vegetation and landform alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that the visual characteristics are those of natural occurrences within the surrounding area or character type. Additional elements must remain visually subordinate to the proposed composition.

Maximum Modification—Vegetation and landform alterations may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middleground, they may not appear to borrow completely from naturally established form, line, color, or texture.

Unacceptable Modification—Management activities demonstrate excessive modification in the landscape regardless of the distance from which the management activity is observed. Usually the size of the activity is not to scale or is so excessive as to contrast with the characteristic landscape.

VISUAL RESOURCE MANAGEMENT (VRM)—The planning, design, and implementation of management objectives to provide acceptable levels of visual impacts for all resource management activities.

VISUAL RESOURCE MANAGEMENT CLASS (VRM Class)—The degree of visual change acceptable within the existing characteristic landscape. An area's classification is based upon the physical and sociological characteristics of any given homogeneous area and serves as a management objective.

Class I—Natural ecological changes and very limited management activity are allowed. Any contrast created within the characteristic landscape must not attract attention. This classification is applied to wilderness areas, wild and scenic rivers, and other similar situations. Similar to a Preservation VQO.

Class II—Changes in any of the basic elements (form, line, color, texture) caused by a management activity

GLOSSARY

should not be evident in the characteristic landscape. Contrasts are seen but must not attract attention. Similar to a Retention VQO.

Class III—Contrasts to the basic elements caused by a management activity are evident, but should remain subordinate to the existing landscape. Similar to a Partial Retention VQO.

Class IV—Any contrast attracts attention and is a dominant feature of the landscape in terms of scale, but it should repeat the form, line, color, and texture of the characteristic landscape. Similar to Modification and Maximum Modification VQOs.

Class V—The classification is applied to areas where the natural character of the landscape has been disturbed to a point where rehabilitation is needed to bring it up to one of the four other classifications. Similar to Unacceptable Modification VQO.

VISUAL SENSITIVITY LEVEL(S)—An index of the relative degree of user interest in scenic quality and concern and attitude for existing or proposed changes in the

landscape features of an area in relation to other areas in the planning unit.

WATERBAR—A barrier several inches high usually consisting of logs, stone, soil, or concrete placed across a trail on a slope to divert water from the trail and prevent erosion.

WATERFLOODING—One method of secondary recovery in which water is injected into an oil reservoir to force additional oil out of the reservoir rock and into the well bores of producing wells.

WILDERNESS STUDY AREA (WSA)—A roadless area or island that has been inventoried and found to have wilderness characteristics as described in Section 603 of the Federal Land Policy and Management Act and Section 2(c) of the Wilderness Act of 1964 (78 Stat. 891).

WORKFORCE—The total number of workers on a specific project or group of projects. The workforce is also referred to as direct employment and primary employment.

PUBLIC HEARINGS REGISTRATION FORM

First public hearings on the draft Bairoil/Dakota Carbon Dioxide Project Environmental Impact Statement.

To: Janis L. VanWyhe, Division of EIS Services, First Floor East, 555 Zang Street, Denver, Colorado 80228

From: Name _____

Street Address _____

City, State _____ Zip Code _____

Representing _____

I wish to appear at the _____ public hearing on _____
1985, 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 November 12, 1985. Registration forms are to be submitted by October 9, 1985. Registration will also be accepted at the door for each hearing.

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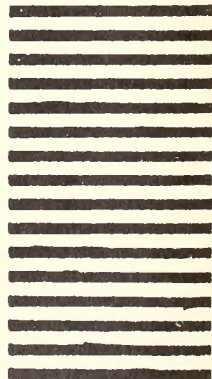
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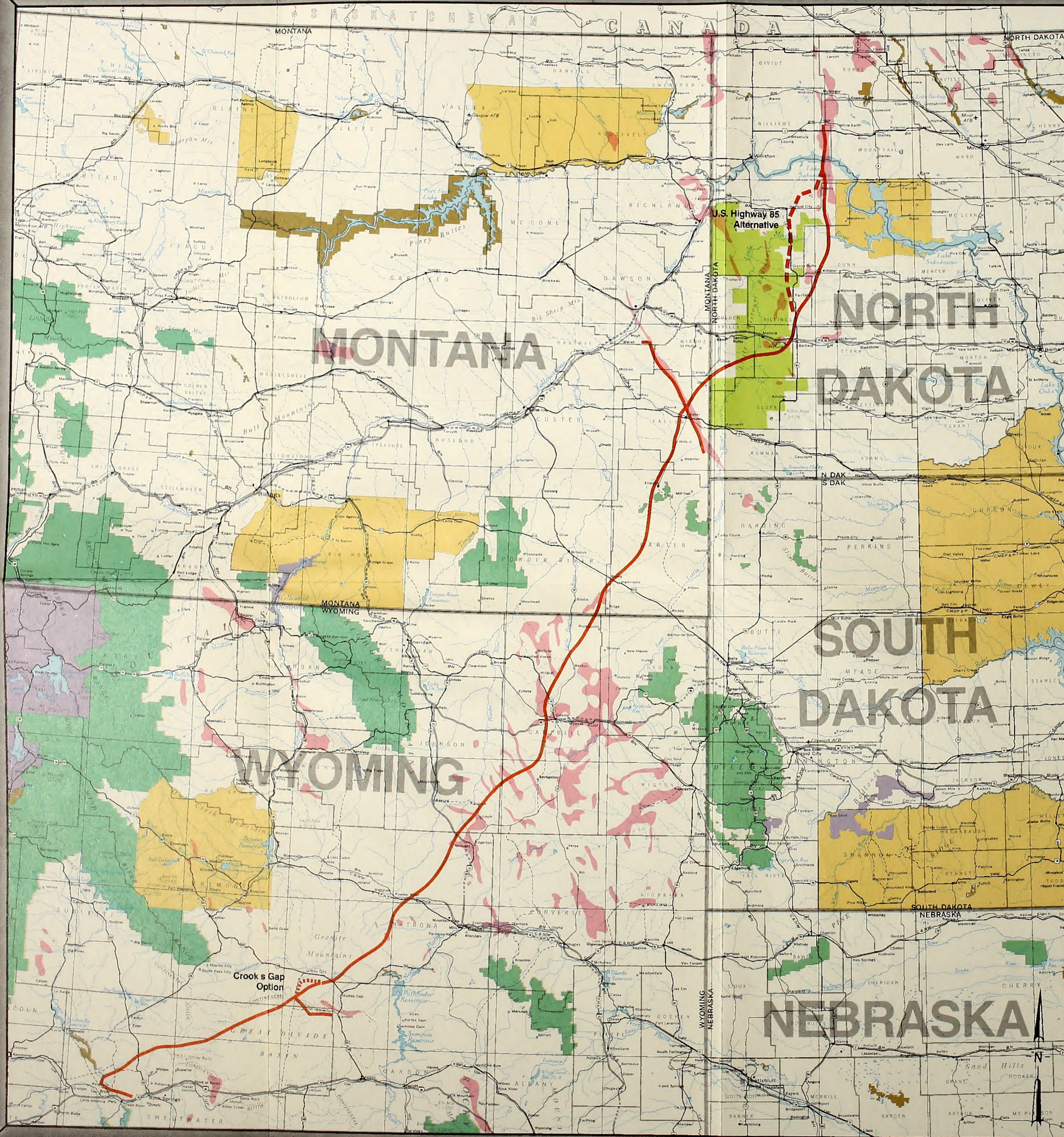
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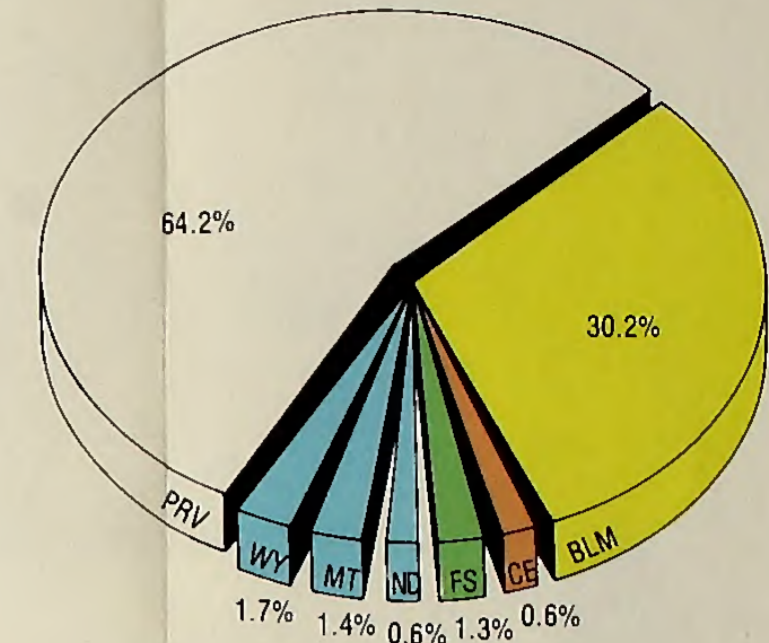
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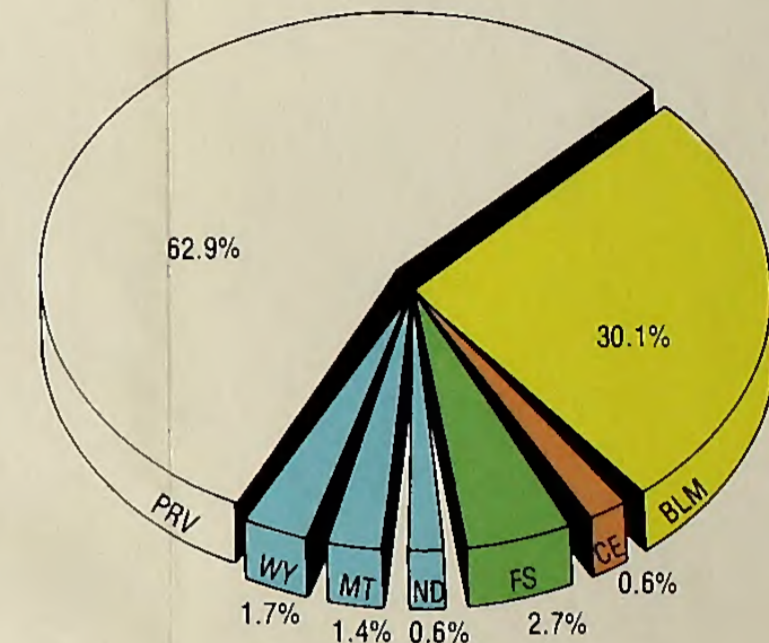




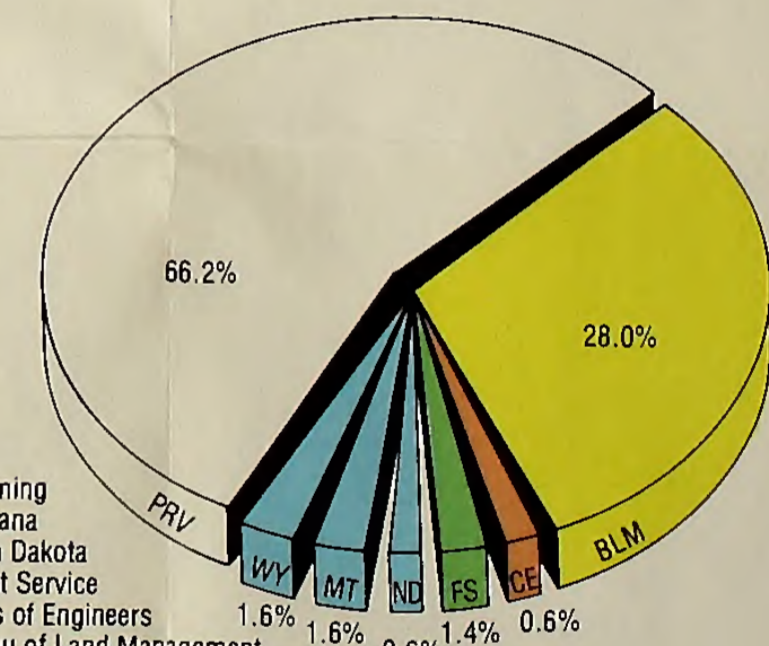
LAND OWNERSHIP



PROPOSED ACTION



U.S. HIGHWAY 85 ALTERNATIVE

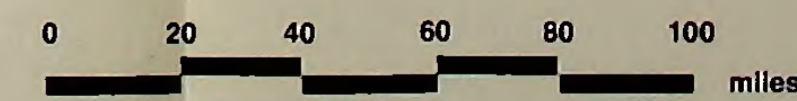


SINGLE BAIROL PIPELINE ALTERNATIVE

Key:
 WY — Wyoming
 MT — Montana
 ND — North Dakota
 FS — Forest Service
 CE — Corps of Engineers
 BLM — Bureau of Land Management
 PRV — Private

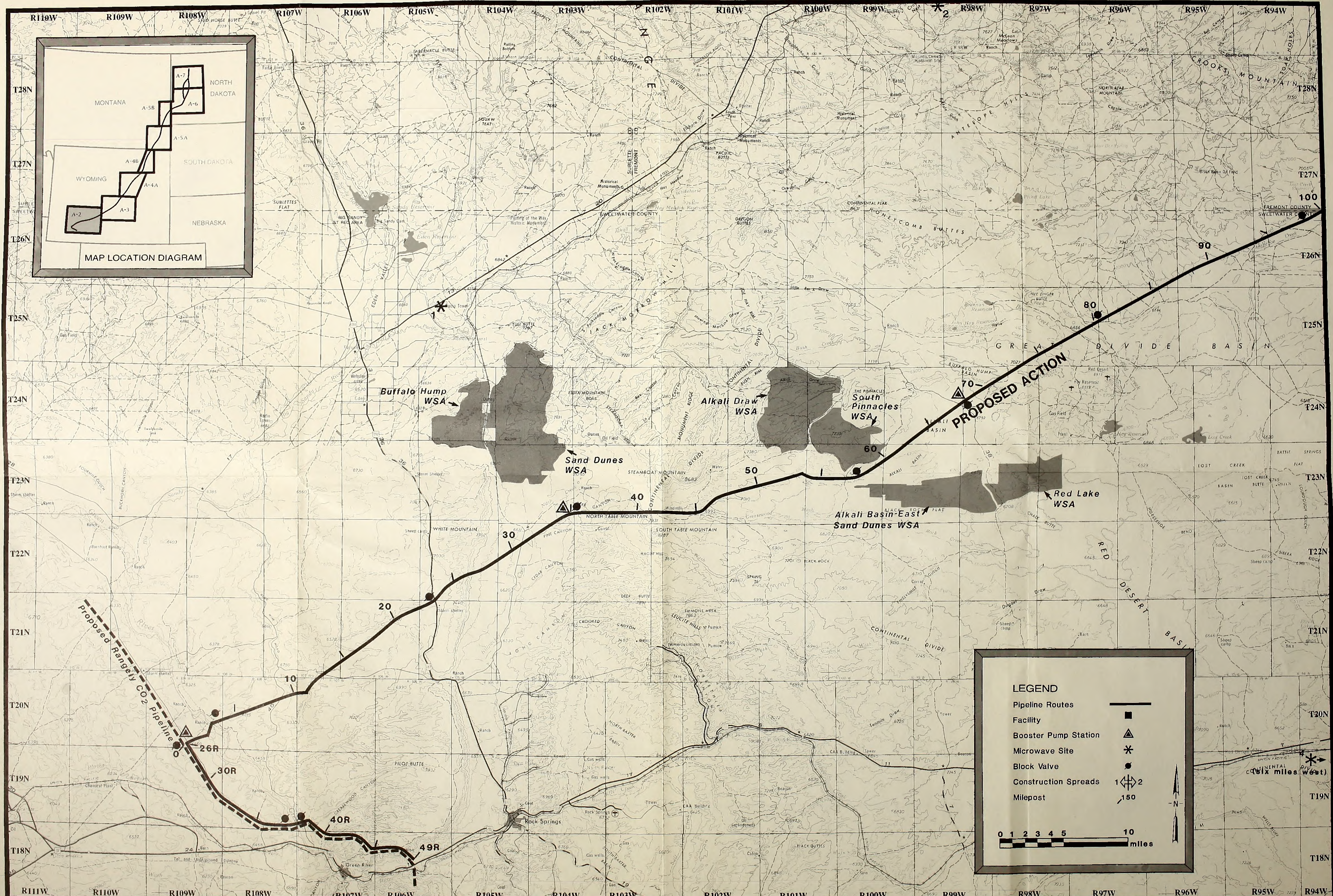
LEGEND

- Proposed Action** —
- Oilfields** ■
- National Parks and Monuments** ■
- National Forest** ■
- Indian Reservation** ■
- National Wildlife Refuge** ■
- National Grassland** ■

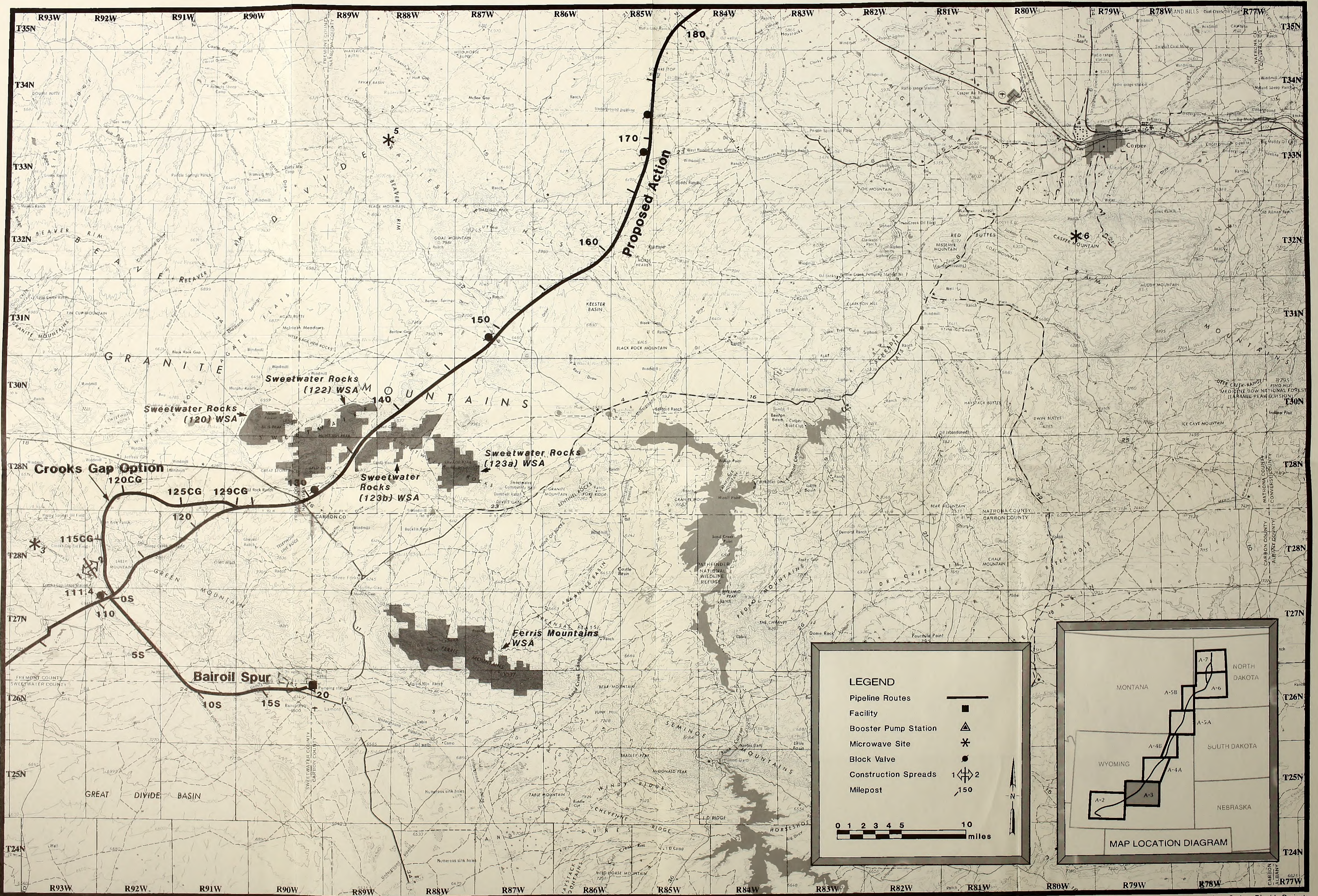


See Maps A-2 thru A-7 for specific location of this project.

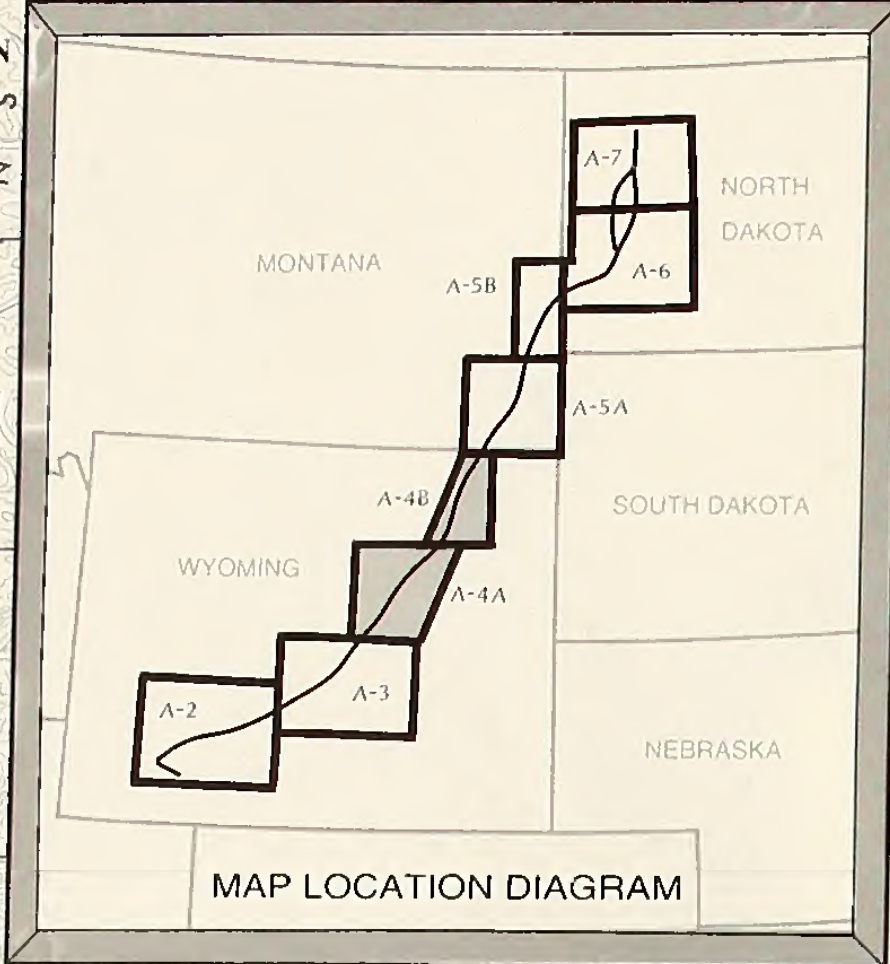
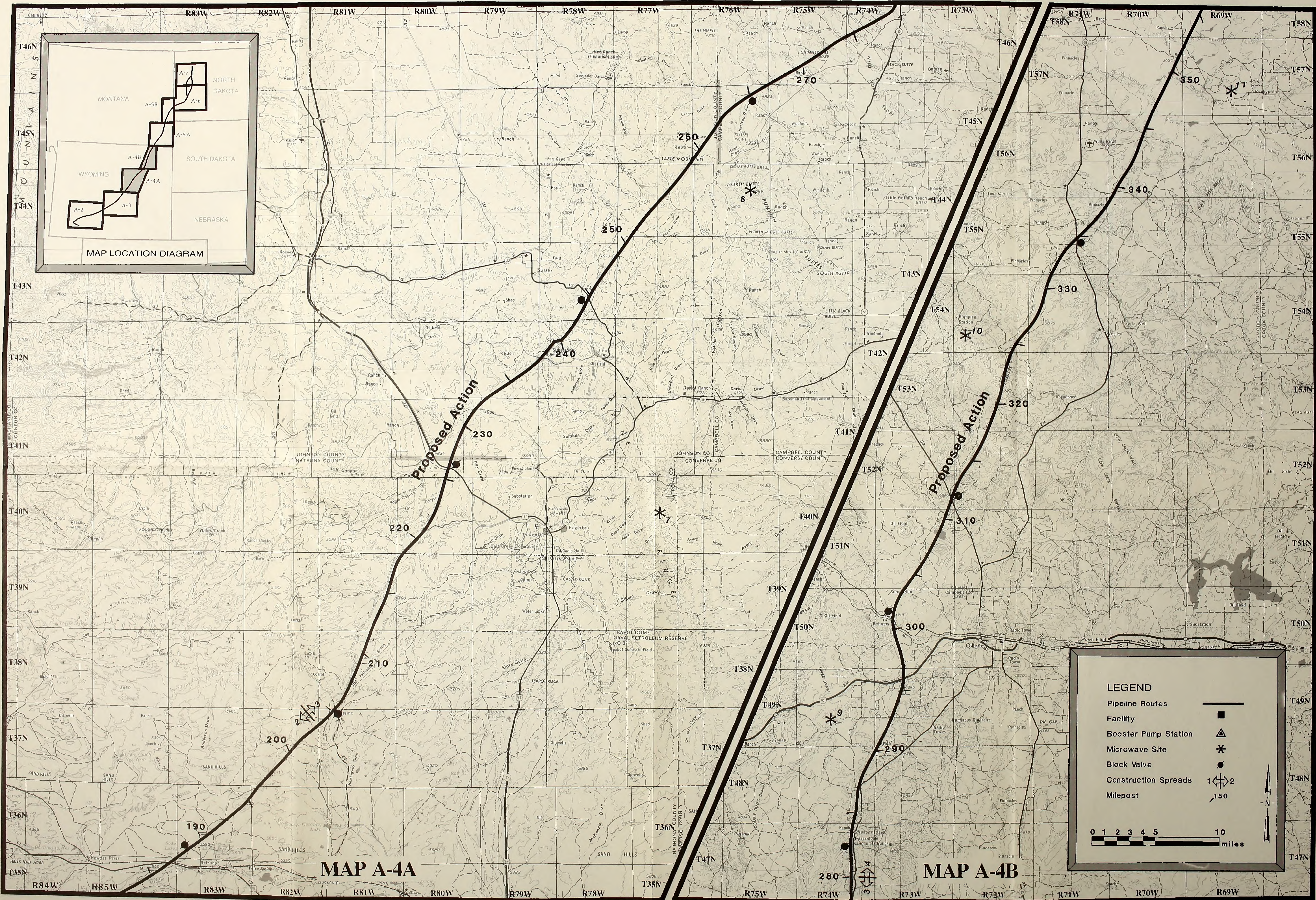
MAP A-1 REGIONAL OVERVIEW OF PROJECTS



MAP A-2 PROJECT MAP



MAP A-3 PROJECT MAP



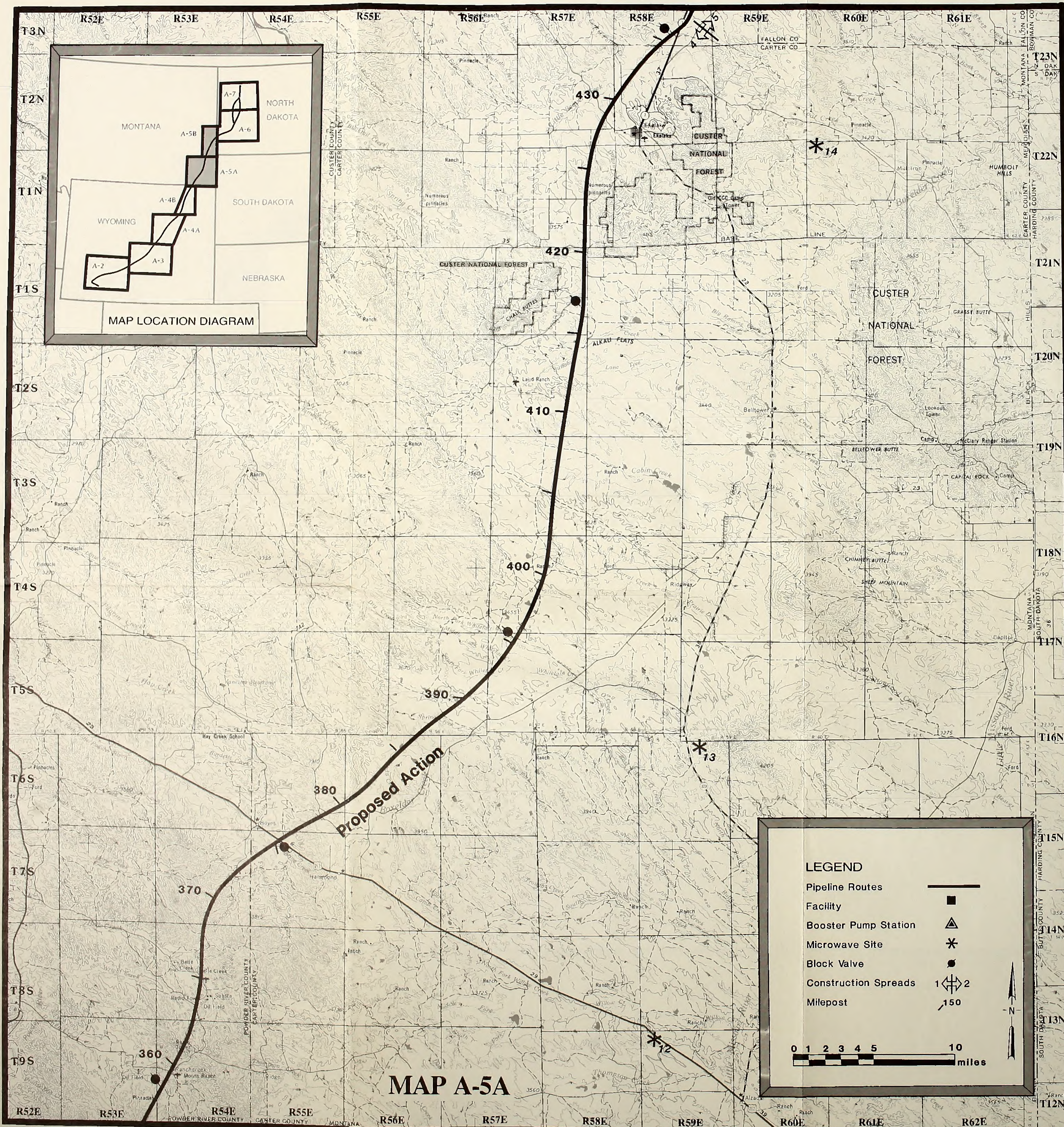
LEGEND

- Pipeline Routes
- Facility
- Booster Pump Station
- Microwave Site
- Block Valve
- Construction Spreads
- Milepost

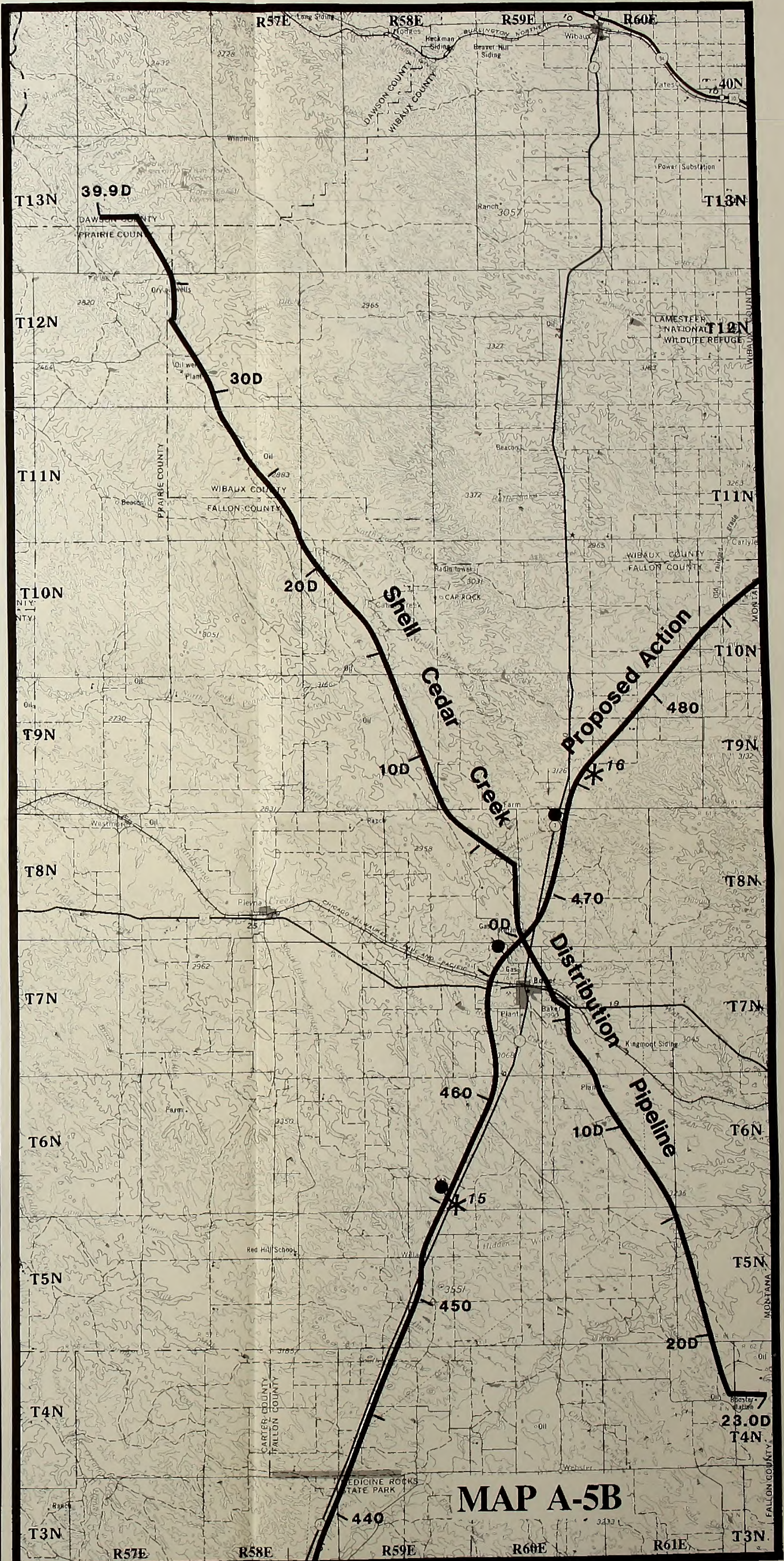
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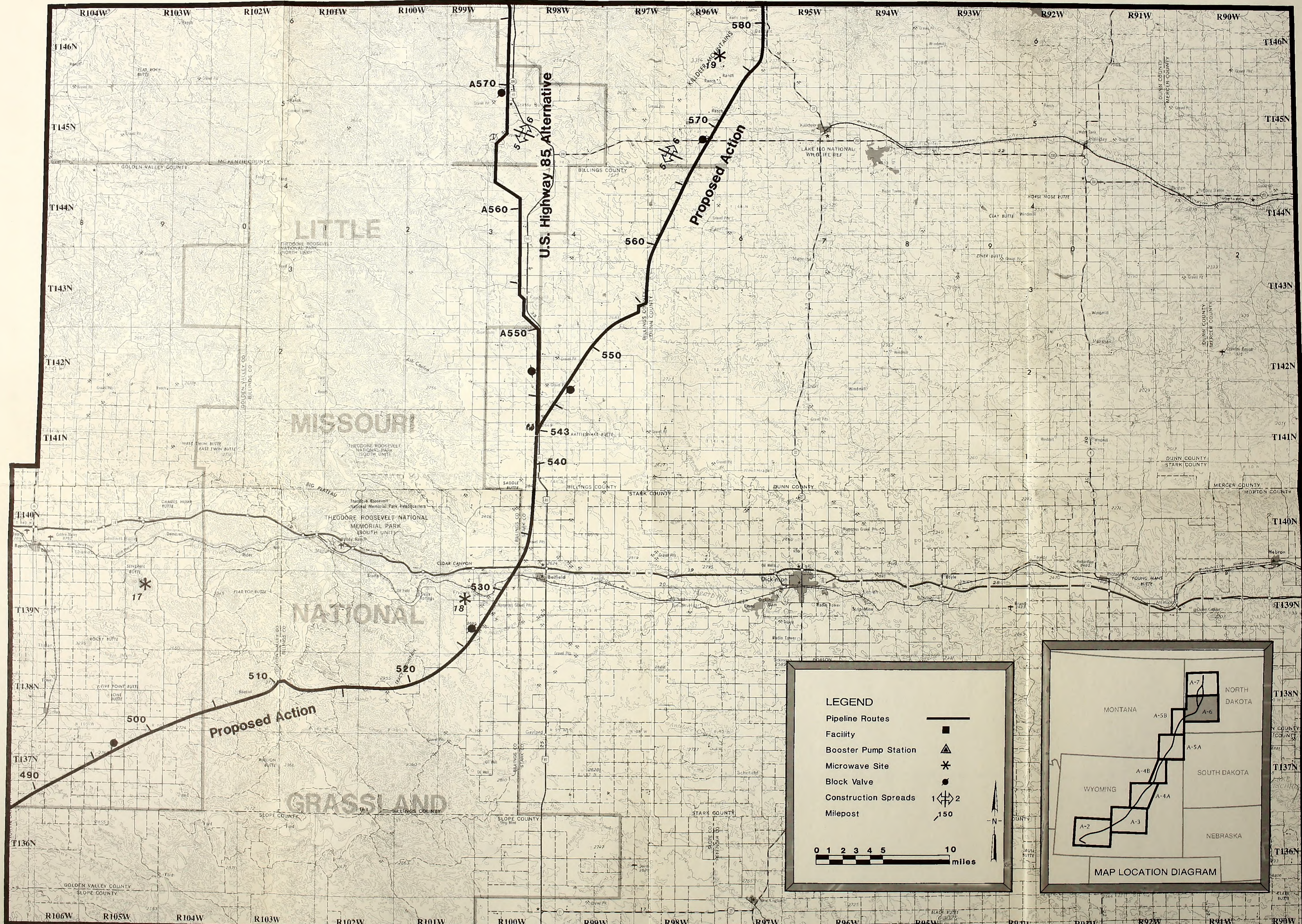
MAP A-4 PROJECT MAP



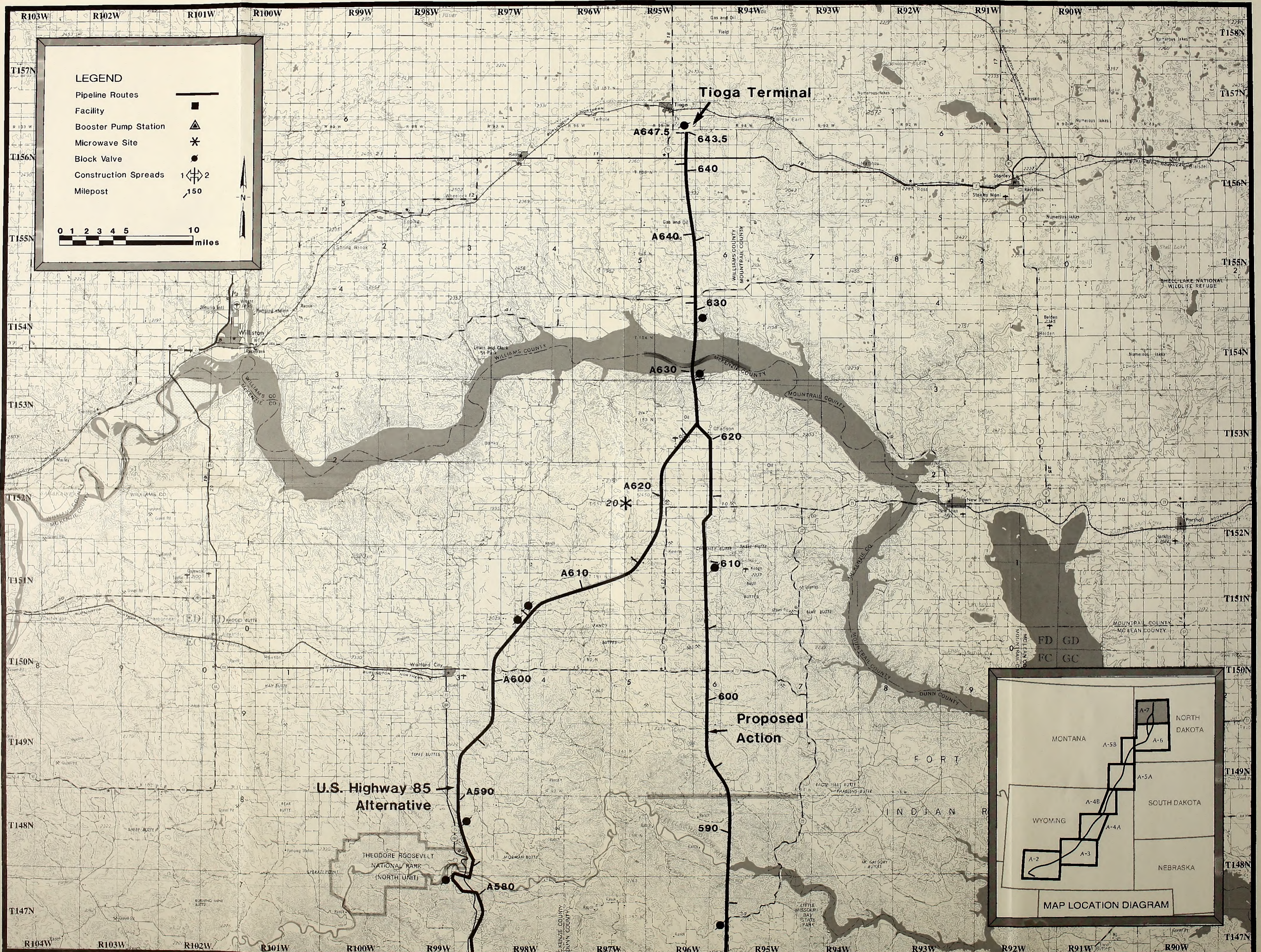
MAP A-5A



MAP A-5B



MAP A-6 PROJECT MAP



MAP A-7 PROJECT MAP

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